Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Faculty of Science and Technology

Board of Studies
Civil Engineering

Syllabus

TY B. Tech. (SEM-V)
Civil Engineering

(w.e.f. AY: 2025-26)
[2023 pattern]

Syllabus: Third Year (TY B. Tech.) Civil Engineering (2023 pattern) w.e.f. A.Y.:2025-26

SEMESTER-V

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
CE23301	Design of Steel Structures	3	2	-	10	30	60	-	-	30	130	3	1	-	4
CE23302	Transportation Engg.	3	2	-	10	30	60	-	-	30	130	3	1	-	4
CE23303	Programme Elective Course	3	2	-	10	30	60	30	-	-	130	3	1	-	4
CE23052	Multi-disciplinary minor	2	2	-	20	20	50	20	-	-	110	2	1	-	3
HS23301	Universal Huma Values/ CI	2	-	-	10	-	60	-	-	-	70	2	-	-	2
OE230XX	Open Elective	2	-	-	-	-	50	-	-	-	50	2	-	-	2
OE23304	Community Engg. Project/Field Project	-	4	-	10	-	-	30	-	30	70	-	2	-	2
HS23303	Constitution of India (Audit course)														
	Total	**15**	**12**	**-**	**70**	**110**	**340**	**100**	**-**	**70**	**690**	**15**	**06**	**-**	**21**

BOS
Civil Engineering

DEAN
Academics

DEAN
Autonomy

PRINCIPAL
VPKBIET, Baramati.

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Bar
Vidyanagari, Baramati-41313

Programme Elective List:

CE23303a	Advanced Surveying
CE23303b	Project Management and Economics
CE23303c	Advanced Geotechnical Engineering
CE23303d	Air Pollution and Control
CE23303e	Waste Water Engineering

Honor	
CE23382	Advanced Design of Steel Structures

Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati.

Faculty of Science and Technology

Board of Studies

Civil Engineering

Syllabus

TY B. Tech. (SEM-VI)
Civil Engineering

(w.e.f. AY: 2025-26)

[2023 pattern]

Syllabus: Third Year (TY B. Tech.) Civil Engineering (2023 pattern) w.e.f. AY:2025-26

SEMESTER-VI

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
CE23311	Structure Design for Reinforced Concrete	3	2	-	10	30	60	-	-	30	130	3	1	-	4
CE23312	Programme Elective Course	3	2	-	10	30	60	-	-	30	130	3	1	-	4
CE23313	Programme Elective Course	3	2	-	10	30	60	-	-	30	130	3	1	-	4
CE23052	Multi-disciplinary minor (GB& SC)	2	2	-	20	20	50	20	-	-	110	2	1	-	3
HS23311	Environment Studies	2	-	-	10	-	60	-	-	-	70	2	-	-	2
OE230XX	Open Elective	2	-	-	-	-	50	-	-	-	50	-	2	-	2
CE23315	VSEC-ETAB	--	4	-	10	-		30	30	-	70	-	2	-	2
Total		15	12	-	70	110	340	80	30	60	690	13	8	-	21

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Vidyanagari, Baramati-413133

VPKBIET BARAMATI
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CE23312	Programme Elective Course
CE23312a	Construction Management and Finance
CE23312b	Formwork and Plumbing Engineering
CE23312c	Airport and Bridge Engineering
CE23312d	Structural Design of Bridges
CE23313	**Programme Elective Course**
CE23313a	Design of Prestressed Concrete Structures
CE23313b	Advanced Concrete Technology
CE23313c	Earthquake Engineering
CE23313d	Hydro power Engineering

Honor	
CE23392	Advanced design of concrete structures

Multidisciplinary Minor (MDM) Subjects			
AI23051	AI & Machine Learning	ET23053	Internet of Things
AI23052	Data Science	CE23051	Waste Management
AI23053	Generative AI	CE23052	Green Building & Smart Cities
CO23051	Cloud Computing	ME23051	Introduction to 3D Printing Technologies
CO23052	High Performance Computing	ME23052	Introduction to Robotics & Automation
CO23053	Comp Graphics & Gaming	EL23051	Solar Tech
IT23051	Cyber Security	EL23052	Industrial Automation
IT23052	Full Stack Development	GS23051	Nano Technology
ET23051	Embedded Systems	GS23052	Linear Algebra and Statistics
ET23052	Drone Technology		

Open Electives (OE) Subjects			
OE2301	Digital Marketing	OE2311	Biotechnology
OE2302	Professional Leadership	OE2312	International Relations
OE2303	Organizational Behavior	OE2313	Universal Human Values
OE2304	Industrial Management	OE2314	Education Technology
OE2305	Disaster Management	OE2315	Design Thinking
OE2306	Energy Economic & Management	OE2316	Financial Literacy for Bharat#
OE2307	Operation Research	OE2317	Sustainability & Climate Change
OE2308	Intellectual Property Rights	OE2318	Agriculture Technology
OE2309	Cyber Laws	OE2319	Architectural Technology
OE2310	Bioinformatics		

Course Name with Code: Structure Design for Reinforced Concrete (CE23311)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 03 Hrs/week	**04**	**Activity : 10 Marks**
PR : 02 Hrs/Week		**In Semester : 30 Marks**
		End Semester : 60 Marks
		OR : 30 Marks

Prerequisite:

Fundamentals of Engineering Mechanics, Concrete Technology, Mechanics of Structure and Structural Analysis

Course Objectives:

To analyze, design and detailing of different component of reinforced concrete framed structure building.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Apply relevant IS provisions for LSM to ensure safety and serviceability of structural members and evaluate moment of resistance for singly, doubly rectangular, and flanged sections.

CO2: Design of one way and two-way slab with different support conditions.

CO3: Design of dog-legged, open-well staircase and beams.

CO4: Design of continuous beams for flexure, shear and bond.

CO5: Design of short columns subjected to axial load, uni-axial/bi-axial bending.

CO6: Design of isolated column footing for axial load and uni-axial bending.

Course Contents

Unit I: Overview of design theories and RC beam section analysis (07 Hours)

Introduction to design philosophies of RC structures; Working stress method and limit state method, types of Limit states, loads on RC structural members and structural properties of concrete and steel, Role of structural engineer, RC sections in flexure, theory and analysis, singly, doubly reinforced rectangular and flanged sections.

Unit II: Design of slabs (06 Hours)

a)Design of one-way slab: simply supported, cantilever and continuous slabs by using IS Code Coefficients.

b) Design of two way slab: continuous and restrained as per Indian Standard code, reinforcement detailing for slabs.

Unit III: Design of staircase and beams (07 Hours)

Introduction to type of staircase and beams, Design of staircase: dog legged and open well, distribution of load from to beams, design of simply supported and cantilever beams for flexure (singly reinforced, doubly reinforced and flanged) with checks for shear, bond and torsion.

Unit IV: Design of continuous beams (06 Hours)

Introduction to redistribution of moment and requirement, design of continuous beam by using IS-456-2000 code coefficients and moment redistribution method along with checks for shear, deflection and development length. Reinforcement detailing for continuous beams.

Unit V: Design of short RC columns (07 Hours)

Introduction to types of columns, check for minimum eccentricity, design of short column for axial load, design of short column subjected to combined axial load and uni-axial/biaxial bending using interaction curves using Indian Standard code and SP-16. Reinforcement detailing for short columns.

Unit VI: Design of isolated RC columns footings (06 Hours)

Introduction to type of column footings in RC framed structure, soil pressure distribution under isolated footing, check for shear and bearing, design and reinforcement detailing of isolated column footing for axial load and uni-axial bending using Indian Standard code.

Books & Other Resources:

Text books:

1. Limit State Theory and Design of Reinforced Concrete, Dr. V. L. Shah and Dr. S. R. Karve, Structures Publications, Pune.
2. Design of Reinforced Concrete Structures, N. Subramanian, Oxford University Press.
3. Reinforced Concrete Design, S. U. Pillai and D. Menon, Tata McGraw Hill, Delhi.

Reference books:

1. Limit State Analysis and Design, P. Dayaratnram, Wheeler Publishing Company.
2. Illustrated Design of Reinforced Concrete Buildings (G+3), Dr. V. L. Shah and Dr. S. R. Karve, Structures Publications, Pune.
3. Limit State Design of Reinforced Concrete, P. C. Varghese, PHI, New Delhi.
4. RCC Analysis and Design, Sinha and Roy, S. Chand and Co. New Delhi.

Reference codes and standards:

1. IS: 456-2000: Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, New Delhi, India.
2. SP 34 – Handbook on Concrete Reinforcement and detailing
3. SP 16 – Design Aids for Reinforced concrete to IS 456:1980 Code Book.

Laboratory Experiments/Assignments

Term work shall consist of a journal containing the following design, drawing and site visit report. Oral examination based on term work.

Note: For term work, the group size should not be more than four students and each group should have different design data.

1. Design Project: Design of G + 2 (residential/commercial/public) building covering all types of slabs, beams, columns, footings and staircase (first and intermediate flight) with following details.
   - i. Minimum plan area of each floor shall be more than 150 m^2.
   - ii. Design of all slabs.
   - iii. Design of plinth, floor and roof beams.
   - iv. Design of three types of columns: (a) axial load, (b) axial load with uniaxial bending, (c) axial load with biaxial bending, from terrace level to footing along with detailed load calculations.
   - v. Design of two footing: (a) axial load, (b) axial load plus uniaxial bending.
   - vi. Prepare schedule of RC elements and reinforcement detailing on four full imperial drawing sheets.
2. Analysis or design any one RC element by using spread sheet.
3. Reports of two site visits on RC framed buildings under construction.

Activity: Assignments for each unit.

Course Name with Code: Construction Management and Finance (CE23312a)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: 3 Hrs/week	**04**	**Activity : 10 Marks**
PR: 2 Hrs/Week		**In Semester : 30 Marks**
		End Semester: 60 Marks
		OR : 30 Marks

Prerequisite:

Fundamentals of Project management, Indian Construction Industry, Economics & finance

Course Objectives:

Students will be able to:

1. Understand various construction activities and evaluating construction projects.
2. Explain methods of planning and scheduling.
3. Describe methods of material and manpower management and its application.
4. Discuss various labour laws and financial aspects.
5. Differentiate budgets and use methods of capital budgeting in project selection.
6. Explain contract costing and its importance in finance.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Understand the overview of construction sector.

CO2: Explain and apply the methods of planning and scheduling.

CO3: Describe and apply methods of material and manpower planning.

CO4: Discuss various labour laws and financial aspects.

CO5: Select best project which is profitable to the business.

CO6: Prepare contract account and analyses its implications of finance.

Course Contents

Unit I: Overview of Construction industry (07 Hours)

Organisational structure of construction industry, Role of construction industry in infrastructure development, components of infrastructure sector, construction industry nature, characteristics, size, structure, role in economic development, construction management: necessity, applications, project management consultants: role, types, selection and appointment process, project overruns and means to combat them, project monitoring and reporting systems, managerial correspondence and communications, generation and identification of project investment opportunities.

Unit II: Construction project planning & Scheduling (07 Hours)

Construction project scheduling: definition, objectives factors affecting scheduling, work breakdown structure, project work break down levels, project monitoring controlling, Bar chart ,Networking methods,CPM,PERT(advantages disadvantages and application), software's used in planning & scheduling.

Unit III: Material and Manpower management (07 Hours)

Concept of material management, role of material manager, inventory control methods, EOQ Model, stores management and control, break even analysis, supply chain management, role of ERP in material management.

Human resource: introduction, human resource in construction sector, human resource management process, human resource development process, recruitment & selection, performance evaluation and appraisal, training & development, manpower planning- Resource smoothing and leveling.

Unit IV: Labour Laws and Financial Aspects of Construction Project (06 Hours)

Need and importance of labour laws, study of some important labour laws associated with construction sector, workman's compensation act 1923, building and other construction workers act 1996, child labour act 1986, 2016, interstate migrant workers act 1979, the minimum wages act 1948.Capital investments: Importance and difficulties, means of finance, working capital requirements, project cash flow projections and statements, project balance sheet, profit loss account statements.

Unit V: Capital budgeting (06 Hours)

Budget, types of budgets, master budgets, cost estimating and budgeting in civil engineering project, definition of capital budgeting, time value of money, simple and compound interest, numerical on computation of interest, rule of 72, process of capital budgeting, techniques of capital budgeting, economic decision making in construction project, depreciation, different methods to calculate depreciation and numerical on it, impact of depreciation in economic decision making.

Unit VI: Construction financial management (06 Hours)

Construction financial management, role of financial manager in construction financial management, meaning and features of contract costing, types of contract and contract costing procedure, Contract account: definition, format/specimen of contract account, treatment of various items in the contract account, methods of recording and reporting site accounts between project office and head office.

Books & Other Resources:

Text books:

1. Projects: Planning, Analysis, Selection, Implementation and Review, Prasanna Chandra, Tata Mc Graw Hill Publications.
2. Total Project Management - The Indian Context, P. K. Joy, Mac Millian Publications.
3. Industrial Organization & Engineering Economics, T. R. Banga and S. C. Sharma, Khanna Publisher.
4. Indian Economy, Gaurav Datt and Ashwani Mahajan, S. Chand Publication.
5. Engineering Economics Management, Dr. Vilas Kulkarni and Hardik Bavishi, S. Chand Publication.

Reference books:

1. Construction Project Management-Planning, Scheduling and Controlling, K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
2. Construction Management and Planning, B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
3. Principles of Construction Management, Roy Pilcher (Mc Graw Hill).
4. Financial Management, Khan and Jain, Tata McGraw-Hill Education.
5. Construction Management and Accounts, Singh H, Tata McGraw Hill, New Delhi.
6. Finance for Engineers: Evaluation and Funding of Capital Projects, Crundwell F. K., Springer, London.
7. Labour and Industrial Laws, S. N. Mishra, Central Law Publications.

Laboratory Experiments/Assignments (Any 10)

1. Prepare an organizational structure/ chart of any one private organization executing construction work in your area.
2. Prepare a work break down structure of any construction site in your area, write a roles and responsibilities of personnel involved and time schedule of activities.
3. Prepare a bar chart of any small construction project.
4. Prepare a network diagram from the data of time schedule and work break for small project.

5. Exercise on CPM and PERT.
6. Visit to any construction store, collect data and conduct ABC analysis.
7. Carry out resource smoothing/ leveling for given project.
8. Prepare a profit and loss account of a given project data.
9. Conduct analysis of balance sheet of any construction industry.
10. Exercise on methods of capital budgeting and on depreciation.
11. Assignment on different labour laws associated with construction industries.
12. Prepare a contract account of completed and in progress contract.

Activity: Assignments for each unit.

Course Name with Code: Formwork and Plumbing Engineering (CE23312b)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 03 Hrs/week	**04**	**Activity :10 Marks**
PR : 02 Hrs/Week		**In Semester : 30 Marks**
		End Semester :60 Marks
		OR : 30 Marks

Prerequisite:

Structural Analysis, Concrete Technology, Building Technology.

Course Objectives:

1. Exposure to formwork techniques in the construction industry.
2. Examine the various forms of formwork, including their design and analysis.
3. Exposure to plumbing types and components.
4. Examine various plumbing system design provisions.

Course Outcomes:

On completion of the course, the learner will be able to:

CO1: Identify the right formwork type and material.

CO2: Examine the formwork under different loading conditions.

CO3: Demonstrate examples of formwork design elements under different conditions.

CO4: Recognize a building's plumbing requirements.

CO5: Understand the principles of plumbing hydraulics and the parts that make up a plumbing system.

CO6: Illustrate the design aspects as per the requirement of Indian Standards.

Course Contents

Unit I: Introduction to formwork. (06 Hours)

Overview of formwork as a provisional construction and its specifications, selection criteria of formwork, Forms of formwork; traditional formwork materials, such as steel, plywood, and timber; Advanced formwork materials, such as fiber reinforced polymer composites, plastic, and aluminum; Formwork planning, formwork economy, and accessories.

Unit II: Analysis of Formwork (07 Hours)

Typical illustration forms for walls, beams, columns, and slab with detailing, loads on formwork: dead loads, live loads, lateral pressure owing to fresh concrete according to IS 14687. Concrete density, discharge height, temperature, placement rate, concrete consistency, vibration, hydrostatic pressure and pressure distribution, examples, design considerations, allowable stresses, deflection limits, and common design flaws.

Unit III: Design of Formwork (07 Hours)

Formwork design concepts for slabs, beams, columns, and footings; slab and wall formwork design; and a demonstration of a beam and column formwork system.

Unit IV: An Overview of Building Plumbing (06 Hours)

Water-borne illness, the significance of premise plumbing, plumbing history, plumbing codes, plumbing organizations and institutes in India and abroad, the necessity of sustainable plumbing practices, the function of plumbing designers, the function of plumbers, plumbing system installations, and upcoming plumbing challenges.

Unit V: Plumbing hydraulics and plumbing system components (06 Hours)

Water demand in various building types according to standards, components of water supply systems in buildings, types of water supply systems in buildings, types of drainage systems in buildings, frictional losses in pipes, minor losses in pipes, common plumbing fixtures, water-efficient fixtures, pipe materials and roughness coefficients, types of fittings, types of valves, types of traps, equivalent lengths for fittings and valves as per standards.

Unit VI: Design of plumbing systems (07 Hours)

Code requirements for plumbing systems include pressure and velocity, simultaneous demand, various pipe sizing techniques in buildings (such as fixture units, water demand calculators, fixture value methods, etc.), the use of segmented loss method for sizing pipes in three-story buildings, the arrangement of plumbing fixtures in toilets, plumbing plans for buildings, and water supply and drainage fixture units for various plumbing fixtures.

Books & Other Resources:

Text books:

1. Modern Practices in Formwork for Civil Engineering Construction Works, Dr. Janardan Jha & Prof. S. K. Sinha, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.
2. Formwork for Concrete Structures, Robert L. Peurifoy and Garold D. Oberlender, McGrawhill Publication.
3. Plumbing: Design and Practice, Deolalikar S. G., Tata Mcgraw-Hill Publication.
4. Water Supply and Sanitary Installation (Within Building), Design, Construction and
5. Maintenance Panchdhari A. C., New Age International publishers.

Reference books:

1. Formwork by Michael P. Hurst, Addison-Wesley Longman Ltd; First Edition (June 1, 1983).
2. Formwork for Concrete, Hurd, M.K., Special Publication No.4, American Concrete Institute, Detroit; Fifth edition
3. Design and Construction of Formwork for Concrete Structures by A.E. Wynn, George Philip Manning, Cement & Concrete Association.
4. Austin C.K., Formwork for Concrete, Cleaver-Hume Press Ltd., London, 1996.

Indian Standards:

1. IS 6461: Part V: 1972, Reaffirmed 2002; Glossary of terms relating to cement concrete: Formwork for concrete, Bureau of Indian Standard, New Delhi.
2. IS 14687: 1999, Falsework for Concrete Structures – guidelines, Bureau of Indian Standard, New Delhi.
3. IS 12183-1-1987, Code of practice for plumbing in multi-storeyed buildings (Part 1 water supply), Bureau of Indian Standards, New Delhi, India.
4. Uniform Illustrated Plumbing Code - India 2018, International Association of Plumbing and Mechanical Officials India.
5. International Plumbing Code - 2018, Appendix E, International Code Council, USA.
6. National Building Code of India - 2016, Vol. 2, Part 9, Bureau of Indian Standards, New Delhi, India.

Laboratory Assignments

The term work shall consist of a journal giving details at least 08 out of 10 of the following experiments. Oral Examination would be based on the term work.

1. Design of timber/steel formwork for slab. (Group of maximum Five students)
2. Design of timber/steel formwork for wall. (Group of maximum Five students)
3. Prototype model of any formwork. (Group of maximum Five students)
4. Analysis and design of any formwork using suitable software.
5. Prototype model of plumbing for G + 2 building. (Group of maximum Five students)
6. Design of plumbing. (Group of maximum Five students)
7. Detailing of plumbing system installation as per Indian Standard.
8. Detailing of plumbing hydraulics and plumbing components.
9. Site visit to view standard formwork and formwork for unique structures or formwork.
10. Site visit to industrial plumbing system

Activity: Assignments for each unit.

Course Name with Code: Airport and Bridge Engineering (CE CE23312c)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 0 3 Hrs/week	**04**	**Activity : 10 Marks**
PR : 0 2 Hrs/Week		**In Semester : 30 Marks**
		End Semester : 60 Marks
		OR : 30 Marks

Prerequisite:

Basic of computer and Infrastructure Engineering, understanding of drawings and specifications.

Course Objectives:

1. Introduce the aspect of airport and bridge system.
2. Study plans, specifications for planning and design.
3. Involve in the planning and design of new runways and terminal buildings
4. Select and design the bridge that will meet the needs of the area

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Analyze the fundamental function of airport.

CO2: Design & understand the runway, taxiway, and drainage systems.

CO3: Understand the BIM, AR and VR in airport planning and pavement design.

CO4: Plan the lighting and marking of airport and heliport

CO5: Estimate various components of bridge and loads on bridges.

CO6: Study and design of bridge structures.

Course Contents

Unit I: Introduction and Classification of Airport (07 Hours)

General, transportation systems, typical air trip, the air age, world civil air transport, geographic distribution of world air transport, air ports characteristics of good layout, runway configuration, airport obstruction, location of terminal buildings, aprons and hangers. zoning requirements regarding permissible heights of constructions and landing within the airport boundary, airport landslide planning, navigation, and landing aids – ILS, air traffic control (ATC).

Airport classification: community size and airport types, airport classification according to types of services, functional classification of airports, airport classification for the purpose of stipulating geometric standards, ICAO, FAA

Unit II: Aircraft Characterizes and Geometric design (07 Hours)

Introduction to Aircraft Characterizes: related to airport design characterizes of principle transport aircrafts, trends size, speed, and productivity of transport aircraft, turning radii. airport planning, size and type of airport, selection of site for the airport.

Geometric design: element of an airport, runway and taxi way width, runway profile and runway length, runway orientation, corrections and calculation, introduction to analytical methods for air travel demand for planning and casting, case study- airport master plan.

Unit III: Airport Visualizing, Airport Capacity and Airport Pavements (07 Hours)

Airports visualizing: introduction to visualizing airports in a virtual environment, building information modelling (BIM) for air ports, introduction to augmented reality (AR) and virtual reality (VR) in airport planning and design,

Airport capacity: ultimate and practical runway capacity, runway arrangement factors effecting

runway capacity, practical annual capacity, and practical hourly capacity,

Airport pavements: comparison- highway and airfield pavement, design of rigid airport pavements, design of rigid pavement and design of flexible pavement, junction of flexible and rigid pavements, airport drainage. Urban flooding hazard for Airports.

Unit IV: Airport Marking and Lighting- Heliports (06 Hours)

Airport Marking and lighting: the need for marking and lighting, runway lighting, runway marking, runway designation marking, runway centre marking, threshold marking, fixed distance marking , touchdown zone marking , runway side strips marking,

Heliports: helicopter characteristics, planning of heliports - site selection, size of landing area, orientation of landing area, heliport marking and lighting, vertical take-off, and landing (VTOL), short take-off and landing (STOL).

Unit V: Introduction to Bridges (06 Hours)

Classification, selection of bridge site and preliminary and detailed survey work, computation of discharge, linear waterway, economic span, afflux, scour depth, effective width, introduction to design loads for bridges, IRC loading standards, load distribution theory, bridge slabs, substructure: abutment, piers, and wing walls with their types based on requirement and suitability.

Unit VI: Types of Bridges (06 Hours)

Culvert: definition, location, waterway of culvert and types, design of pipe culverts, design of box culvert (Single vent only). Washing away issue of Culverts in High rainfall hilly area catchment. **Temporary bridges**: definition, materials used, brief general ideas about timber, floating- pontoon bridges. (Introduction only), Movable bridges: bascule, cut boat, flying, swing, lift, transporter and transverse bridges, their requirement and suitability. (Introduction only), Fixed span bridges: simple, continuous, cantilever, arch, suspension, bowstring girder type and rigid frame and cable stayed bridges, materials for super structure.

Bearing: definition, purpose and importance, types of bearings with their suitability (Introduction only).

Books & Other Resources:

Text books:

1. Airport Engineering, by Saxena S.C., CBS Publishers & Distributors
2. Airport planning and design – S.K. Khanna, M.G. Arora , S.S. Jain, Nem Chand and Brothers, Roorkee
3. Bridge Engineering by Rangwala, Charotar Publication
4. Airport Engineering by Rangwala, Charotar Publication

Reference books:

1. Ashford, N., and P. H. Wright. 1992. Airport Engineering, 3rd ed. New York: John Wiley & Sons
2. Essentials of Bridge Engineering – D. Johnson and Victor, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

Handbooks and Manuals:

1. Airport Planning Manual, Part 2 Land Use and Environmental Control, Doc 9184 AN/902

2. Airport Planning and Development Handbook, Paul Stephen Dempsey, Paul Dempsey, McGraw Hill Professional, 2000
3. https:///panchayatrajengineers.wordpress.com/2019/01/27/irc-codes-for-roads-and-bridges-direct-download-links-from-panchayatraj-engineers-blog
4. Indian Road Congress (IRC) – Standard Specifications and code of practice for bridges.

Laboratory Experiments/Assignments

Term work consists of the following. Oral Examination would be based on the term work

A. **Compulsory assignment**

1. Runway design for length and related corrections, and sketches of essential runway markings.
2. Design of pipe culverts and design of box culvert (Single vent only) one each.
3. Site visit to bridge site or airport site (report on visit)
4. Select best Airports, bridges in the world, and prepare its PPT and its presentation in practical along with submission of report on its details.

B. **Any Five from the following**

1. Structural design of flexible or rigid runway
2. Report on study of recent trends in airport planning and design.
3. Selection of bridge site, alignment, and collection of design data.
4. Building information modeling (BIM) system.
5. Report on guest lecture in applications of AR and VR in Airport or bridge engineering.
6. Prepare the drawing/plate (A3)/PPTs on airport marking and lighting (describing importance)
7. Study of planning and importance of Heliports.
8. Study of movable bridges/ temporary bridges/bearing.
9. Study of bridge substructure
10. Seminar presentation on one of the given topics from Syllabus and submission of report

Activity: Assignments for each unit.

Course Name with Code: Structural Design of Bridges (CE23312d)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 0 3 Hrs/week	**04**	**Activity : 10 Marks**
PR : 0 2 Hrs/Week		**In Semester : 30 Marks**
		End Semester : 60 Marks
		OR : 30 Marks

Prerequisite:

Fundamentals of Structural Analysis, Design of Steel Structure, Design of reinforced concrete Structure, Design of prestressed concrete elements.

Course Objectives:

1. To recognize the appropriate types of bridge structures as per site conditions.
2. To analyze and design reinforced concrete, steel and prestressed concrete bridges.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Identify loads on bridges and selection of type of bridge for the site condition as per Indian Standards.

CO2: Design the reinforced concrete deck slab, culvert slab and T beam deck slab for highway bridges.

CO3: Analysis and design of reinforced concrete and post tension prestressed concrete girders.

CO4: Classify the types of rail bridges and design the Truss steel bridges

CO5: Recognize different types of bearing and design the bearings for bridges.

CO6: Analysis and design of RC abutments and piers for bridges

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Course Contents

Unit I: Introduction to highway and railway bridges (07 Hours)

Types of RC highway and steel railway bridges, IRC loading standard for RC highway bridges, IRS codal provisions for railway steel bridges, impact factors for moving loads as per IRC loading standards and equivalent uniformly distributed load (EUDL).

Unit II: RC highway bridges (06Hours)

Slab culvert and T-beam deck slab bridges – Design of slab culvert, Deck slab: Structural configuration, Piegaud‘s method, analysis and design of deck slab supported on all sides for T-beam.

Unit III: RC highway bridges using post tensioned prestressed concrete girders (07 Hours)

T-beam deck slab bridges – Post tensioned girders: Load distribution on longitudinal and cross girders, Courbon’s theory, analysis and design of longitudinal and cross girders.

Unit IV: Railway steel bridges (06 Hours)

Introduction to types of railway steel bridges, Truss bridges: Structural configurations, loads and load combinations, analysis and design of truss elements, longitudinal and cross-girders, bracing systems.

Unit V: Bridge bearings (07 Hours)

Introduction to types of bearings, general features and function of various types bearings, design of steel bearings and elastomeric bearings.

Unit VI: Bridge Sub-structure **(06 Hours)**

Introduction of sub-structure, function of bridge sub-structure, loads on sub-structure, analysis and design of RC abutments and piers.

Books & Other Resources:

Text books:

1. Design of Bridges, N. Krishna Raju, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.
2. Design of Bridge Structures, T. R. Jagdish and M. A. Jayaram, Prentice-Hall of India Pvt. Limited., New Delhi.
3. Prestressed Concrete, N. Krishna Raju, Tata-McGraw Hill International.

Reference books:

1. Essentials of Bridge Engineering, Johnson Vector D., Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.
2. Design of Steel Structures, Ramachandra, Standard Publications New-Delhi.
3. Bridge Superstructure, Rajagopalan. N., Alpha Science International, New Delhi.
4. Bridge Engineering, Ponnuswamy S., Tata McGraw-Hill, New Delhi.

Laboratory Experiments/Assignments

The term work shall consist of a journal giving details of at least 01 out of 02 projects of the following experiments. Practical/Oral Examination would be based on the term work.
Note: - The term work can be prepared in a group of not more than four students in a group.

1. Project on RC highway bridges which shall include - the design of deck slab, longitudinal girder, cross-girder, bearings and abutment and pier. The detailing shall be shown in at least three full imperial sheets.
2. Project on railway steel bridges which shall include – the design of truss elements, longitudinal girder, cross-girder, and bearings. The detailing shall be shown in at least two full imperial sheets.
3. Report of at least two site visits covering the contents of the syllabus.

Activity: Assignments for each unit.

Course Name with Code: Design of Prestressed Concrete Structures

(CE23313a)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 3 Hrs/week	**04**	**Activity : 10 Marks**
PR : 2 Hrs/Week		**In Semester : 30 Marks**
		End Semester : 60 Marks
		OR : 30 Marks

Prerequisite:

1. Structural Mechanics, Structural Design: Concrete or equivalent course

Course Objectives:

1. To introduce the students to the basic concepts and principles of prestressed concrete structures.
2. Develop an insight into the behavior of prestressed concrete structural members both at service loads and overloads.
3. To explain fundamentals of prestressed concrete design.
4. To understand the applications of precast prestressed components in civil infrastructure.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Apply the basic concepts of prestressing in various Civil Engineering Structures.

CO2: Assess the various prestressing losses in prestressed concrete elements as per Indian Standard Codal provisions

CO3: Analyse and design the prestressed concrete elements design of sections for flexure

CO4: Analyse and design the prestressed concrete elements for Shear.

CO5: Design the prestressed concrete slab

CO6: Design the prestressed concrete flat slab

Course Contents

Unit I: Introduction: (6 Hours)

Basic Concepts of Prestressing, Historical development of prestressing, Materials and systems for prestressing, Types of Prestressing, advantages and limitations of Prestressing. Introduction of composite sections of prestressed concrete beam and cast in-situ RC slab.

Unit II: Analysis of Prestressed Members and Losses in Prestress: (6 Hours)

Analysis of prestressed concrete member, stress calculations and concept of cable profile and losses in prestressed concrete.

Unit III: Design of Sections for Flexure: (7 Hours)

Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure including end block

Unit IV: Design for Shear: (7 Hours)

Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

Unit V: **Design of Slab: (7 Hours**)

Introduction to slab, Types of Slab, Design of one way and two way post tensioned slab.

Unit VI: Design of Flat Slab (7 Hours)

Introduction to flat slab, Introduction to slab, Types of Flat Slab design of prestressed two-way flat slab by direct design method.

Books & Other Resources:

Text books:

1. Prestressed Concrete, Krishna Raju, N., Tata McGraw Hill Publishing Company, New Delhi 2006

2. Pre-stressed Concrete - Problems and Solutions, Krishna Raju. N., CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
3. Pre - stressed Concrete, Rajagopalan N., Narosa Publishing House, New Delhi

Reference books:

1. Advanced Concrete Design, Praveen Nagarajan, Person Publishers
2. Prestressed Concrete Structures, P. Dayaratnam. Scientific International Pvt. Ltd.
3. Design of Pre - stressed Concrete Structures , Lin T Y and Burns N H, John Wiley and Sons, New York
4. Prestressed Concrete, Pundit G S and Gupta S P, C B S Publishers, New Delhi
5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi. IS: 3370- Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

Laboratory Experiments/Assignments

The submission work shall include a journal documenting the assigned experiments and tasks. The Practical/Oral Examination will be conducted based on the completed submission.

1. Students must solve two numerical examples from Unit I and Unit II as part of the tutorial.
2. Prepare structural detailing sketches of Prestressed Concrete Elements on an A3 size sheet or in a sketchbook, based on Units III, IV, V and VI.
3. Arrange two site visits related to the course topics, such as Post-Tensioned/Pre-Tensioned Prestressed Concrete Beams, PT Slabs, Prestressed Sleepers, Electric Poles, etc.

Activity

An activity can be designed such as to enhance students learning experience. The students need to submit assignment on each unit as part of activity.

Course Name with Code: Advanced Concrete Technology (CE23313b)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 03 Hrs/week	**04**	**Activity :10 Marks**
PR : 02 Hrs/Week		**In Semester : 30 Marks**
		End Semester : 60 Marks
		OR : 30 Marks

Prerequisite:

Fundamentals of Concrete Technology.

Course Objectives:

1. To provide an advanced understanding on cement chemistry, influence of supplementary cementitious materials, and effect of admixtures on properties of concrete.
2. To illustrate the role of fibers and understand the durability properties of concrete.
3. To study advanced testing methods on concrete.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Understand the chemistry of cement and its effect on properties of concrete

CO2: Apply the knowledge of supplementary cementitious materials to produce sustainable concretes.

CO3: Understand the mechanism of working of admixtures and their effect on properties of concrete.

CO4: Evaluate the characteristic properties of fiber reinforced concrete.

CO5: Understand the durability properties of concrete.

CO6: Interpret the properties of concrete through advance testing methods.

Course Contents

Unit I: Cement and Concrete (07 Hours)

Types of cements, Bogue's compounds, structure of a hydrated cement paste, volume of hydrated product, porosity of cement paste, interfacial transition zone in concrete (ITZ), influence of ITZ on properties of concrete, types of elastic moduli, factors affecting elastic modulus of concrete.

Unit II: Supplementary Cementitious Materials (07 Hours)

Fly ash, blast furnace slag, silica fume, rice husk ash, metakaolin, industrial waste or by products, chemical composition and classification, effect on hydration process of portland cement, effect on workability of concrete, effect on the properties of hardened concrete, effect on durability of concrete.

Unit III: Chemical Admixtures (06 Hours)

Classification of admixtures, chemistry and mechanism, effect of admixtures on plastic properties and hardened properties of concrete, applications, specialty admixtures - viscosity modifying admixtures, corrosion-inhibiting admixtures, shrinkage-reducing admixtures.

Unit IV: Fiber Reinforced Concrete (06 Hours)

Types of fibers, matrix, stress transfer mechanism, steel fiber reinforced concrete (SFRC): types of steel fibers, balling effect, effect on properties of hardened concrete, applications, slurry infiltrated fiber concrete (SIFCON): fresh and hardened properties of SIFCON, applications, synthetic fiber reinforced concrete: types of synthetic fibers, properties of fibers, effect of fibers on properties of

concrete, applications.

Unit V: Durability of Concrete **(06 Hours)**

Plastic shrinkage, autogenous shrinkage, drying shrinkage, mitigation strategies, transport properties of concrete, permeability, corrosion, chloride penetration, carbonation, sulphate attack and acid attack.

Unit VI: Testing of Concrete **(07 Hours)**

Ultrasonic pulse velocity method: theory of pulse propagation through concrete, interpretation of results, corrosion: half-cell potential measurement, electrical resistivity method, permeability and absorption tests, concrete cores: core location and size, drilling, testing and interpretation of results, in-situ load testing.

Books & Other Resources:

Text books:

1. Concrete Technology, A.R. Santhakumar, Oxford University Press.
2. Concrete Technology, Job Thomas, Cengage Publications.

Reference books:

1. Properties of Concrete, A. M. Neville, Pearson Education.
2. 02 Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta and Paulo J.M. Monteiro, McGraw Hill Education.

IS Codes:

1. IS 1199 – 1959, Methods of sampling and analysis of concrete, Bureau of Indian Standards, New Delhi
2. IS 3085 – 1965, Method of test for permeability of cement mortar and concrete, Bureau of Indian Standards, New Delhi
3. IS 14959 – 2001, Method of test determination of water soluble and acid soluble chlorides in mortar and concrete Part 2: Hardened mortar and concrete, Bureau of Indian Standards, New Delhi
4. IS 516 – 1959, Method of tests for strength of concrete, Bureau of Indian Standards, New Delhi.

Laboratory Assignments

The term work shall consist of a journal giving details at least 08 out of 12 of the following experiments. Oral Examination would be based on the term work.

1. Shrinkage test on cement / concrete: Determine the drying shrinkage of cement/concrete in accordance to IS 1199.
2. Concrete mix design and production in lab of any one – Self compacting concrete, Fiber reinforced concrete, light-weight concrete, high strength or ultra-high strength concrete. Comparison with traditional concrete mix is to be clearly stated in the report.
3. Cost analysis (material, labour, equipment, others) of any type of concrete for lab, in-situ and RMC production.
4. Permeability test on concrete: Determine the permeability of concrete in accordance to IS 3085.
5. Perform any two Fresh (workability tests – Slump Flow Test, T-50, J-Ring, Visual Stability Index, Column Segression, L-Box, U-box) and Hardened (Compressive, tensile, flexural) properties tests on any high performance concrete.
6. Flexure test on fiber reinforced concrete beams: Determine the improvement in toughness of concrete containing fibers (any type of fiber)
7. Optimum dosage of admixture using Marsh cone apparatus: Determine the optimum dosage of plasticizers and superplasticizers for different types of cement

8. Test on chloride penetration in concrete: Determine the chloride content in hardened mortar / concrete in accordance to IS: 14959 (Part 2)
9. Elastic modulus of concrete: Determine the elastic modulus of concrete in accordance to IS: 516
10. NDT on concrete: Perform NDT on concrete using ultrasonic pulse velocity method
11. Write a review on any recent research article from standard peer-reviewed journal.
12. Report on at least one patent (national/international): on any topic related to advanced concrete technology.

Activity: Assignments for each unit.

Course Name with Code: Earthquake Engineering (CE23313c)

Teaching Scheme:	Credits	Examination Scheme:
TH: 3 Hrs. / week	4	Activity : 10 Marks
PR: 2 Hrs. / week		In-semester : 30 Marks
		End semester : 60 Marks
		OR : 30 Marks

Prerequisite:

Engineering Mechanics, Engineering Geology, Structural Design, Geotechnical Engineering, Engineering Mathematics.

Course Objectives: Students should have the ability to:

1. Understand earthquake causes, seismic waves, and ground motion parameters.
2. Analyze and solve single degree of freedom vibration systems.
3. Analyze and solve multi-degree of freedom vibration systems.
4. Apply static seismic analysis methods as per IS 1893.
5. Apply dynamic seismic analysis methods as per IS 1893.
6. Design lateral load-resisting systems using seismic design principles.

Course Outcomes: students will be able to

CO1: Explain the causes, types of seismic waves, and ground motion parameters.

CO2: Solve single degree of freedom vibration problems.

CO3: Analyze and solve multi-degree of freedom vibration systems.

CO4: Apply static seismic analysis methods in structural design.

CO5: Apply dynamic seismic analysis techniques using IS 1893.

CO6: Design lateral load-resisting systems using seismic design principles.

Course Contents

Unit I: Earthquake and Seismology (06 Hours)

Causes of earthquakes, types of seismic waves, magnitude and intensity, introduction to seismographs and accelerometers, key ground motion parameters such as peak acceleration, peak velocity, peak displacement, and ground motion spectra.

Unit II: Vibration Analysis: SDOF Systems (07 Hours)

Types of vibrations, dynamic equilibrium, mathematical modeling of systems, stiffness, damping, and types of damping. Analysis of Single Degree of Freedom (SDOF) systems subjected to free vibrations.

Unit III: Vibration Analysis: MDOF Systems (07 Hours)

Modeling and analysis of Multi-Degree of Freedom (MDOF) systems, solution methods for MDOF systems, and understanding Eigenvalues and Eigenvectors in vibration analysis.

Unit IV: Seismic Analysis: Static Approach (06 Hours)

Overview of seismic analysis, provisions in IS 1893, and equivalent static analysis for buildings subjected to seismic forces.

Unit V: Seismic Analysis: Dynamic Approach (07 Hours)

Introduction to dynamic analysis for earthquake response, provisions in IS 1893-2016, and response spectrum analysis for seismic design.

Unit VI: Seismic Design **(06 Hours)**

Seismic design factors, including building configuration, damping, torsion, and ductility. Lateral load-resisting systems such as moment-resisting frames, shear walls, diaphragms, and braced frames. Design provisions from IS 1893 and IS 13920 for ductile detailing of steel and concrete structures, focusing on strength and ductility of materials.

Text Books:

1. Structural Dynamics: Theory and Computation, Mario Paz & William Leigh, Springer Publications.
2. Earthquake Resistant Design of Structures, S. K. Duggal, Oxford Publications.
3. Earthquake Resistant Design of Structures, Pankaj Agarwal and Manish Shrikhande, Prentice Hall India Learning Private Limited.

Reference Books:

1. Dynamics of Structures, A. K. Chopra, Pearson Education India.

Indian Standards:

1. IS 1893 (Part 1): 2016 Reaffirmed in 2021, Criteria for Earthquake Resistant Design of Structures - Part 1: General Provisions and Buildings, Bureau of Indian Standards, New Delhi, India.
2. IS 13920: 2016 Reaffirmed in 2021, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice (First Revision), Bureau of Indian Standards, New Delhi, India.

Earthquake Engineering Lab

The oral examination will be based on the following term work.

A. Experiments

1. Using any programming language or spreadsheet, plot the response functions for different types of earthquake excitations.
2. Demonstrate the applications of horizontal and vertical shake tables.
3. Perform an equivalent static seismic analysis of a multi-story building frame based on the provisions of IS 1893 using suitable software.
4. Perform a dynamic seismic analysis of a multi-story building frame using the response spectrum method as per IS 1893-2016 with suitable software.

B. Virtual Lab Experiments

1. Simple Harmonic Oscillator.
2. Free Vibration of S.D.O.F System.
3. Forced Vibration of S.D.O.F System.
4. Vibration of M.D.O.F System.
5. Concept of Response Spectrum.
6. Continuous Systems.

Activity: Assignments for each unit.

Course Name with Code: Hydropower Engineering (CE23313d)

Teaching Scheme:	Credits	Examination Scheme:
TH: 3 Hrs/week	04	Activity : 10 Marks
PR: 2 Hrs/week		In Semester : 30 Marks
		End Semester : 60 Marks
		OR :30 Marks

Prerequisite:

Basics of Fluid Mechanics, Hydrology

Course Objectives:

1. Introduce the energy resources planning and potential concept.
2. Estimate the load factor and study the power house components and layout.
3. Understand the design of hydraulic turbines and study the economic consideration of hydroelectric power.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Understand the classification of power resources & trends in energy use patterns.
CO2: Identify the components of hydro power plant.
CO3: Analyze the load assessment for turbines.
CO4: Prepare the layout of power house based on the various structures need for it.
CO5: Design the turbines and surge tanks.
CO6: Understand the laws and regulatory aspects of hydroelectric power.

Course Contents

Unit 1: Hydropower Plants & Its Classification (07 Hours)

Introduction: sources and forms of energy, types of power plants, and elements of hydropower scheme, hydropower development in India. Power house structures-substructure and superstructure layout and dimensions, deign considerations. Hydropower plants classification: surface and underground power stations, pumped storage plants, tidal power plants, micro tidal units.

Unit II: Energy Resources and Load Assessment (06 Hours)

Estimation of electrical load on turbines, load factor, plant factor, peak demand and utilization factor, load curve, load duration curve, prediction of load, tariffs, hydro-thermal mix.

Unit III: Power and Energy Potential study (07 Hours)

Processing of hydrological data, use of extreme and long term hydrological data, mass and elevation volume curves, flow duration curves, gross and net head and estimation, reservoirs and their regulation, need for flow regulation, source of sediment, sediment yield in rivers, life of the reservoirs, methods of fixing installed capacity of a hydropower plant, estimation of power and energy potential, mean and peak load, load curve, load factor.

Unit IV: Water Conductor System and Powerhouse (06 Hours)

Water conductor system, alignment, intake structures, location and types, trash rack, penstock and pressure shaft, types of powerhouses, typical layout of powerhouse, components, power plant equipment's, instrumentation and control.

Unit V: Design of Hydraulic Turbines (07 Hours)

Components of hydraulic turbines, standardization and selection of turbine, Pelton turbine design, draft tube theory, standardization and applications draft tube. Water hammer and surge tanks: rigid and elastic water column theories, water hammer pressure, behavior of surge tanks, types of surge tanks, hydraulic design, design of simple surge tank-stability.

Unit VI: Economics of Hydroelectric Power: (06 Hours)

Hydropower, economic value and cost and total annual cost. economic considerations – pricing of electricity, laws and regulatory aspects, policies, electricity act- 2003, investment in the power sector, carbon credits, participation of private sector.

Books & Other Resources:

Text Books:

01.Water Power Engineering, Dandekar and Sharma, Vikas Publishin house, New Delhi
02. Water Power Engineering, R. K. Sharma and T. K. Sharma, S. Chand and Co. Ltd.
03. Irrigation Engineering and Hydraulic Structures, Garg , S. K. Khanna Publishers, New Delhi
04. Water Power Engineering, P. K. Bhattacharya, Khanna Pub., Delhi.

Reference Books:

01. Handbook of Hydroelectric Engineering, P. S. Nigam
02. Modern Power System Planning, Wang.
03. Hydropower Resources in India, CBIP
04. Hydro Power Structures, R. S. Varshney.
05. Water Power Development. E. Mosonvi, Vol. I & II.
06. Hydro-electric Engineering Practice, G. Brown, Vol. I, II & III.
07. Hydro – Electric Hand Book, Creager and Justin.
08. Centrifugal and axial flow Pump, A. J. Stephenoff, Krieger Publishing Company.

Term Work:

Term work marks will be based on continuous assessment.

01. Calculating the electricity bill of upper middle class family that uses various electrical appliances.
02. Determination of power output for a run of river plant with and without pondage.
03. Justification of economics of pumped storage plants.
04. Design of Kaplan / Francis / Pelton turbine.
05. Design of straight conical draft tube.
06. Use of any software to calculate water hammer pressure.
07. Case study of any hydropower project in detail.
08. Design of intake of a hydropower plant with neat sketch: Design of settling basin of a hydropower plant with neat sketch.
09. Hydraulic Design of Forebay and preparation of plan and longitudinal sections, Hydraulic Design of Surge Tank and preparation of plan and vertical Sections: Estimation of hydrodynamic pressure and steel thickness of penstock.
10. Report based on visit to any micro/small/mega hydropower project.

Activity: Assignments for each unit.

Course Name with Code: Solid Waste Management (Course Code: CE23051)

Teaching Scheme:	**3 Credits**	**Examination Scheme:**
TH: 2 Hrs./week		**Activity : 20 Marks**
PR: 2 Hrs./week		**In semester : 20 Marks**
		End Semester: 50 Marks
		TW : 20Marks

Prerequisite:

1. Fundamentals of Environmental Studies, Engineering Chemistry and Waste Water Engineering

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To understand problems of solid waste, estimate and characterize solid waste.
2. To apply the knowledge of mathematics, science and engineering for effective solid waste collection systems and for waste collection route optimization.
3. To understand the working of waste to energy system.
4. To understand management and legal requirements of special waste, reuse, recycle and material recovery.

Course Outcomes: After Completion of course students will be able to

CO1: understand solid waste management systems with respect to characteristics, sampling and generation rate.
CO2: explain methods of storage, collection and transportation of solid waste.
CO3: describe waste to energy systems from solid waste.
CO4: understand legal requirements of special waste.

Course Contents

Unit 1: Evolution, Sources and Types of Solid Waste

Introduction of solid waste, Functional elements, Types and sources of solid waste, Sampling and characteristics, Estimation of solid waste quantity, Factors affecting solid waste generation rate.

Unit 2: Collection and Transportation of Solid Waste

Integrated solid waste management, different methods of solid waste collection, transfer and transportation of solid waste, use of radio frequency identification (RFI)/global positioning system (GPS) for tracking vehicle location and optimization of route, methods of measuring solid waste.

Unit 3: Waste to energy

Basic principles of processing and treatment of municipal solid waste, Materials recovery and recycling, composting, anaerobic digestion or bio methanation, incineration and sanitary landfilling.

Unit 4: Special Waste Management and Regulations

Objectives and key points of hazardous and other waste management rules- 2016, domestic hazardous waste, e-waste, biomedical waste, plastic waste, slaughterhouse waste, construction & demolition waste and lead battery waste.

Books & Other Resources:

Textbooks

01 Integrated Solid Waste Management: Engineering Principles and Management Issues, George Tchobanoglous, Hilary Theisen, Samuel Vigil, Tchobanoglous George, Vigil Samuel, McGraw-Hill Companies, Incorporated.
02 Solid waste management, Dr. A.D. Bhide
03 Solid Waste Management, Sasikumar K and Sanoop Gopi Krishna, PHI.

Reference Books

01 Solid waste Engineering, Vesilind P. A., Worrell W and Reinhart, Thomson Learning Inc., Singapore.
02 CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.
03 Hazardous Waste Management, Charles A. Wentz, Second Edition, McGraw Hill International Edition, New York.
04 C for Environmental Scientists and Engineers, Y. Anjaneyulu and Valli Manickam, Wiley Publications. 05 Standard Handbook of Hazardous Waste Treatment and Disposal, Harry Freeman, McGraw-Hill Education, 1998

Laboratory Course: Solid Waste Management – Lab
Examination Scheme: PR: 30 Marks
TW: 20 Marks

Practical and Term work

1. Report of site visit to municipal solid waste management (Society/village/town/city).
2. Practical/theoretical identification of impacts of improper management of municipal solid waste.
3. Practical/theoretical sampling methods and characterization study of municipal solid waste.
4. Practical/theoretical estimation of solid waste generation and estimation of quantity
5. Prepare a report for management of any of the special wastes.
6. Prepare a report on use of smart technologies in solid waste management.
7. Determine calorific value of municipal solid waste using bomb calorimeter.
8. Determine moisture content and volatile solids for organic fraction of municipal solid waste.

Green Building and Smart Cities Course Code:-CE23052

Teaching Scheme:	Credits	Examination Scheme:
Theory: 02 Hours/week	3	Activity :20 Marks
PR: 02 Hrs /week		In-sem :20 Marks
		End-sem : 50 Marks
		T W : 20 Marks

Prerequisites: Building Materials, Global Warming.

Course Objectives:

1. To understand the definition, concept & objectives of the green building and to imbibe basics of green design.
2. To understand planning specifications of green building.
3. To understand the definition, concept & objectives of the smart city.
4. To understand the policies of smart city.

Course Outcomes (COs): The students will be able to learn:

CO1: Demonstrate green concept skills and apply tools of green building assessment.

CO2: Select appropriate green building material and technique.

CO3: Acquaint knowledge on smart cities planning and development.

CO4: Develop work break down structure, scheduling and project management of smart cities.

Course Contents

Unit I Concept of Green Buildings (06 Hours)

a) Definition of Green Buildings, typical features of green buildings, Necessity, Initiatives, Green buildings in India, Green building Assessment- Green Building Rating Systems (BREEAM, USGBC, LEED, IGBC, TERI-GRIHA, GREEN STAR), Criteria for rating, Energy efficient criteria, environmental benefits economic benefits, health and social benefits, Major energy efficiency areas for building, Life cycle cost of buildings, Codes and Certification Program

b) **Green Design**: Definition, Principles of sustainable development in Building Design, Characteristics of Sustainable Buildings, sustainably managed Materials, Integrated Lifecycle design of Materials and Structures (Concepts only)

UNIT-II Green Building Materials, Planning and Specifications (06 Hours)

a) **Green Building Materials**: Sustainably managed Materials, depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials, Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials.

b) **Green Building Planning and Specifications**: Environment friendly and cost-effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste & Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption.

UNIT-III Introduction to Smart cities (06 Hours)

a) Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city. Introduction to city planning, Concept, principle stakeholders, key trends in smart cities developments.
b) **Intelligent transport systems**: Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing

UNIT-IV Project management and Policies in Smart Cities (06 Hours)

a) **Project management**: Phases, Stages of project and work break down Structure, Project organization structure, Planning, Scheduling and CPM, Project cost analysis, resource allocation & leveling, Line of balancing technique, Project monitoring and control, Project risk management. Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system.
b) **Policy for Smart City**: Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.

Text Books:

1. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers
2. Integrated Life Cycle Design of Structures – By AskoSarja – SPON Press
3. Green Buildings (McGraw hill publication): by Gevorkian
4. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li
5. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos
6. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development

List of free reference guides/resources available on the net:

1. http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines
2. IGBC reference guide
3. Free abridged versions of LEED reference guides.

List of Practical's:

1. Assignment on- Identify sources of pollution in your area.
2. Assignment on- Technology involved in different construction of green building.
3. Assignment on- Technology involved in different construction of smart building.
4. Model making of green building/ smart cities (Maximum 4 students in one group).

HS23311: Environmental Studies

Teaching Scheme:	Credits	Examination Scheme:
TH: 02 Hrs/Week	02	Course Activity: 10 Marks ESE Exam: 60 Marks

Prerequisites:

Fundamentals of the environment.

Course Objectives:

1. Understand the fundamental concepts of environmental science and its relevance to engineering.
2. Analyze the environmental impact of various engineering industries.
3. Learn about sustainable engineering practices, pollution control, and waste management.
4. Study environmental laws in India and global initiatives for environmental conservation.

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Understand the components of the environment and types of energy resources.
CO-2: Analyze the impact of engineering industries on the environment.
CO-3: Learn sustainable engineering solutions for mitigating environmental damage.
CO-4: Aware of Indian and global initiatives for environmental protection.

Course Contents

Unit I: Introduction to Environmental Studies (6 Hrs)

Importance of Environmental Studies, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere, Ecosystems and Biodiversity: Types, Importance, and Conservation, Sustainable Development Goals (SDGs) and Role of Engineers in Sustainability, Renewable and Non-Renewable Resources, Water Resources: Overuse, Pollution, and Engineering Solutions, Energy Resources: Fossil Fuels, Nuclear Power, and Renewable Energy Alternatives, Land Resources: Soil Degradation, Deforestation, and Urbanization.

Unit II: Impact of Engineering Industries on Environment (7 Hrs)

Manufacturing & Automobile Industry: Air pollution, Carbon emissions, Waste disposal, Chemical & Pharmaceutical Industry: Water and soil contamination, Hazardous waste, Construction & Infrastructure: Land degradation, Dust pollution, Waste generation, Electronics & IT Industry: E-waste, Energy consumption, Semiconductor waste, Power Generation (Thermal, Hydropower, Nuclear): Pollution, Waste heat, Radiation hazards, Causes and Effects of Climate Change, Global Warming and Greenhouse Effect.

Unit III: Engineering Solutions for Environmental Mitigation and Sustainable Practices (7 Hrs)

Carbon Capture and Storage (CCS), Eco-friendly Materials, Sustainable Design & Life Cycle Assessment (LCA), Energy-efficient Technologies & Smart Grids, Case Studies on Successful Pollution Reduction **Waste Management Strategies:** Solid Waste and Biomedical Waste Management, E-Waste: Sources, Impact, and Recycling, Hazardous Waste Handling and Treatment, Circular Economy and Zero-Waste Technologies **Sustainable Engineering Practices:** Renewable Energy Technologies (Solar, Wind, Biomass, Hydropower) Green Buildings and Sustainable

Architecture, Electric Vehicles and Smart Transportation Systems, Sustainable Agriculture and Water Conservation Technologies.

Unit IV: Environmental Initiatives in India and Worldwide (6 Hrs)

National Initiatives: Swachh Bharat Abhiyan, Namami Gange, National Green Tribunal (NGT), Corporate Social Responsibility (CSR) & Environmental Compliance, Environmental Activism and the Role of NGOs, Environmental Laws and Policies in India, The Environmental Protection Act, 1986, Role of Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCB), International Environmental Agreements (Kyoto Protocol, Paris Agreement, COP Summits), Global Initiatives: UNEP, IPCC, World Bank Environmental Policies.

Books & Other Resources:

Text Books:

1. Benny Joseph, Environmental Studies, McGraw Hill Education, 3rd Edition, 2021. Anubha Kaushik & C.P. Kaushik, Environmental Studies, New Age International Publishers, 5th Edition, 2022.

Reference Books:

1. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 3rd Edition, 2021.
2. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Press, 3rd Edition, 2021.
3. Suresh K. Dhameja, Environmental Science and Engineering, S.K. Kataria & Sons, 2nd Edition, 2020.

Additional Reports & Resources:

- Government of India - Ministry of Environment, Forest & Climate Change (MoEFCC) Reports (Website)
- United Nations Environment Programme (UNEP) Reports (Website)
- IPCC Climate Change Reports (Website)
- Central Pollution Control Board (CPCB) Reports (Website)

List of Activities for reference:

Perform any two activities of the following.

1. **Ecosystem Study Report –** Visit a local park, water body, or forested area and document its ecosystem components (flora, fauna, food chains).
2. **Sustainability Case Study** – Choose one of the Sustainable Development Goals (SDGs) and prepare a report on its implementation in India.
3. **Renewable vs. Non-Renewable Resources** – Prepare a comparative chart listing sources, usage, and sustainability factors.
4. **Water Conservation Survey** – Conduct a survey in your neighborhood or campus to assess water consumption and suggest conservation strategies.
5. **Industrial Impact Assessment –** Select an engineering industry (automobile, chemical, IT, etc.) and analyze its environmental impact.
6. **Carbon Footprint Calculation** – Calculate the carbon footprint of your daily activities (electricity, transportation, food, etc.) and suggest ways to reduce it.

7. **Climate Change Awareness Video** – Create a short video (2–3 min) explaining global warming and its impact.
8. **Case Study on Pollution Control Failures** – Research a real-world incident of industrial pollution (e.g., Bhopal Gas Tragedy, Minamata Disease) and analyze the causes and consequences.
9. **Waste Management Audit –** Conduct a waste audit in your college or home, classify the waste generated, and propose a waste management plan.
10. **E-Waste Collection Drive** – Organize a drive to collect and safely dispose of e-waste in your locality. Submit a report on the amount collected and its disposal method.
11. **Renewable Energy Model** – Create a working or conceptual model of a solar panel, wind turbine, or biomass plant.
12. **Green Building Analysis** – Identify a green building in your city (or college) and analyze its energy-efficient features.
13. **Report on National Environmental Policies –** Summarize key environmental laws in India and their effectiveness.
14. **International Climate Agreements Presentation** – Prepare a presentation on major agreements like the Paris Agreement, Kyoto Protocol, and their impact on India.
15. **NGO/CSR Initiative Study** – Research an NGO or corporate social responsibility (CSR) initiative focused on environmental protection and prepare a report.
16. **Swachh Bharat Implementation Review** – Visit a local area, document cleanliness conditions, and suggest improvements under Swachh Bharat Abhiyan.

Evaluation Criteria (10 Marks Total)

- Depth of Analysis (3 Marks)
- Presentation & Clarity (3 Marks)
- Creativity & Practical Application (2 Marks)
- Timely Submission (2 Mark)

Course Name with Code: Disaster Management (OE2305)

Teaching Scheme:TH: 2 Hrs. / week	Credits 2	Examination Scheme: End semester : 50 Marks

Prerequisite:

Basic Geography and Environmental Science

Course Objectives:

1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management.
3. To build skills to respond to disaster.
4. To enhance disaster preparedness through training, awareness, GIS techniques, and risk assessment.

Course Outcomes: students will be able

CO1: To explore disaster types, risks, vulnerabilities, and management of natural and man-made events.

CO2: To summarize the various types of natural disasters, their management strategies, andthe socio-economic and environmental impacts, with a focus on case studies from Sikkim.

CO3: To explore disaster mitigation, management techniques, policies, and construction in seismic zones.

CO4: To summarize skills in disaster preparedness, awareness, GIS usage, and risk assessment projects.

Course Contents

Unit I **(06 Hours)**

Definition and types of disaster Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

Unit II **(06 Hours)**

Study of Important disasters Earthquakes and its types, magnitude and intensity, seismic zonesof India, major fault systems of India plate, flood types and its management, drought types andits management, landside and its managements case studies of disasters in Sikkim (e.g.) Earthquakes, Landside). Social Economics and Environmental impact of disasters.

Unit III **(06 Hours)**

Mitigation and Management techniques of Disaster Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, building design and construction in highly seismic zones, retrofitting of buildings.

(06 Hours)

Unit IV

Training, awareness program and project on disaster management Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, Mini project on disaster risk assessment and preparednessfor disasters with reference to disasters in Sikkim and its surrounding areas.

Textbooks:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Introduction to International Disaster Management, Damon, P. Copola, (2006), Butterworth Heineman.
3. Disaster management and Risk Reduction, Role of Environmental Knowledge, Gupta A.K., Niar S.S and Chatterjee S. (2013). Narosa Publishing House, Delhi.
4. Disaster Management, Murthy D.B.N. (2012), Deep and Deep Publication PVT. Ltd. NewDelhi.
5. Managing Natural Disasters, Modh S. (2010), Mac Millan publishers India LTD.

Course Name with Code: Sustainability and Climate Change (Course Code: OE2317)

Teaching Scheme:	**2 Credits**	**Examination Scheme:**
TH: 2 Hrs./week		**End Semester: 50 Marks**

Prerequisite:

1. Fundamentals of Environmental Studies, Engineering Chemistry

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To Understand the scientific basis of climate change
2. To analyze the environmental, social, and economic impacts of climate change.

Course Outcomes: After Completion of course students will be able to

CO1: Understand the scientific basis of climate change.
CO2: Analyze the environmental, social, and economic impacts of climate change.
CO3: Understand policies and strategies for mitigating climate change and explore sustainable practices and their implementation.
CO4: Develop critical thinking skills to address sustainability challenges

Course Contents

UNIT 1

Introduction to Sustainability and Climate Change (06 Hours)

Definitions and key concepts, History of climate science, Overview of sustainability principles Climate Change Science: Greenhouse gases and the greenhouse effect, Climate models and predictions Evidence of climate change Impacts of Climate Change: Environmental impacts (e.g., sea level rise, extreme weather events), Social impacts (e.g., health, displacement), Economic impacts (e.g., agriculture, industry)

UNIT 2

Mitigation Strategies (06 Hours)

Renewable energy sources, Energy efficiency and conservation, Carbon capture and storage Adaptation Strategies: Resilient infrastructure, Disaster risk reduction, Climate-smart agriculture

UNIT 3 (06 Hours)

Sustainable Practices: Sustainable transportation, Waste management and recycling, Water conservation, Policy and Governance: International climate agreements (e.g., Paris Agreement), National and local climate policies, Role of non-governmental organizations

UNIT 4 (06 Hours)

Future Directions and Innovations: Emerging technologies for sustainability, Role of education and awareness, Interdisciplinary approaches to climate change

Books & Other Resources:

Textbooks

1. The Great Derangement: Climate Change and the Unthinkable, Amitav Ghosh
2. Global Warming in India by R. N. Singh
3. Climate Change and India: Vulnerability Assessment and Adaptation edited by P. R. Shukla, S.

K. Sharma, and P. V. Ramana

4. Sustainable Development and Climate Change by Neeraj Prasad, Shyamal Sarkar, and others
   Climate Change: Perspectives from India edited by Navroz K. Dubash

Reference Books

1. The Sixth Extinction: An Unnatural History by Elizabeth Kolbert
2. This Changes Everything: Capitalism vs. The Climate by Naomi Klein
3. Sustainability: A Comprehensive Foundation by Tom Theis and Jonathan Tomkin

Course Name with Code: Vocational and Skill Enhancement Course (VSEC)_ETAB (CE23315)

Teaching Scheme:	Credits	Examination Scheme:	
		Activity	: 10 Marks
PR: 4 Hrs. / week	2	TW	: 30 Marks
		PR	: 30 Marks

Prerequisite:

To get the most out of ETABS training, trainees/students should have solid understanding in the following subjects.

1. Mathematics: Vector analysis.
2. Matrix, differential equations.
3. Strength of Materials.
4. Structural Analysis.
5. Steel Design.
6. Concrete Design.

Course Objectives:

7. To learn basic operations in ETABS

Course Outcomes: students will be able to

Perform analysis and design of RC and steel structure.

List of Practical's

5. Introduction to ETABS Basics.
   a) General Tools.
   b) Commands & their Functions in ETABS.

6. Modelling in ETABS.
   a) Modelling
      - Model Initialization Methods.
      - Defining Grids Part-1 (Uniform Grid Spacing).
      - Defining Grids Part-2 (Custom Grid Spacing).
      - Modelling of Simple Beam.
      - Defining Material Properties.
      - Defining Sectional Properties.
      - Creating Frame over Grid Lines.
      - Assigning Restraints / Support.

   b) Load Patterns, Load Cases & Their Combination.
      - Defining load pattern, load case and combinations.
      - Assigning load over the frames.

c) Analysis & Design of Model.
- Check the Model for Error.
- Analyzing The Model.
- Generate SFD & BMD.
- Design of Model.

7. ANALYSIS & DESIGN OF G+1 BUILDING.
   a) Study of Building Drawing.
   b) Importing CAD File In ETABS.
   c) Assigning & Modifying Grid Lines.
   d) Defining Material & Sectional Properties.
   e) Modelling of Building.
   f) Assigning Sectional Properties.
   g) Defining Load Patterns & Combination.
   h) Assigning Loads on Building Frames.
   i) Analyzing the Model & Generate SFD & BMD.
   j) Design of Structure.
   k) Schedule of Reinforcement.

8. Introduction to use of Steel Sections.

Activity-

Mini project using ETAB

Group of max.four students, each student will evaluated separately.

Course Name with Code: Advanced Design of Concrete Structures (Honor CE23392)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 0 3 Hrs/week	**04**	**Activity :20 Marks**
PR : 0 2 Hrs/Week		**In Semester :20 Marks**
		End Semester :70 Marks
		PR :20 Marks
		TW :20 Marks

Prerequisite:

Fundamentals of Engineering Mechanics, Mechanics of Materials, Structural Analysis and Design of Reinforced Concrete Structures.

Course Objectives:

1. This course is designed to provide understanding of IS code provisions, fundamentals of concrete design and its applications for design of various components.
2. Students should be able to understand components of reinforced concrete structures and its arrangements.
3. To introduce basic concept of prestressed concrete.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Analyze and design of flat.

CO2: Understand grid slab and ductile detailing.

CO3: Analyze and design of earth retaining structures.

CO4: Analyze and design of liquid retaining structures.

CO5: Analyze and design of foundations.

CO6: Explain the general behavior of Prestressed Concrete sections under external load.

Course Contents

Unit I: Design of Flat Slab (06 Hours)

Flat slabs, types, design methods, column and middle strip, proportioning of flat slab element, total design moment, distribution of moments, effect of pattern loading, design for shear, design of intermediate and end panel by direct method only.

Unit II: Design of Grid Slab and Ductile detailing (06 Hours)

Design of Grid Slab by I.S. code method. Detailing for earthquake resistant construction. Introduction, Cyclic behavior of concrete and reinforcement, significance of Ductility, Ductile detailing for beams, columns, beam-column joint and footing.

Unit III: Design of Earth Retaining Structures (06Hours)

Types of retaining walls, various backfill conditions, design of cantilever type retaining walls for different backfill conditions

Unit IV: Design of Liquid Retaining Structures (07 Hours)

Types of liquid retaining structures, code provisions, analysis by approximate method and by using IS code method, design of circular and rectangular water tanks resting on ground.

Unit V: Design of Combined Footing and Pile Foundation (07 Hours)

Design of combined footing, design of pile and pile cap.

Unit VI: Introduction to Prestressed concrete (07 Hours)

Materials and their characteristics, types of prestressing, Methods and various prestressing systems, Losses

of prestressed. Analysis of Rectangular and flanged beams.

Books & Other Resources:

Text books:

1. Reinforced Concrete Design, 3rd Edition, 2009, S. Unnikrishna Pillai and Devdas Menon, Tata Mcgraw Hill.
2. Advanced Reinforced Concrete Design, N Krishnaraju, CBS Publishers and Distributors.
3. Advance R. C. C. Design, S. S. Bhavikatti, New Age International Publishers.
4. Prestressed Concrete Structures; Krishna Raju, N., TMH; Delhi.

Reference books:

5. Design of Reinforced Concrete Structures, by Ramamrutham S, Dhanpat Rai Publications.
6. Advanced Reinforced Concrete Design, P. C. Varghese, Prentice Hall of India Pvt. Ltd., New Delhi.
7. Fundamentals of Reinforced Concrete, N. C. Sinha, S.K. Roy, S. Chand & Co. Ltd, New Delhi limited, New Delhi.

IS Codes

1. IS 1893 (Part 1): 2016, Reaffirmed in 2021, Criteria for Earthquake Resistant Design of Structures - Part 1: General Provisions and Buildings, Bureau of Indian Standards, New Delhi.
2. IS 13920: 2016 Reaffirmed in 2021, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice (First Revision), Bureau of Indian Standards, New Delhi.
3. IS: 456-2000, Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.
4. IS: 3370-2021, Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi.
5. IS 1343:2012 Indian Standard Code of Practice for Prestressed Concrete - Code of Practice (Second Revision).

Laboratory Experiments

Term work consists of a journal containing the following design, drawing and site visit report. Oral examination will be based on term work.

4. Four full imperial drawing sheets showing the reinforcement details.
5. Compulsory site visits based on above syllabus. Report should contain structural details with sketches.

Activity

Activity shall consist of at least one of the following

An activity can be designed such as to enhance students learning experience. The students need to submit assignment on each unit as part of activity.

Multidisciplinary Minor (MDM) Subjects			
AI23051	AI & Machine Learning	ET23053	Internet of Things
AI23052	Data Science	CE23051	Waste Management
AI23053	Generative AI	CE23052	Green Building & Smart Cities
CO23051	Cloud Computing	ME23051	Introduction to 3D Printing Technologies
CO23052	High Performance Computing	ME23052	Introduction to Robotics & Automation
CO23053	Comp Graphics & Gaming	EL23051	Solar Tech
IT23051	Cyber Security	EL23052	Industrial Automation
IT23052	Full Stack Development	GS23051	Nano Technology
ET23051	Embedded Systems	GS23052	Linear Algebra and Statistics
ET23052	Drone Technology		

Open Electives (OE) Subjects			
OE2301	Digital Marketing	OE2311	Biotechnology
OE2302	Professional Leadership	OE2312	International Relations
OE2303	Organizational Behavior	OE2313	Universal Human Values
OE2304	Industrial Management	OE2314	Education Technology
OE2305	Disaster Management	OE2315	Design Thinking
OE2306	Energy Economic & Management	OE2316	Financial Literacy for Bharat
OE2307	Operation Research	OE2317	Sustainability & Climate Change
OE2308	Intellectual Property Rights	OE2318	Agriculture Technology
OE2309	Cyber Laws	OE2319	Architectural Technology
OE2310	Bioinformatics		

Course Name with Code: Design of Steel Structures (CE23301)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 0 3 Hrs/week	**04**	**Activity :10 Marks**
PR : 0 2 Hrs/Week		**In Semester : 30 Marks**
		End Semester : 60 Marks
		OR : 30 Marks

Prerequisite:

Fundamentals of Engineering Mechanics, Mechanics of Materials and Structural Analysis

Course Objectives:

1. This course is designed to provide understanding of IS code provisions, fundamentals of structural steel design and its applications for design of various components.
2. Students should be able to understand components of steel structures and its arrangements.
3. Student should be able to design beams, columns, column footings, roof trusses, gantry girder and plate girders.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Understand the fundamentals of structural steel fasteners and connections

CO2: Learn the analysis and design of tension and compression members.

CO3: Analyze and design steel column and column bases.

CO4: Analyze and design the flexural members.

CO5: Analyze and design industrial truss and gantry girder.

CO6: Analyze and design of welded plate girder.

Course Contents

Unit I: Design Philosophy and Connections (07 Hours)

Steel as a structural material, various grades of structural steel, properties, various rolled steel sections and their properties, Introduction to IS 800:2007,808,816,875 etc, Design philosophies, Plate(Local) buckling, Classification of cross-sections(flexure). Structural Steel Fasteners: Introduction, Behavior of bolted and welded connections (types, designations, properties, permissible stresses), failure of bolted and welded joints. Strength of bolt and strength of weld, Efficiency of joints, Design of simple, bolted and welded connections.

Unit II: Design of Tension and Compression Members (07Hours)

Design of axially loaded members (a) Tension members: Introduction, Net area, Shear-lag and block shear.

(b) Compression members: Introduction, Euler's buckling theory, Classification of cross- sections (buckling), Imperfection factor.

Unit III: Design of Columns and Column Bases (07 Hours)

Design of columns: Introduction, Design of axially loaded rolled sections, built up columns, laced and battened columns, Column base: slab base and gusseted base under axial loads.

Unit IV: Design of Flexural Members (06 Hours)

Design of simple beams: Introduction, Flexural behavior of beams which does not undergo lateral buckling, Flexural behavior of beams which undergo lateral buckling, Shear behavior, Web buckling and Crippling,

Design strength in bending, Design strength in shear, Limit state serviceability–Deflection,

Unit V: Design of Industrial truss and Gantry Girder (06 Hours)

Analysis of roof truss of an industrial building: Introduction to different components of industrial shed, types of trusses, assessment member forces under various loads (dead load, live load and wind load), design of members of a truss, design of purlin. Design of gantry girder: selection and design of cross section, check for moment capacity, buckling resistance, bi-axial bending, serviceability and fatigue strength.

Unit IV: Design of Welded Plate Girder (06 Hours)

Concept of plate girder, components of welded plate girder, intermittent weld, design of cross section, curtailment of flange plates, end bearing, load bearing, and intermediate stiffeners, design of connection between flange & web plate and web plate & stiffeners, check for shear buckling of web, shear capacity of end panel and serviceability condition.

Books & Other Resources:

Text books:

1. Limit State Design of Steel Structures, S K Duggal, Tata McGraw Hill Education, New Delhi.
2. Design of Steel Structure by Limit State Method as per IS: 800- 2007, Bhavikatti S S, I. K. International publishing house, New Delhi.
3. Design of Steel Structures, K. S. Sai Ram, Pearson, New Delhi

Reference books:

1. Design of Steel Structure, N Subramanian, Oxford University Press, New Delhi
2. Limit State Design in Structural Steel, M. R. Shiyekar, PHI, Delhi
3. Fundamentals of structural steel design, M L Gambhir, Tata McGraw Hill Education Private limited, New Delhi.
4. Limit State Design of Steel Structure, Ramchandra & Gehlot, Scientific Publishers, Pune
5. Analysis and Design: Practice of Steel Structures, Karuna Ghosh, PHI Learning Pvt. Ltd. Delhi
6. Limit State Design of Steel Structure, V L Shah & Gore, Structures Publication, Pune

IS Codes

1. IS 800-2007: Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi
2. IS 808-1989: Dimensions for hot rolled steel beam, column, channel and angle sections, Bureau of Indian Standards, New Delhi
3. IS 875- Part 1 and 2 (1987) and Part 3 (2015): Code of practice for design loads (other than earthquake) for building and structures, Bureau of Indian Standards, New Delhi
4. SP-6(1) and 6(6): ISI handbook for Structural Engineers, Bureau of Indian Standards, New Delhi

Laboratory Experiments/Assignments

Term work consists of a journal containing the following design, drawing and site visit report. Oral examination will be based on term work

1. Four full imperial size hand drawn drawing sheets consists of steel structural detailing of 16 sketches based on the syllabus.
2. Design of welded plate girder: design of cross section, curtailment of flange plates, stiffeners and connections. One full imperial size drawing sheet used to present the design details using any suitable software.
3. Compulsory two site visits based on industrial steel structure and welded plate girder Report should contain structural details with sketches.

Activity

Activity shall consist of at least one of the following

An activity can be designed such as to enhance students learning experience. The students need to submit assignment on each unit as part of activity.

Course Name with Code: Transportation Engineering (CE23302)

Teaching Scheme:		**Examination Scheme:**
TH: 3 Hrs. / week	**Credits**	**Activity : 10 Marks**
	4	**In-semester : 30 Marks**
PR: 2 Hrs. / week		**End semester : 60 Marks**
		OR : 30 Marks

Prerequisite:

Concrete Technology, Construction Materials, Geotechnical Engineering and Surveying.

Course Objectives: Students should have the ability to:

1. Learn the principles and practices of transportation planning.
2. Describe traffic studies, their analysis, and interpretation.
3. Understand the geometric design of cross-sectional elements of pavements.
4. Study the characteristics, properties, and testing procedures of highway materials.
5. Enumerate different types of pavements and design both flexible and rigid pavements.
6. Understand the fundamentals of Bridge Engineering and Railway Engineering.

Course Outcomes: students will be able to

CO1: Understand the principles and practices of transportation planning.

CO2: Demonstrate knowledge of traffic studies, analysis, and their interpretation.

CO3: Design geometric elements of road pavements.

CO4: Evaluate the properties of highway materials for use in road pavements.

CO5: Analyze different types of pavements and their design.

CO6: Understand the fundamentals of Bridge Engineering and Railway Engineering.

Course Contents

Unit I: Highway Development and Planning (06 Hours)

History and development of highways, classification of roads, road patterns, road development in India: vision 2021, rural road development vision 2025, current road projects in India, highway alignment, highway project report preparation (planning surveys & master plans based on saturation system), problems based on saturation system.

Unit II: Traffic Engineering and Control (06 Hours)

Traffic characteristics, traffic engineering studies, traffic flow and capacity, traffic control devices (signs, signals, islands and road markings), accident studies, types of road intersections, parking studies and highway lighting.

Unit III: Geometric Design of Highways (07 Hours)

Introduction to geometric design, highway cross section elements, sight distance, design of horizontal alignment, basic problems of horizontal alignment, design of vertical alignment and simple problems related to vertical alignment, design of intersections and simple problems on intersection design.

Unit IV: Pavement Materials (07 Hours)

Materials for highway construction: Types of materials- soil subgrade, aggregates and bituminous binders. Bituminous materials: Bitumen, modified bitumen, emulsions and cutbacks; overview of polymer modified bitumen, crumb rubber modified bitumen and foamed bitumen. Marshall stability test: Introduction to the Marshall mix design method and its tests (stability, flow, VMA, air voids etc.). Soil and aggregate testing: Brief overview of soil tests (CBR test) and aggregate tests used in pavement construction.

Unit V: Pavement Design (07 Hours)

Introduction to pavement types: Overview of flexible and rigid pavements. Flexible pavement design: Design traffic, vehicle damage factor, lane distribution factor, and traffic growth rate; design guidelines based on IRC 37-2018 (no numerical problems). Rigid pavement design: Components, stresses in concrete pavements, wheel load stresses, and temperature stresses; design guidelines based on IRC 58-2015 (no numerical problems). Subsurface and surface drainage: Importance of drainage in pavement design; basic methods of subsurface and surface drainage.

Unit VI: Bridge and Railway Engineering (06 Hours)

Bridge Engineering: Types and components of bridges, site investigation for bridge construction, factors affecting the choice of bridge superstructure and approach roads. Loads on bridges: Overview of load types and specifications (IRC specifications). Substructure of bridges: Types of substructures (abutments, piers, and wing walls). Railway Engineering: Overview of the role and necessity of railways, permanent way components, different types of railway gauges and their suitability.

Text Books:

1. Highway Engineering, S. K. Khanna, C. E. G. Justo and A. Veeraragavan, Nem Chand and Brothers.
2. Principles and Practices of Highway Engineering, Dr. L. R. Kadiyali, Khanna Publishers Delhi.
3. Principles of Highway Engineering and Traffic Analysis (4th Edition), F. L. Mannering and Scott S. Washburn, Wiley India.
4. Highway and Bridge Engineering, B. L. Gupta and Amit Gupta, Standard publishers Distributors.
5. Principles of Railway Engineering, Rangwala, Charotar publication.

Reference Books:

1. A Course in Highway Engineering, S. P. Bindra, Dhanpat Rai and Sons.
2. Principles of Transportation Engineering, G. V. Rao, Tata MacGraw Hill Publication.
3. Highway Engineering, Rangawala, Charotar publishing House.
4. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, Prentice Hall of India Pvt. Ltd.
5. Railway Engineering, M. M. Agarwal.

Indian Standards and Handbooks:

1. IS 1201 to 1220 - 1978, IS 73, IS 2386 part I to V.
2. IRC 58 - 2015, IRC 37 - 2018.
3. Specifications for Road and Bridge works (MORTH) - IRC, New Delhi.
4. Handbook of Road Technology, Lay M. G., Gorden Breach Science, Newyork.
5. Civil Engineering Handbook, Khanna S. K.

Transportation Engineering Lab

The oral examination will be based on the following term work.

A. The practical consists of three parts:

I. Tests on Aggregate (Any Five)

1. Aggregate Impact Value Test.
2. Aggregate Crushing Strength Test.
3. Los Angeles Abrasion Test.
4. Shape Test (Flakiness Index and Elongation Index).
5. Specific Gravity and Water Absorption Test by basket method.
6. Stripping Value Test.
7. Soundness Test.

II. Tests on Bitumen (Any Five)

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash Point and Fire Point Test.
5. Bitumen Extraction Test.
6. Viscosity Test (Tar Viscometer).
7. Specific Gravity Test.

III. Tests on Aggregate and Bitumen Combination

1. Demonstration of Marshall Stability Test.

B. Technical visits

1. Site Visit Report: Road Construction Project.
2. Site Visit Report: Hot Mix Plant.

Activity: Assignments for each unit.

Course Name with Code: Advanced Surveying (CE23303a)

Teaching Scheme:		**Examination Scheme:**
TH: 3 Hrs. / week	**Credits**	**Activity : 10 Marks**
		In-semester : 30 Marks
PR: 2 Hrs. / week	**4**	**End semester : 60 Marks**
		TW : 30 Marks

Prerequisite:

Basic introduction to Civil Engineering field and Engineering Mathematics.

1. To understand the advanced surveying techniques and instruments.
2. To interpret the advanced surveying measurements.
3. To create accurate and detailed maps of the terrain using aerial mapping.

Course Outcomes: students will be able to

1. Recognize the concept of triangulation for fixing the ground control points.
2. Differentiate most probable values for different measurement and adjust those in a given figure.
3. Summarize the concepts of astronomical and hydrographic surveying.
4. Demonstrate the use of aerial photographs for mapping.
5. Analyze use of modern surveying instruments in the field.
6. Execute GPS and the associated software for different applications in Civil Engineering.

Course Contents

Unit I: Geodetic Surveying and Trigonometric Levelling (07 Hours)

(a) Geodetic surveying: objectives and methods of geodetic surveying, concept of triangulation, triangulation figures, classification of triangulation survey, concept of well-conditioned triangle, selection of stations, inter visibility and height of stations, field work in triangulation, concept satellite station.

(b) Trigonometric levelling: terrestrial refraction, angular corrections for curvature and refraction, axis signal correction, determination of difference in elevation by single observation and reciprocal observations

Unit II: Theory of Errors and Triangulation Adjustment (06 Hours)

Types of errors, definitions, laws of accidental errors, laws of weights, determination of the most probable values of quantities, theory of least squares, method of normal equations, method of corrections, method of correlates, rules for giving weights and distribution of errors to the field observations. Angle and station adjustment, figure adjustment, adjustment of geodetic quadrilateral, spherical triangle and calculations of spherical excess and sides of spherical triangle.

Unit III: Astronomical and Hydrographic Survey (07 Hours)

(a) Astronomical surveying: definitions of astronomical terms, coordinate systems for locating heavenly bodies, geographic, geodetic, geocentric, cartesian, local and projected coordinates for earth resources mapping, elements of spherical trigonometry, shortest distance between two points on earth, determination of latitude and longitude, determination of azimuth.
(b) Hydrographic surveying: objectives of hydrographic survey, shore line and river survey, soundings: equipment's to measure sounding, methods to locate sounding, three-point problem and its solution (analytical, mechanical and graphical), determination of MSL using GPS.

Unit IV: Aerial Photogrammetry (06 Hours)

Introduction, principle, uses, classification-qualitative and quantitative photogrammetry, types of aerial photographs, definitions, scale of vertical photograph, ground co-ordinates, relief displacement, parallax bar, height from parallax measurements, mirror stereoscope, flight planning, procedure of aerial survey, photomaps and mosaics, digital photogrammetry, drone mapping and photogrammetry.

Unit V: Modern Surveying Instruments and Techniques (07 Hours)

Introduction to remote sensing, active and passive remote sensing, developments of remote sensing technology and advantages, different platforms of remote sensing, EM spectrum, interaction of EM radiation with atmosphere, remote sensing applications in flood mapping, definition of GIS, components of GIS, importance of GIS, raster data and vector data, primary and secondary data, applications of GIS. Total station: classification, fundamental quantities measured, parts and accessories, basic measuring and working principle of total station, field procedure for total station survey, sources of errors in total station, care and maintenance of total station, basic principles of electronic distance measuring instrument, reflector-less total station, robotic total station, smart station, LIDAR and GPR.

Unit VI: GPS Surveying (06 Hours)

Geodesy fundamentals, geoid, datum, ellipsoid: definition and basic concepts, coordinate systems, special referencing system, map scale, scale factors, Indian geodetic system, reference surface, geodetic systems, segments of GPS, GPS codes, types of GPS receivers, principle of GPS positioning, GPS data formats. GPS errors sources and GPS accuracy, GPS survey methods, future developments in GPS, DGPS and RTK technique, GPS applications and limitations, advantages of GPS surveying over conventional methods, digital terrain model (DTM): topographic representation of the terrain and generation of DTM on computers using spot heights and contour maps.

Text Books:

1. Surveying and Leveling - Part-II and III, T. P. Kanetkar and S. V. Kulkarni, Pune Vidyarthi Griha Prakashan, Pune.

2. Surveying Vol. II, S.K. Duggal, Tata McGraw Hill Publishing Company Ltd. New Delhi.

Reference Books:

1. Advanced Surveying: Total Station, GPS, GIS & Remote Sensing, Satheesh Gopi, 2/e, Pearson Education, Chennai.
2. Surveying Vol. II & III, B C Punmia, Laxmi Publications, New Delhi.
3. Surveying Vol. II & III, K R Arora, Standard book house, New Delhi.
4. Surveying and Leveling, R Subramanian, Second edition, Oxford University Press, New Delhi.
5. Remote Sensing and Geographical Information Systems, Anji Reddy, BS Publications, Hyderabad.

Term work

It shall consist of list of practical exercises and projects for surveying as detailed below

a) Perform any 5 Practical's out of 1 to 7 and Any 01 project:

8. Measurement of vertical angles using 1" theodolite and digital theodolite.
9. Solution of three-point problem using analytical and graphical method.
10. Measuring the height of a tower using total station.
11. Setting up stakes for marking the foundation of a building on ground using total station.
12. Measurement of distances, angles, gradient and distance between two inaccessible points using total station.
13. Demonstration of the use of unmanned aerial vehicle (UAV).
14. Measuring the GPS coordinates of ground control points in a mapping survey using any GNSS system.

b) Projects: (Minimum One)

8. Preparing a topographic map using total station and appropriate mapping software.
9. Mapping a given area using a differential GPS.

Activity:

Assignment on each unit.

Course Name with Code: Project Management and Economics (CE 23303b)

Teaching Scheme:	Credits	Examination Scheme:
TH: 3 Hrs. / week	4	Activity : 10 Marks
PR: 2 Hrs. / week		In-semester : 30 Marks
		End semester : 60 Marks
		TW : 30 Marks

Prerequisite:

Fundamentals of management, Indian construction industry, Economics.

Course Objectives: Students should have the ability to:

1. Describe the various concepts involved in project management.
2. Explain scientific methods of planning and management.
3. Segregate the materials as per their annual usage and explain process to find production rate of construction equipment.
4. Demonstrates methods of manpower planning and use various project monitoring methods.
5. Discuss engineering economics and its applications in construction.
6. Differentiate and use methods of project selection to select best project.

Course Outcomes: Students will be able to

CO1: Describe project life cycle and the domains of Project Management.

CO2: Explain networking methods and their applications in planning and management.

CO3: Categorize the materials as per their annual usage and also calculate production rate of construction equipment.

CO4: Demonstrates resource allocation techniques and apply it for manpower planning.

CO5: Understand the economic terms, laws and prepare balance sheet along with profit and loss account statement.

CO6: Apply the methods of project selection and recommend the best economical project.

Course Contents

Unit I: Introduction to Project management (06 Hours)

Importance, objectives & functions of management, principles of management, categories of project, project failure, project life cycle concept and cost components, project management book of knowledge (PMBOK) -different domain areas, project management institute and certified project management professionals (PMP). Importance of organizational structure in management, authority and responsibility relationship.

Unit II: Project planning & scheduling (07 Hours)

WBS – work breakdown structure, gantt bar chart & its limitations, mile stone chart, network planning, network analysis, C.PM., activity on arrow (A.O.A.), critical path and type of floats, precedence network analysis (A.O.N), types of precedence relationship, PERT analysis

Unit III: Project resources and Site planning (06 Hours)

Objectives of materials management – primary and secondary, material procurement procedures , record keeping ,use of excel sheets, ERP software, inventory control- ABC analysis, EOQ, introduction to equipment management -productivity studies, Site layout and planning, safety norms- measures and precautions on site, implementation of safety programs.

Unit IV: Project monitoring and control (07 Hours)

Resource allocation – resource smoothening and leveling, network crashing- time- cost-resource optimization, project monitoring methods, updating and earned value analysis, introduction to use of project management software's-MS project / primavera.

Unit V: Project economics (06Hours)

Introduction to project economics- definition, principles, importance in construction industry, difference between cost, value, price, rent, simple and compound interest, profit, cash flow diagram, annuities and its types, demand and supply curve, law of diminishing marginal utility, law of substitution, concept of time value of money, importance of economics in construction industry, assets, liabilities ,balance sheet, profit and loss account

Unit VI: Project appraisal (07 Hours)

Types of appraisals such as political, social, environmental, techno-legal, financial and economical, criteria for project selection - benefit - cost analysis, NPV, IRR, ARR, pay-back period, break even analysis, study of project feasibility report and detailed project report (DPR), role of project management consultants.

Text Books:

1. Project Planning and Control with PERT and CPM, Dr. B.C. Punmia and K. K. Khadelwal, Publisher: Firewall Media, Laxmi publication New Delhi
2. Project Management Principles and Techniques, B. B. Goel Publisher: Deep and Deep publisher

Reference Books:

1. Construction Project Management-Planning, Scheduling and Controlling, K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
2. Construction Management and Planning, B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction planning, equipment and methods, Robert L Peurifoy, Mc Graw Hill publication
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
5. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.
6. Total Quality Management, Dr. S. Rajaram and Dr. M. Sivakumar—Biztantra.
7. Total Engineering Quality Management, Sunil Sharma – Macmillan India Ltd.
8. Engineering Economics by R. Panneerselvam Publisher-PHI Learning; 2nd edition (2014).

Project Management and Economics Lab

Laboratory Experiments/Assignments (Perform Any 8 Out of 10, Expt. 7 is compulsory)

The term work shall consist of a journal including the exercises and activity to be conducted on the following contents

1. Study project management domains and project life cycle through a case study
2. Preparation of work breakdown structure of any construction industry and report writing.
3. Visit to the shops and collect information about the different construction materials, chemicals, trade names, costs, applications- report writing.
4. Understand concept of productivity and calculate the production rate of any construction equipment available on the site.
5. Prepare site layout of any construction site you visited, suggest ideal site layout to it.
6. Exercises on resource smoothing /levelling, updating and on earned value analysis.
7. Planning and scheduling for a small project with minimum 25 activities using MSP software.
8. Study a balance sheet of any construction company and conduct its analysis.
9. Exercise on project economics.
10. Exercise on selection of best economical project by using project selection methods.

Activity: Assignments on each unit.

Course Name with Code: Advanced Geotechnical Engineering

(CE23303c)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 03 Hrs/week	**04**	**Activity : 10 Marks**
PR : 0 2 Hrs/Week		**In Semester : 30 Marks**
		End Semester : 60 Marks
		TW : 30 Marks

Prerequisite:

1. Fundamentals of Engineering Mechanics
2. Fundamentals of Fluid Mechanics
3. Fundamentals of Geotechnical Engineering

Course Objectives:

4. To learn classification of soil, soil structure, earth pressure on retaining structures and design of retaining structures.
5. To study triaxial test and stress path.
6. To study methods of soil stabilization and different ground improvement techniques.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Classify the soil and understand the soil structure.
CO2: Calculate lateral pressure on retaining structure and carry out design of retaining structure.
CO3: Interpret the results of triaxial test under different drainage conditions.
CO4: Draw the stress path for different conditions.
CO5: Select and implement soil stabilization techniques based on field conditions.
CO6: Explain different ground improvement techniques and its suitability.

Course Contents

Unit I: Soil Classification, Soil Structure and Clay Minerals (06 Hours)

Soil identification and classification, criteria for classifying soil, classification on the basis of grain size, plasticity, symbolic and graphic presentation, classified soils and Engineering properties uses AASHTO, USCS, BIS and textural classification systems, clay minerals, clay water relations clay particle interaction, soil structure and Fabric granular soil fabric

Unit II: Earth Pressure Theory and Design of Earth Retaining Structures (06Hours)

Types of earth retaining structures, design of gravity and cantilever retaining walls, bracing system and Apparent Earth pressure diagram for open cuts only, concept of cantilever sheet pile walls and an anchored sheet pile wall, reinforced Earth retaining wall, general principles concepts and mechanism of reinforced Earth

Unit III: Shear Strength of Soil (06 Hours)

Shear strength of clay soils: strength from UU test consolidated undrained strength from CU test consolidated drained strength from CD test, stress strain and volume change relationship, share strength of Sands: stress strain and volume change relationship, behaviour of saturated sand under conditions, factors affecting angle of shearing resistance, pore pressure parameters and

determination

Unit IV: Stress Path **(06 Hours)**

Failure lines in stress path, TSP and ESP, stress path for: isotropic consolidation, one-dimensional consolidation, unloading of over consolidated clay, sedimentation, elastic stress path, stress path for: triaxial drained and triaxial undrained test, stress path for field conditions: Embankment construction, excavation, failure of infinite and finite slope, stress changes below foundation and near retaining wall

Unit V: Soil Stabilization **(06 Hours)**

Soil stabilization: Introduction, objectives, factors affecting stabilization of soil, methods of stabilization: Mechanical, cement, lime, bituminous; classification of stabilizing agents and stabilization processes, lime stabilization: Base exchange mechanism, pozzolanic reaction, lime - soil interaction, cement stabilization: Mechanism, amount, fly ash: lime stabilization and soil bitumen stabilization

Unit IV: Ground Improvement **(06 Hours)**

In-situ ground improvement by compaction piles, dynamic loads, explosion sand drains, grouting, deep mixing, inserting reinforcement elements, freezing soil, and vibro-floatation without numerical

Books & Other Resources:

Text books:

4. B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publishing Co., New Delhi.
5. Gopal Ranjan and A. S. Rao, "Basic and Applied Soil Mechanics", New Age Publication.
6. Shashi K. Gulati and Manoj Datta, "Geotechnical Engineering", Tata Mc-Graw Hill.

Reference books:

7. Joseph E Bowles, "Physical and Geotechnical Properties of Soil", McGraw Hill.
8. Braj M. Das, "Principles of Geotechnical Engineering", Cengage Learning.
9. Braja Mohan Das, "Advance Soil Mechanics", Tata Mc-Graw Hill.
10. Joseph E Bowles, "Foundation Analysis and Design", McGraw Hill.
11. Monfred R. Housmann, "Engineering Principles of Ground Modification", Mc Graw Hill Publishing co.
12. P. Purushothama Raj, "Ground Improvement Techniques", Lakshmi Publications, New Delhi.

Laboratory Experiments/Assignments

The term work shall consist of a journal giving details of at least **08 out of 10** of the following assignments.

4. To perform sieve analysis and classify the soil by any method using software/programming
5. Design of cantilever and gravity retaining wall for same problem statement.
6. To determine shear strength parameters using triaxial UU test, CU test and CD test.
7. One numerical on determination of pore pressure parameters using triaxial test.
8. Report on a field case study on soil stabilization using lime/cement/fly ash.
9. Case study of sub grade stabilization using fly ash.
10. Explanation of any one ground improvement technique using a case study.
11. Site visit report for any type of retaining wall.

12. Ground Improvement technique – A review of stone column method with the case study.
13. Review of five research papers on clay minerals

Activity:

One assignment on each unit.

Course Name with Code: Air Pollution and Control (CE23303d)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: 3 Hrs. / week	**4**	**Activity : 10 Marks**
PR: 2 Hrs. / week		**In-semester : 30 Marks**
		End semester : 60 Marks
		TW : 30 Marks

Prerequisite: Basic concepts of science and mathematics.

Course Objectives:

1. To provide general understanding of outdoor and indoor quality of air, its impacts and existing air acts.
2. To study meteorology, transport of air pollutants and its modelling aspects.
3. To discuss the various types of air pollution control equipment's and their design principles and limitation.

Course Outcomes:

On successful completion of this course, the learner will be able to:

1. Understand sources of air pollution and their local and global impacts.
2. Calculate concentration of pollutants as a function of meteorology.
3. Discuss sampling results with prescribed standards.
4. Understand indoor air pollution and its control techniques.
5. Recall air pollution control equipment.
6. Recall air acts and environmental impact assessment.

Course Contents

Unit I: History, Sources and Effects of Air Pollution (07 Hours)

Air Pollution- Definition, Sources, Types and classification, its effect on human health, vegetation, materials and properties, Air pollution Episodes and lesson learnt, Global effects: Global Warming, Acid Rain, Dust dome effects and Heat Island effect, Ozone Layer Depletion.

Unit II: Meteorology and Dispersion of Pollutants (06 Hours)

Meteorology and Atmospheric Stability. Lapse Rate, Plume Behaviour, and Air Quality Monitoring, Air Quality Index (AQI), Air Quality Modelling, Gaussian dispersion models for point source.

Unit III: Ambient Air Sampling and Analysis (07 Hours)

Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling of gases and particulates. Stack emission monitoring for particulate and gaseous matter, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Emission inventory and source apportionment studies. Ambient air quality monitoring as per the procedure laid down by CPCB. National Ambient Air Quality Standards (NAAQS) 2009.

Unit IV: Indoor Air Pollution (06 Hours)

Causes, sources and effects of indoor air pollutants, sick building syndrome. Sampling and assessment of indoor air quality, control of indoor air pollutants and air cleaning systems. Use of various plants to control indoor air pollution.

Unit V: Control of Air Pollution (06 Hours)

Control of particulate and gaseous emissions: Settling chambers, Cyclone Separators, Wet collectors, Fabric Filters, Electrostatic Precipitators. Other removal methods like Absorption, Adsorption and Precipitation.

Unit VI: Air Acts, Introduction to Environmental Impact Assessment (EIA) (07 Hours)

Air pollution emission standards, National and international policies, acts, rules and regulations. Methodology for preparing environmental impact assessment (Identifying the sources of air pollution, calculating the incremental values, prediction of impacts and mitigation measures). Role of regulatory agencies and control boards in obtaining environmental clearance for project.

Books & Other Resources:

Reference Books

1. Air Pollution – H. V. N. Rao and M. N. Rao, TMH, Pub.
2. Air pollution – KVSG Murali krishna.
3. Environmental Engineering – Davis, McGraw Hill- Pub.
4. Environmental Engineering – Peavy H.S and Rowe D.R, McGraw Hill- Pub.
5. Air Pollution Control – Martin Crawford.
6. Fundamentals of Air Pollution-Richard W. and Donald L. Academic Press.

Air Pollution and Control Lab

Term Work

Term work consists report on

1. Application of remote sensing and satellite-based data in air quality management.
2. International Environmental Treaties to Reduce Air Pollution and GHG Emissions.
3. Impact of Lockdown on air quality.
4. Mitigation Measures to Control Air Pollution in sectors such as Thermal Power plants/Industries/Domestic/Agriculture/Transportation.
5. Wind rose diagram construction and application using freeware.
6. Detailed industrial visit report on Cement/Steel/Thermal/Dairy industry with reference to air pollution Control devices.
7. Status of air quality in any city.
8. Stack emission monitoring.
9. Ozone layer depletion/ Global warming/ Climate change/ acid rain-A case study.

Activity: Assignments for each unit.

Course Name: Wastewater Engineering (CE23303e)

Teaching Scheme:		**Examination Scheme:**	
TH: 3 Hrs. / week	**Credits**	**Activity**	**: 10 Marks**
PR: 2 Hrs. / week	**4**	**In-semester**	**: 30 Marks**
		End semester	**: 60 Marks**
		TW	**: 30 Marks**

Prerequisite: Basic concepts of science and mathematics.

Course Objectives:

1. To understand the basic characteristics of wastewater and the design and working principle of various treatment methods.
2. To identify potential wastewater for recycle and reuse.

Course Outcomes:

On successful completion of this course, the learner will be able to:

1. Recall characteristics of wastewater and basics of sanitary sewer design.
2. Design primary wastewater treatment units.
3. Design suspended growth systems of biological treatment of wastewater.
4. Design attached growth systems of biological treatment of wastewater.
5. Recall emerging technologies of wastewater treatment.
6. Understand various sludge management systems and the potential recycle and reuse of wastewater.

Course Contents

Unit I: Quantity and Quality of Sewage (06 Hours)

Introduction: Wastewater Sources and flow rates, Characteristics, Standards of Disposal, Treatment Objectives and Strategies, Sanitary sewer design, Self-purification of natural streams: Oxygen sag curve, Streeter Phelps equation.

Unit II: Preliminary and Primary Wastewater Treatments (06 Hours)

Layouts of Wastewater Treatment Plant, Preliminary and Primary Treatment Operations: Screens, Grit Chambers, Skimming Tank, Primary Sedimentation tank. Design of Screens, Grit Chamber and Primary Sedimentation Tank.

Unit III: Biological Treatment- Suspended Growth System (07 Hours)

Unit operations and Unit Processes for secondary treatment, Role of microorganisms in wastewater treatment, Activated Sludge Process: Process Design Criteria, Oxygen and Nutrient Requirements, Classification and Design of Oxidation Ponds and Lagoons.

Unit IV: Biological Treatment- Attached Growth System (06 Hours)

Attached Growth Processes: Design of Trickling Filters (Standard Rate, High Rate), Biofilters, Rotating Biological Contactors, Constructed Wetlands, Phytoremediation, Root Zone Treatment Systems.

Unit V: Anaerobic Digestion and Emerging Treatment Methods (07 Hours)

Anaerobic sludge digestion processes, Steps in anaerobic digestion, Design of digester tank, Design of septic tank, Up-flow anaerobic sludge blanket (UASB) reactor: principle, advantages & disadvantage, applications, Emerging wastewater treatment systems: sequencing batch reactor (SBR), membrane bio reactors (MBR), moving bed bio reactor (MBBR), fluidized membrane bio reactor (FMBR), packed bed reactor (PBR), advantages, limitations and applications.

Unit VI: Sludge Management (07 Hours)

Sludge management system: primary and secondary sludge, quantity and characteristics, sludge thickening, sludge dewatering, sludge disposal/ reuse, challenges in sludge management, **Wastewater recycle and reuse:** driving factors for recycle and reuse, recycling of grey water municipal sewage, storm water and industrial effluent, reuse opportunities in municipal, industrial, agricultural sector, regulatory guidelines: WHO, USEPA

Text Books

1. Manual on Sewerage & Sewage Treatment published by Ministry of Urban Development, New Delhi, Third Edition.
2. Waste Water Treatment & Disposal, Metcalf & Eddy, McGraw Hill Education (India) Private Limited.

Reference Books

1. Environmental Engineering, Peavy Rowe, McGraw Hill Education (India) Private Limited
2. Wastewater Treatment for Pollution Control and Reuse, Arceivala and Asolekar, McGraw Hill Education (India) Private Limited.
3. Industrial Wastewater Treatment, A. D. Patwardhan, Eastern Economy Edition, PHI Learning Private Limited.
4. Sewage Disposal & Air Pollution Engineering, S. K. Garg, Khanna Publication.
5. Standard Methods for examination of water and wastewater, Mary Franson, American Public Health Association.

Wastewater Engineering Lab

Term Work

The term work consists of details of at least 8 Practical. Experiment no. 10 and 11 are compulsory.

1. Determination of Dissolved Oxygen (DO).
2. Determination of Biochemical Oxygen Demand (BOD).
3. Determination of Chemical Oxygen Demand (COD).
4. Determination of Electrical Conductivity.
5. Determination of Solids – Total, Suspended, Volatile, Dissolved.
6. Determination of Sludge Volume Index.
7. Determination of nitrate by spectrophotometer.
8. Determination of phosphates by spectrophotometer.
9. Determination of heavy metals like Cu^{2+}, Zn^{2+} or Pb^{2+}.
10. Visit to domestic/Industrial wastewater treatment plant.

11. Computer aided design of Sewage Treatment Plant.

Activity: Assignments for each unit.

Course Name with Code: Solid Waste Management (Course Code: CE23051)

Teaching Scheme:	**3 Credits**	**Examination Scheme:**
TH: 2 Hrs./week		**Activity : 20 Marks**
PR: 2 Hrs./week		**In semester : 20 Marks**
		End Semester: 50 Marks
		TW :20Marks

Prerequisite:

1. Fundamentals of Environmental Studies, Engineering Chemistry and Waste Water Engineering

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To understand problems of solid waste, estimate and characterize solid waste.
2. To apply the knowledge of mathematics, science and engineering for effective solid waste collection systems and for waste collection route optimization.
3. To understand the working of waste to energy system.
4. To understand management and legal requirements of special waste, reuse, recycle and material recovery.

Course Outcomes: After Completion of course students will be able to

CO1: understand solid waste management systems with respect to characteristics, sampling and generation rate.
CO2: explain methods of storage, collection and transportation of solid waste.
CO3: describe waste to energy systems from solid waste.
CO4: understand legal requirements of special waste.

Course Contents

Unit 1: Evolution, Sources and Types of Solid Waste (06 Hours)

Introduction of solid waste, Functional elements, Types and sources of solid waste, Sampling and characteristics, Estimation of solid waste quantity, Factors affecting solid waste generation rate.

Unit 2: Collection and Transportation of Solid Waste (06 Hours)

Integrated solid waste management, different methods of solid waste collection, transfer and transportation of solid waste, use of radio frequency identification (RFI)/global positioning system (GPS) for tracking vehicle location and optimization of route, methods of measuring solid waste.

Unit 3: Waste to energy (06 Hours)

Basic principles of processing and treatment of municipal solid waste, Materials recovery and recycling, composting, anaerobic digestion or bio methanation, incineration and sanitary landfilling.

Unit 4: Special Waste Management and Regulations (06 Hours)

Objectives and key points of hazardous and other waste management rules- 2016, domestic hazardous waste, e-waste, biomedical waste, plastic waste, slaughterhouse waste, construction & demolition waste and lead battery waste.

Books & Other Resources:

Textbooks

01 Integrated Solid Waste Management: Engineering Principles and Management Issues, George Tchobanoglous, Hilary Theisen, Samuel Vigil, Tchobanoglous George, Vigil Samuel, McGraw-Hill Companies, Incorporated.
02 Solid waste management, Dr. A.D. Bhide
03 Solid Waste Management, Sasikumar K and Sanoop Gopi Krishna, PHI.

Reference Books

01 Solid waste Engineering, Vesilind P. A., Worrell W and Reinhart, Thomson Learning Inc., Singapore.
02 CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.
03 Hazardous Waste Management, Charles A. Wentz, Second Edition, McGraw Hill International Edition, New York.
04 C for Environmental Scientists and Engineers, Y. Anjaneyulu and Valli Manickam, Wiley Publications. 05 Standard Handbook of Hazardous Waste Treatment and Disposal, Harry Freeman, McGraw-Hill Education, 1998

Laboratory Course: Solid Waste Management – Lab
Examination Scheme: PR: 30 Marks
TW: 20 Marks

Practical and Term work

1. Report of site visit to municipal solid waste management (Society/village/town/city).
2. Practical/theoretical identification of impacts of improper management of municipal solid waste.
3. Practical/theoretical sampling methods and characterization study of municipal solid waste.
4. Practical/theoretical estimation of solid waste generation and estimation of quantity
5. Prepare a report for management of any of the special wastes.
6. Prepare a report on use of smart technologies in solid waste management.
7. Determine calorific value of municipal solid waste using bomb calorimeter.
8. Determine moisture content and volatile solids for organic fraction of municipal solid waste.

Green Building and Smart Cities. Course Code:-CE23052

Teaching Scheme:	Credits	Examination Scheme:
Theory: 03 Hours/Week	3	Activity :20 Marks
		In-sem :20 Marks
		End-sem : 50 Marks
		T W : 20 Marks

Prerequisites: Building Materials, Global Warming.

Course Objectives:

1. To understand the definition, concept & objectives of the green building and to imbibe basics of green design.
2. To understand planning specifications of green building.
3. To understand the definition, concept & objectives of the smart city.
4. To understand the policies of smart city.

Course Outcomes (COs): The students will be able to learn:

CO1: Demonstrate green concept skills and apply tools of green building assessment.

CO2: Select appropriate green building material and technique.

CO3: Acquaint knowledge on smart cities planning and development.

CO4: Develop work break down structure, scheduling and project management of smart cities.

Course Contents

Unit I Concept of Green Buildings (06 Hours)

a) Definition of Green Buildings, typical features of green buildings, Necessity, Initiatives, Green buildings in India, Green building Assessment- Green Building Rating Systems (BREEAM, USGBC, LEED, IGBC, TERI-GRIHA, GREEN STAR), Criteria for rating, Energy efficient criteria, environmental benefits economic benefits, health and social benefits, Major energy efficiency areas for building, Life cycle cost of buildings, Codes and Certification Program

b) **Green Design**: Definition, Principles of sustainable development in Building Design, Characteristics of Sustainable Buildings, sustainably managed Materials, Integrated Lifecycle design of Materials and Structures (Concepts only)

UNIT-II Green Building Materials, Planning and Specifications (06 Hours)

a) **Green Building Materials**: Sustainably managed Materials, depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials, Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials.

b) **Green Building Planning and Specifications**: Environment friendly and cost-effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste & Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption.

UNIT-III Introduction to Smart cities (06 Hours)

a) Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city. Introduction to city planning, Concept, principle stakeholders, key trends in smart cities developments.
b) **Intelligent transport systems**: Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing

UNIT-IV Project management and Policies in Smart Cities (06 Hours)

a) **Project management**: Phases, Stages of project and work break down Structure, Project organization structure, Planning, Scheduling and CPM, Project cost analysis, resource allocation & leveling, Line of balancing technique, Project monitoring and control, Project risk management. Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system.
b) **Policy for Smart City**: Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.

Text Books:

1. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers
2. Integrated Life Cycle Design of Structures – By AskoSarja – SPON Press
3. Green Buildings (McGraw hill publication): by Gevorkian
4. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li
5. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos
6. 7. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development

List of free reference guides/resources available on the net:

1. http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines
2. IGBC reference guide
3. Free abridged versions of LEED reference guides.

List of Practical's:

1. Assignment on- Identify sources of pollution in your area.
2. Assignment on- Technology involved in different construction of green building.
3. Assignment on- Technology involved in different construction of smart building.
4. Model making of green building/ smart cities (Maximum 4 students in one group).

Course Name with Code: Disaster Management (OE2305)

Teaching Scheme:	Credits	Examination Scheme:
TH: 2 Hrs. / week	2	End semester : 50 Marks

Prerequisite:

Basic Geography and Environmental Science

Course Objectives:

1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management.
3. To build skills to respond to disaster.
4. To enhance disaster preparedness through training, awareness, GIS techniques, and risk assessment.

Course Outcomes: students will be able

CO1: To explore disaster types, risks, vulnerabilities, and management of natural and man-made events.

CO2: To summarize the various types of natural disasters, their management strategies, andthe socio-economic and environmental impacts, with a focus on case studies from Sikkim.

CO3: To explore disaster mitigation, management techniques, policies, and construction in seismic zones.

CO4: To summarize skills in disaster preparedness, awareness, GIS usage, and risk assessment projects.

Course Contents

Unit I **(06 Hours)**

Definition and types of disaster Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

Unit II **(06 Hours)**

Study of Important disasters Earthquakes and its types, magnitude and intensity, seismic zonesof India, major fault systems of India plate, flood types and its management, drought types andits management, landside and its managements case studies of disasters in Sikkim (e.g.) Earthquakes, Landside). Social Economics and Environmental impact of disasters.

Unit III **(06 Hours)**

Mitigation and Management techniques of Disaster Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, building design and construction in highly seismic zones, retrofitting of buildings.

Unit IV **(06 Hours)**

Training, awareness program and project on disaster management Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, Mini project on disaster risk assessment and preparednessfor disasters with reference to disasters in Sikkim and its surrounding areas.

Textbooks:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Introduction to International Disaster Management, Damon, P. Copola, (2006), Butterworth Heineman.
3. Disaster management and Risk Reduction, Role of Environmental Knowledge, Gupta A.K., Niar S.S and Chatterjee S. (2013). Narosa Publishing House, Delhi.
4. Disaster Management, Murthy D.B.N. (2012), Deep and Deep Publication PVT. Ltd. NewDelhi.
5. Managing Natural Disasters, Modh S. (2010), Mac Millan publishers India LTD.

Course Name with Code: Sustainability and Climate Change (Course Code: OE2317)		
Teaching Scheme: **TH: 2 Hrs./week**	**2 Credits**	**Examination Scheme:** **End Semester: 50 Marks**

Prerequisite:

1. Fundamentals of Environmental Studies, Engineering Chemistry

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To Understand the scientific basis of climate change
2. To analyze the environmental, social, and economic impacts of climate change.

Course Outcomes: After Completion of course students will be able to

CO1: Understand the scientific basis of climate change.
CO2: Analyze the environmental, social, and economic impacts of climate change.
CO3: Understand policies and strategies for mitigating climate change and explore sustainable practices and their implementation.
CO4: Develop critical thinking skills to address sustainability challenges

Course Contents

UNIT 1

Introduction to Sustainability and Climate Change (06 Hours)

Definitions and key concepts, History of climate science, Overview of sustainability principles Climate Change Science: Greenhouse gases and the greenhouse effect, Climate models and predictions Evidence of climate change Impacts of Climate Change: Environmental impacts (e.g., sea level rise, extreme weather events), Social impacts (e.g., health, displacement), Economic impacts (e.g., agriculture, industry)

UNIT 2

Mitigation Strategies (06 Hours)

Renewable energy sources, Energy efficiency and conservation, Carbon capture and storage Adaptation Strategies: Resilient infrastructure, Disaster risk reduction, Climate-smart agriculture

UNIT 3 (06 Hours)

Sustainable Practices: Sustainable transportation, Waste management and recycling, Water conservation, Policy and Governance: International climate agreements (e.g., Paris Agreement), National and local climate policies, Role of non-governmental organizations

UNIT 4 (06 Hours)

Future Directions and Innovations: Emerging technologies for sustainability, Role of education and awareness, Interdisciplinary approaches to climate change

Books & Other Resources:

Textbooks

1. The Great Derangement: Climate Change and the Unthinkable, Amitav Ghosh
2. Global Warming in India by R. N. Singh
3. Climate Change and India: Vulnerability Assessment and Adaptation edited by P. R. Shukla, S.

K. Sharma, and P. V. Ramana
4. Sustainable Development and Climate Change by Neeraj Prasad, Shyamal Sarkar, and others
   Climate Change: Perspectives from India edited by Navroz K. Dubash

Reference Books

1. The Sixth Extinction: An Unnatural History by Elizabeth Kolbert
2. This Changes Everything: Capitalism vs. The Climate by Naomi Klein
3. Sustainability: A Comprehensive Foundation by Tom Theis and Jonathan Tomkin

Course Name with Code: Community Engineering Project/Field Project (CE23203)

Teaching Scheme:	**Credits**	**Examination Scheme:**
PR: 04 Hrs./week	**2**	**Activity : 10 Marks**
		Term Work : 30 Marks

Course Objectives:

1. To identify the challenges and problems in rural and urban sectors related to the environment and explore solutions for the same.
2. To apply classroom knowledge of courses to filed realties and thereby improve quality of learning

Course Outcomes:

After learning the course, the students should be able to:

1. Apply technical knowledge to understand rural and urban life, culture and social realities.
2. Identify the environmental challenge and conceptualize its practical solution for societal benefits

Course Contents

1. The project group consists of a maximum of 5/6 students in one group in one batch.
2. The project group should select the rural/urban area and identify the environmental challenge that can be worked upon.
3. The presentation includes the initial work for problem identification, data collection and exploring of the solutions to be presented and get approved by the faculty.
4. Working on the solution identified for the challenge to be continuously worked upon and to be monitored during practical hours called as progress by faculty.
5. The evaluation is to be done in three instances Review -I of 30 marks, Review-2 of 30 marks and Review 3 for 30 marks and project report 30 marks.

Course Name with Code: Advanced design of steel structures (HONOR-CE23382)

Teaching Scheme:	**4**	**Examination Scheme:**
TH: 0 3 Hrs/week	**Credits**	**Examination Scheme:**
PR: 02 Hrs/Week		**Activity : 20 Marks**
		In Semester : 20 Marks
		End Semester :70 Marks
		PR :20 Marks
		TW :20 Marks

Prerequisite:

1. Elementary Design of Steel Structures and Structural Analysis

Companion Course, if any: Laboratory Practical

Course Objectives:

The course on Advanced Design of Steel Structures acquaints the students to analyze and design steel structures as per the Indian Standard code of practice.

Course Outcomes:

After learning the course, the students should be able to:

1. Analyze and design the Castellated beam.
2. Analyze and design of Hoarding Structures.
3. Analyze and design of Cold-Form steel sections.
4. Analyze and design of Industrial Shed.
5. Analyze and design the Pre-Engineering Building (PEB).
6. Analyze and design Steel Bridges.

Course Contents

Unit I: Design of Castellated beams: (6 Hours)

Concept, fabrication of the castellated beam from rolled steel section, analyze and design of castellated beam for bending and shear as per latest code by limit state method.

Unit II: Analysis and Design of Hoarding Structures: (7 Hours)

Concept of hoarding Structures, Analysis and design of hoarding structures under dead, live, and wind load as per the latest IS:875 by limit state method.

Unit III: Design of Cold Form Steel: (7 Hours)

Introduction, advantages of cold-formed sections, load buckling, beam, axially compressed column, combined bending & compression, Tension members, Design based on testing, empirical method & examples.

Unit IV: Analysis and Design of Industrial Shed (6 Hours)

Various design guidelines of Industrial Shed by IS 800, Design of industrial shed considering gravity and wind load.

Unit IV: Analysis and Design of Pre-Engineering Building (PEB) (7 Hours)

Concept of Pre-Engineering Building (PEB), Various components of PEB, Load combinations for PEB design, Analysis and design of PEB structure using IS code.

Unit VI: Design of Steel Bridges (6 Hours)

Introduction, steel used in bridges, classification of steel bridges load & load combination, Analysis and design of girder bridge, plate girder bridges, truss bridges, gusseted connection.

Books & Other Resources:

Text books:

1. Design of Steel Structures – N. Subrhamanyan, Oxford.
2. Plastic Design of Low -rise frames, Horne, M.R., and Morris, L.J., Granada Publishing
3. Steel Structure -Design and Behaviour, Salmon, C.G., and Johnson, J.E. Harper and Row,
4. Design of Steel Structure - Duggal, Tata Mc Graw Hill.
5. Steel Design for Structural Engineers, Kuzamanovic,B.O. and Willems,N., Prentice Hall,
6. Cold-formed Steel Structures, Wie - Wen Yu., McGraw Hill Book Company, 1973.
7. Steel Structures, William McGuire, Prentice Hall, Inc., Englewood Cliffs, N.J.1986.
8. Guidelines to design cold form section by Tata Steel.
9. Design of Steel Structure- Shah and Gore, Structures Publishers, Pune

Laboratory Experiments/Assignments:

Term work shall consist of a journal containing the following design, and site visit report.
Oral examination based on term work.

1. Analysis and design of castellated beams using Finite Element software.
2. Design of hoarding structures using commercial software
3. Site visit report on PEB/Industrial shed

Activity: Assignment on each unit

Universal Human Values and Professional Ethics

Course Code	**HS23301**	**Semester**	V
Teaching Hours/Week (L: T:P: S)	2	**CAA**	10
		End Sem Marks	60
Total Hours:	13	**Total Marks**	70
Credits	02	**Exam Hours**	02 Hour

Course objectives:

This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Course outcome (Course Skill Set)

At the end of the course, students will be able

- To become more aware of themselves, aspirations in life, happiness and prosperity
- To handle problems with sustainable solutions, while keeping human relationships and human nature in mind.
- To become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- To develop harmony with nature
- To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
- To follow professional Ethical human conduct

Unit-1

Introduction to Value Education **(5 hours)**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Unit-2

Harmony in the Human Being: (5 hours)

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Unit-3

Harmony in the Family and Society: (5 hours)

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Unit-4

Harmony in the Nature/Existence: (5 hours)

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Unit-5

Implications of the Holistic Understanding – a Look at Professional Ethics: (6 hours)

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Suggested Learning Resources:

Text Book and Teachers Manual

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2. The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
3. Professional Ethics and Human Values, Premvir Kapoor, Khanna Book Publishing

Reference Books :

4. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
5. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
6. The Story of Stuff (Book).
7. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
8. Small is Beautiful - E. F Schumacher.
9. Slow is Beautiful - Cecile Andrews
10. Economy of Permanence - J C Kumarappa
11. Rediscovering India - by Dharampal
12. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
13. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972
14. Limits to Growth – Club of Rome’s report, Universe Books.
15. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
16. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
17. A N Tripathy, 2003, Human Values, New Age International Publishers.

18. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
19. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
20. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
21. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
22. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

- Value Education websites,
- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Constitution of India (HS23302)

(Mandatory Audit Course)

Course Type: Audit (Non-Credit)

Course Objectives:

The primary objectives of this course are to:

1. Familiarize students with the salient features, structure, and significance of the Constitution, including the principles enshrined in the Preamble.
2. Provide an understanding of fundamental rights and duties, their scope, significance, and role in ensuring justice, equality, and freedom in a democratic society
3. Explain the concept of Directive Principles of State Policy (DPSP) and their role in governance, emphasizing their interrelationship with Fundamental Rights.
4. Analyze emergency provisions and constitutional amendments, discussing their implications on Indian democracy and governance.
5. Encourage a comparative understanding of the Indian Constitution with other constitutions worldwide, fostering awareness of global governance models.

Course Outcomes (COs):

After completing this course, students will be able to:

1. Describe the salient features and basic structure doctrine of the Constitution and Interpret the values enshrined in the Preamble
2. Comprehend Fundamental Rights and Duties of Indian Citizens
3. Analyze the Role of Directive Principles of State Policy (DPSP) in Governance

Course Syllabus

Unit 1: Introduction to the Constitution of India (5 Hours)

- Historical Perspective and Making of the Indian Constitution
- Salient Features of the Constitution
- Preamble and its Significance
- Basic Structure of the Constitution
- Emergency Provisions in the Indian Constitution
- Important Amendments to the Constitution

Unit 2: Fundamental Rights and Duties (4 Hours)

- Fundamental Rights: Meaning, Scope, and Significance
- Right to Equality, Freedom, Protection from Exploitation, Freedom of Religion
- Cultural and Educational Rights, Right to Constitutional Remedies
- Fundamental Duties of Indian Citizens

Unit 3: Directive Principles and Governance (4 Hours)

- Directive Principles of State Policy: Meaning and Purpose
- Relationship between Fundamental Rights and Directive Principles
- Role of Directive Principles in Policy Formulation
- Comparison with Other Constitutions

Reference Books & Study Materials

1. **M. Laxmikanth**, Indian Polity, McGraw Hill Education, 6th Edition, 2020.
2. **D.D. Basu**, Introduction to the Constitution of India, LexisNexis, 25th Edition, 2021.
3. **Subhash Kashyap**, Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust, 2019.
4. **J.N. Pandey**, The Constitutional Law of India, Central Law Agency, 2020.
5. **Bare Act**, Constitution of India, Government of India Publications.

Evaluation and Assessment

Since this is an audit course, there is a mandatory internal evaluation which can be based on the following:

- **Assignments & Reports**– Writing about a constitutional provision or case study.
- **Quiz/MCQs** – To test basic understanding of the Constitution.
- **Group Discussion/Presentation** – On relevant topics like Fundamental Rights or Constitutional Amendments