Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5	III	3CE200PC	Strength of Materials	3	45 Hrs	3 Hrs.	60

Course Description:

Subject Code: 3CE200PC Strength of material is a compulsory Program core course for Second Year B.E. Civil Engineering.

Course Objectives:

The objective of course is to comprehend the mechanical properties of materials and their responses to loading. The course also seeks to offer structured approaches for tackling and examining engineering challenges to assess the strengths of various materials through the basic principles of stress, strain, and material behavior (elastic behavior).

Course Outcomes (COs)

After completing the course students will be able to:

CO	Course Outcome
CO1	Apply concepts of strength of materials, stress-strain relationships, and mechanical properties in engineering applications.
CO2	Analyze shear force and bending moment diagrams for various loading conditions and their relationships.
CO3	Illustrate types of beams, loading conditions, bending stress, moment of inertia, and section modulus.
CO4	Examine torque and power transmission in circular shaft.
CO5	Evaluate uniaxial stresses and strains, principal stresses, maximum shear stress.
CO6	Determine the slope and deflection of beams.

Details of Syllabus:

Unit 1	**Introduction and Basic Concepts:** Overview of Strength of Materials and its applications : Concept of direct and shear stresses and strains, elastic constants, stress-strain types and relationship, stress-strain diagrams and their characteristics for mild steel, Generalized Hook's law, Mechanical properties of materials.	8 Hrs.

Unit 2	**Basics of Beam Analysis:** Types of beams, Shear force and bending moment diagrams (SFD & BMD) for different loading conditions, relation between shear forces, bending moment and loading intensity.	8 Hrs.
Unit 3	**Bending Stress in Beams:** Bending stress and its distribution across a cross-section, Moment of inertia and section modulus calculations, Simple bending theory, section modulus, moment of resistance, bending stresses in different section (solid and hollow)	8 Hrs.
Unit 4	**Torsion of Circular Shafts** Assumption for derivation of shaft and torsion equation, Torsion, angle of twist and power transmission of shaft.	7 Hrs.
Unit 5	**Analysis of stress and strain** Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, Principal stresses and maximum shear stress,	7 Hrs.
Unit 6	**Study of deflection and slope in beam** Determination of beam's deflection and slopes for beams subjected to different load conditions.	7 Hrs.

Recommended Books:

1. E. P. Popov, Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S.Timoshenko and O. H. Young, Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Ferdinard L. Singer, Strength of Materials, Harper and Row, New York
4. Shames, I. H., Introduction to solid mechanics, Prentice Hall of India, New Delhi
5. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.
6. Junnarkar, S. B., Mechanics of materials
7. Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.
8. Beer and Johston, Mechanics of materials, Mc-Graw Hill
9. S. Ramamrutham, Strength of Materials, DhanpatRai Publishing Co Pvt Ltd

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5	III	3CE201PC	Concrete Technology	3	45 Hrs	3 Hours	60

Course Description:
Subject Code 3CE201PC Concrete Technology is a compulsory program core course for Second Year B.E. in Civil Engineering.

Course Objectives:
The objective of the course is to provide knowledge about concrete composition, materials, mix design, properties, special concretes, quality control, and durability techniques for effective construction and repair of concrete structures.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome
CO1	Identify the composition and properties of concrete.
CO2	Classify the properties of materials required for concrete.
CO3	Design a concrete mix as per IS guidelines.
CO4	Identify the various tests and properties of fresh and hardened concrete.
CO5	Identify the application of special types of concrete.
CO6	Select the quality control technique and repairing techniques.

Details of Syllabus:

Unit 1	**Introduction to Concrete** Definition and Composition: Concrete as a construction material, Ingredients of concrete: Cement, Aggregates, Water, Admixtures, Water-cement ratio and its significance, Properties of Concrete, Factors affecting concrete properties and mix proportions, environmental conditions.	7 Hrs
Unit 2	**Materials for Concrete** Types of cement and their characteristics, Hydration of cement and its effects on concrete properties, Test of cement, Classification of aggregates, Properties of aggregates, Testing of aggregates, Water quality, Impurities and their effects on concrete, Types of admixtures, Functions and advantages of admixtures, Standards and specifications for admixtures.	8 Hrs
Unit 3	**Concrete Nominal and Mix Design** Introduction to Nominal and Mix Design: Importance of mix design,	8 Hrs

	Factors influencing mix design (workability, strength, durability), IS 10262: 2019, Methods of Mix Design: Design Mix, Steps in concrete mix design, Adjustments for different types of cement, aggregates, and environmental conditions, Strength of concrete: Compressive, Tensile, Flexural, and curing of concrete, Shrinkage and Creep of concrete	
Unit 4	**Fresh and Hardened Concrete** Properties: Workability, Segregation, Bleeding, Methods for improving workability, Temperature effects and other factors affecting workability, Methods for measuring workability,Durability of concrete: Resistance to freezing, thawing, chemical attack, and abrasion.	8 Hrs
Unit 5	**Introduction to Special Concretes** High-Performance Concrete: Characteristicsand its applications, Lightweight Concrete: Types and properties, Applications in structural elements High-Strength Concrete: Properties, and Application in high-rise buildings, Introduction self compacted and fiber reinforced concrete.	7 Hrs
Unit 6	**Quality Control in Concrete** Importance, Concrete testing methods for Cube, Cylinder, Beam testing, Acceptance criteria and standards for concrete, Concrete Protection and Repair: Methods for enhancing durability, Techniques for repairing concrete structures.	7 Hrs

Text Books:

1. Concrete Technology by M. L. Gambhir, 5th Edition, Tata McGraw-Hill Publication, 2013.
2. Concrete Technology: Theory and practice by M. S. Shetty and A. K. Jain, 8th Edition, S Chand Publication, 2018.
3. Properties of Concrete by A. M. Neville – 5th Edition, Pearson Publication, 2012.

Reference Books:

1. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford University Press, 2018.
2. Concrete: Microstructure, Properties and Materials by P. Kumar Mehta, Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education, 2014.
3. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, 1st Edition, CBS Publishers & Distributors Pvt. Ltd, 2017.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5	III	3CE202PC	Building Construction & Materials	3	45 Hrs	3 Hours	60

Course Description:

Subject Code 3CE202PC Building Construction & Materials is a compulsory Program Core Course for Second Year B.E. Civil Engineering.

Course Objectives:

The objective of the course is to encompass the essential aspects of building materials, construction components, and techniques, aiming to develop a knowledge of their role in creating safe and functional structures.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Classify different building materials and their suitability.
CO2	Apply the principles of masonry in construction works .
CO3	Classify the different types of formworks.
CO4	Illustrate floor finishes& roof types.
CO5	Classify the types of doors and windows.
CO6	identify the types of plastering and advance construction materials.

Details of Syllabus:

Unit 1	**Introduction to Building Materials:** Scope of construction materials in various Civil Engineering Sectors, Classification of Construction material and its suitability – Natural Material (Stone, Timber, Soil, Sand, Coarse Aggregates and Bitumen), artificial materials (Cement, Clay Brick, Flooring Tiles, Concrete Blocks, Plywood, and Glass), Importance of material selection in construction	8 Hrs
Unit 2	**Masonry:** Brick Masonry-Classification of bricks, manufacturing of bricks, tests on bricks, Brick masonry construction – Technical terms, general principles, commonly used types of bonds such as stretcher, header, English bond and Flemish bond, their suitability, Stone masonry	8 Hrs
Unit 3	**Formwork:** Different types, their relative merits, demerits, period for removal of formwork for different members, basic concept of formwork design	7 Hrs

Unit 4	**Introduction to Floor finishes& stair Case**– Types of flooring material, different types of floor finishes, Staircase types and design steps for Doglegged staircase **Introduction to Roofs** – Flat, pitched roof, steel roof trusses – types and suitability, types of roof covering.	8 Hrs
Unit 5	**Doors**: Purpose, criteria for location, door frames & its types, methods of fixing, Types of door shutters and their suitability, **Windows** – Purpose, criteria for location, types of windows & their suitability. Fixtures & fastening for doors and windows.	7 Hrs
Unit 6	**Plastering -** Necessity, types, processes of different types of plastering, defects in plastered work. Advance Construction material, Acoustical materials,Geo-fibers, Laminations and adhesives.	7 Hrs

Text Books:

1. Building Materials by S.K. Duggal, New Age International Publisher
2. Sushil Kumar: Building Construction, Standard Publishers Distributors.

Reference Books:

1. Mackay W.B.: Building Construction, Vol. I, II, III, Longmans.
2. Building Construction by B.C. Punmia and Ashok Kumar Jain
3. Engineering Materials by S. C. Rangwala, Charotar Publication
4. Building Construction by S. C. Rangwala, Charotar Publication
5. National Building Code of India, 2016, Bureau of Indian Standard, New Delhi

Level	Semester	Course Code	Course Name	Credits	Practicum Hours	Exam Duration	Maximum Marks
5	III	3CE400EL	Building Construction & Material (Field Project)	2	60 Hrs	-	25

Course Description:
Subject Code 3CE400EL Building Construction & Material is a compulsory Experiential Learning Course for Second Year B.E. Civil Engineering.

Course Objectives:
The objective of this course is to provide hands-on exposure to construction materials, techniques, and building components through field visits, practical exercises, and report writing, enabling students to gain practical knowledge of construction processes and materials' quality assessment.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome
CO1	Select appropriate construction materials based on project requirements.
CO2	Analyze the construction site and identify materials.
CO3	Identify elements of staircases, doors, windows, and other building components.

Details of Syllabus:
Minimum eight Practical from the list should be perform

1. Study of available construction materials in the lab with photos, sketches, sources, and utility.
2. Conduct a field visit to an ongoing construction site and report on materials, processes, human resources, and details.
3. Field visit to observe building components in load-bearing and framed structures, followed by a report.
4. Perform shape, size, and field tests on bricks (dropping, striking, scratching) to assess quality and prepare a report.
5. Field visit to examine different types of roofs and trusses, documenting materials and construction techniques.
6. Prepare any six freehand sketches of foundations, brick bonds, floors, stairs, roof trusses, expansion joints, and fixtures for doors and windows.
7. Plan, calculate, and draw the design of a staircase, including plans and sections on an A-2 size sheet.
8. Create detailed drawings of doors (paneled, flush), windows (glazed), and steel roof trusses on an A-2 size sheet.
9. Conduct a survey of materials for brickwork, flooring, plastering, and painting available in the local market, and prepare a report.

Level	Semester	Course Code	Course Name	Credits	Practical Hours	Exam Duration	Maximum Marks
5	III	3CE203PC	Strength of Materials Lab	1	30 Hrs	-	25

Course Description:
Subject Code 3CE203PC Strength of Materials Lab is a compulsory Laboratory Program Core Course for Second Year B.E. Civil Engineering.

Course Objectives:
The objective of the Strength of Materials Laboratory is to provide hands-on experience on the mechanical properties of materials through tension, compression, shear, impact, hardness, torsion tests, and structural analysis of beams, springs, and columns.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome
CO1	Measure tensile strength of steel bars using a Universal Testing Machine.
CO2	Perform compression tests on brick and wooden block specimens.
CO3	Perform shear tests on mild steel bars.
CO4	Perform Impact test for energy absorption.
CO5	Perform hardness, torsion and deflection testing on metals.

Details of Syllabus:
Minimum of Eight practical from the list mentioned below.

1. To find tensile strength of steel bar using UTM.
2. To conduct compression test on brick using UTM/CTM.
3. To conduct compression test on wooden block using UTM/CTM
4. To perform Shear test on mild steel bar.
5. To perform Impact test for determining energy absorb by the specimen using Izod Test.
6. To perform Impact test for determining energy absorb by the specimen using Charpy Test.
7. To perform Hardness test on metals.
8. To determine the torque in the metal.
9. To perform deflection test on specimen using UTM.

Level	Semester	Course Code	Course Name	Credits	Practical Hours	Exam Duration	Maximum Marks
5	III	3CE204PC	Concrete Technology Lab	1	30 Hrs	-	25

Course Description:

Subject Code 3CE204PC Concrete Technology Lab is a Laboratory program core course for Second Year B.E. in Civil Engineering.

Course Objectives:

The objective of this course is to develop the ability to perform various tests and interpret results of ingredients of concrete and properties of fresh and hardened concrete.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Measurethe consistency of standard cement paste for required workability
CO2	Perform the slump test to assess the workability of concrete mix
CO3	Test the compressive strength of cement by applying load to cement cubes
CO4	Design a concrete mix as per IS guidelines.

Details of Syllabus:

(Minimum eight practical from the list should be perform)

1. Determination of fineness of cement.
2. Determination of soundness of cement.
3. Determination of consistency of standard Cement Paste.
4. Determination of Initial and Final Setting times of Cement and soundness of cement.
5. Determination of Compressive Strength of Cement.
6. Determination of Fineness modulus of Coarse and Fine Aggregates.
7. Determination of Bulking of sand.
8. Determination of Workability of concrete by slump cone.
9. Determination of Workability of concrete by compaction factor.
10. Determination of Compressive Strength of Concrete.
11. Concrete mix design by IS code method.
12. Site visit to RMC plant and preparation of report.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5	III	3CE207EM	Construction Management	2	30 Hrs	2 Hours	30

Course Description:

Subject Code 3CE207EM Construction Management is a compulsory Humanities Social Science and Management Course for Second Year B.E. in Civil Engineering.

Course Objectives:

The objective of this course is to introduces students to the concept of Management, fundamental principles and techniques of construction management, covering aspects such as project planning, scheduling, resource management, cost estimation, and quality control.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Describe the roles and responsibilities of construction industry stakeholder in civil engineering projects.
CO2	Prepare the project development stages, analyse and assess resource requirements, understand and utilize Planning tools.
CO3	Identify the roles and interdependencies of various allied management required at construction project.

Details of Syllabus:

Unit	Description	Duration (Hrs)
1	**Introduction to Construction Management** Concept of management, Overview of Construction Industry: Structure and types of construction projects (residential, commercial, infrastructure), Stake holders of Construction industry - Roles and Responsibilities of Construction Managers: Project manager, site engineer, contractors, subcontractors, and labour, Construction Management concept, need and functions.	10 Hrs
2	**Project Development Process** Project Life Cycle: - Initiation , Planning , Execution , controlling , Handover. Term Resources – 4M's of Resources. Detail steps of project planning – Tasks, milestones, work breakdown structure, scheduling, resource allocation. Introduction only to Planning tools – Network (CPM,	10 Hrs

	PERT).	
3	**Construction Management – Sub departments Roles and Responsibility and functions of** - Human Resources Management - Inventory ManagementDepartment - Quality control and assurance Management Department - Safety Management - Time Management and introduction to management Information System (MIS)	10 Hrs

Text Books:

1. Construction Planning & Management by P.S. Gahlot & B M Dhir, New Age International Limited Publishers.
2. Construction Project planning & Scheduling by Charles Patrick, Pearson, 2012.
3. Construction Project Management Theory & practice by Kumar Neeraj Jha, Pearson,2012.
4. Construction management Fundamentals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill, 2nd Edition, 2014
5. Modern construction management, Harris, Wiley India.

Reference Books:

1. Project Management, K Nagrajan, New age International Ltd.
2. Professional Construction Management Barrie, Paulson-McGraw Hill Institute Edition.
3. Project Management, Ahuja H.N., John Wiely, New York.
4. Construction Project Management Planning, Scheduling and Controlling-Chitakara-Tata McGraw Hill, New Delhi
5. Construction Management, Roy, Pilcher
6. Construction Management, O'Brien.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5	III	3CE205MD	Introduction to Civil Engineering	2	30 Hrs	2 Hours	30

Course Description:

Subject Code 3CE205MD Introduction to Civil Engineering (Multidisciplinary Minor-I) is a course for minor in Civil Engineering for Second Year.

Course Objectives:

The course aims to provide students with insights in the field of Civil Engineering, its history, significance, basic concepts, and the various branches and applications of the discipline.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Describe the scope of Civil Engineering.
CO2	Classify the building components and materials.
CO3	Apply the fundamental principles of surveying and measurement techniques.

Details of Syllabus:

Unit 1	**Introduction to Civil Engineering:** Overview of Civil Engineering, History and Evolution of Civil Engineering, Definition and Scope,Role & importance of Civil Engineers in nation-building and infrastructure development, various disciplines of Civil Engineering, Introduction to types of buildings as per NBC.	9 Hrs.
Unit 2	**Elements of Building and Materials:** Basic Principles of Structures, Types of Structures, Introduction to Materials; Components in building- Need, function and types of foundation, beams, columns, slabs, walls and roofs, Construction Materials- uses and properties of bricks, sand cement, aggregates and steel.	11 Hrs.
Unit 3	**Basics of Surveying and Measurement:** Fundamentals of Surveying: Principles, Importance, Applications, Types of Surveys: Chain, Compass, Plane Table, Theodolite, Total Station, Basic Measurement Techniques: Linear, Angular, Levelling,Modern Surveying Techniques: GIS, GPS, Drones, Remote Sensing.	10 Hrs.

Text Books:

1. Building Construction, B. C. Punmia

2. Building Materials, S. K. Duggal, New Age International Publication
3. Basic Civil Engineering by M. S. Palanichamy.
4. Building Construction" by M. L. Gambhir
5. Surveying Vol.1. B. C. Punmia

Reference Books:

1. Building Construction, W. B. Mackay : Vol. I, Longmans.
2. Construction Engineering L. S. Sane, ManakTalas Mumbai.
3. Basic of Civil Engineering, S. S. Bhavikatti

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5.0	III	3CE206OE1	Disaster Management	3	45 Hrs	3 Hrs	60

Course Description:

Subject Code 3CE206OE1 Disaster Management is Civil Engineering Open Elective for Second Year.

Course Objectives:

The objective of this course is to identify disaster management principles, risk reduction techniques, vulnerabilities, and strategies for preparedness, response, and recovery to enhance resilience and safeguard communities.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Identify different types of natural disasters, their effects on the environment and society.
CO2	Identify the ecological fragility of areas prone to manmade disasters.
CO3	Identify hazard-prone locations, global and national disaster trends in the context of climate change.
CO4	Describe disaster phases, management measures, vulnerabilities and post-disaster environmental responses.
CO5	Identify institutional mechanisms, stakeholder roles, and policies for disaster risk reduction.
CO6	Identify disaster practices, engineer's roles

Details of Syllabus:

Unit 1	**Introduction:** Introduction of disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation. Study about natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.)	8 Hrs
Unit 2	**Manmade Disasters:** Manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.	7 Hrs
Unit 3	**Disaster Impacts:** Disaster impacts (environmental, physical, social, ecological, economic,	7 Hrs

	political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.	
Unit 4	**Disaster Risk Reduction (DRR):** Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures, vulnerability and capacity assessment; early warning systems, Post disaster environmental response	7 Hrs
Unit 5	**Roles and Responsibilities:** Institutional mechanism for Disaster Management, Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, Disaster Management Policy Environment and local Action, Funding for Disaster Management, Capacity Building, Disaster Management Act 2005.	8 Hrs
Unit 6	**Disaster Management practices:** Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster, plan to counter, threats to water supply.	8 Hrs

Reference Books:

1. Cuny, Fred C; Disasters and management, oxford Uni. Press.
2. Alexander, David; Principles of emergency planning and management, Terra publishing, ISBN1-903544-10-
3. National Disaster Management Authority, Govt. of India, Report.
4. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994.

Reference Books:

Introduction to Disaster Management Prof. S. M. Dhawade and Prof. R. S. Ingalkar Dr. P. S. Mahatme, Dr. A. B. Ranit, Dr. S. M. Harle, SGSH Publication

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5	III	3CE206OE2	Water Resources Management	3	45 Hrs	3 Hours	60

Course Description:

Subject Code 3CE206OE2 Water Resources Management is Civil Engineering Open Elective for Second Year.

Course Objectives:

The objective of this course is to develop awareness in water resources, their management, conservation, and sustainable practices considering societal, economic, and environmental challenges.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Identify water resources role in societal and economic development.
CO2	Describe hydrological processes and their applications in water planning.
CO3	Explain IWRM principles for equitable and participatory water management.
CO4	Apply traditional and modern techniques for sustainable water conservation.
CO5	Describe urban water systems for efficient management and sustainability.
CO6	Develop strategies for water management andclimate change

Details of Syllabus:

Unit 1	**Introduction:** Importance and role of water resources in societal and economic development, Types of water resources: surface water, groundwater, and rainwater, Global and Indian water resource scenarios: availability, demand, and challenges.	7 Hrs
Unit 2	**Hydrological Processes and Water Budget** Hydrological cycle: precipitation, infiltration, runoff, evaporation, and transpiration, River basin management and catchment hydrology, Water budgeting: concepts, methods, and applications in water resources planning.	8 Hrs
Unit 3	**Integrated Water Resource Management (IWRM)** Principles and components of IWRM, Water allocation policies and equitable distribution, Stakeholder participation in water management: government, community, private sector.	7 Hrs
Unit 4	**Water Storage and Conservation Techniques** Traditional water harvesting methods in India, Modern techniques: dams,	8 Hrs

	reservoirs, rainwater harvesting, aquifer recharge, Sustainable practices in water conservation.	
Unit 5	**Urban Water Management and Pollution Control** Water supply and demand management in urban areas, Storm water management,and urban drainage systems, Water pollution and wastewater management.	8 Hrs
Unit 6	**Climate Change and Water Resource Sustainability** Impact of climate change on water resources, Strategies for adaptation and mitigation in water management, Case studies on climate-resilient water management systems.	7 Hrs

Text Books:

1. David Stephenson, Water Resources Management, 2004, A. A. Balkema Publishers, Netherlands.

Reference Books:

1. Louis Theodore, Ryan Dupont R., Water Resource Management Issues, Basic Principles and Applications, 2020, CRC Press, Taylor & Francis Group, New York.
2. Philippe Cullet and Sujith Koonan, Water Law in India- An Introduction to Legal Instruments, 2017. Second Edition, Oxford University Press, New Delhi.
3. Subramanya. K., Engineering Hydrology, 2020, Fifth Edition, McGraw Hill Education Pvt. Ltd., New Delhi.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5	III	3CE206OE3	Air and Noise Pollution Control Engineering	3	45 Hrs	3 Hours	60

Course Description:

Subject Code 3CE206OE3 Air and Noise Pollution Control Engineering is Civil Engineering Open Elective for Second Year.

Course Objectives:

The objective of this course is to analyse the sources, effects, measurement, control techniques, and policies related to air and noise pollution, emphasizing sustainable practices and the role of civil engineers in pollution management.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Identify air pollutants, their effects, and air quality standards with environmental and health awareness.
CO2	Illustrate air pollutant sampling, monitoring, and air quality indices with awareness of their implications.
CO3	Determine the techniques of air pollution control promoting sustainable environmental practices.
CO4	Identify noise pollution sources, measurement techniques, and impacts on health productivity.
CO5	Describe noise control strategies and regulations, promoting sustainable urban noise management solutions.
CO6	Describe environmental laws and sustainability practices, highlighting civil engineers' roles.

Details of Syllabus:

Unit 1	**Introduction:** Definition, sources, and types of air pollutants (particulate and gaseous), Effects of air pollution on human health, ecosystems, and materials, Atmospheric processes: dispersion, diffusion, and transport of air pollutants, Air Quality Standards: Indian (NAAQS) and international (WHO, EPA).	7 Hrs

Unit 2	**Air Pollution Measurement and Monitoring** Sampling and measurement of air pollutants: gravimetric and instrumental techniques, Air quality monitoring networks and devices, Case studies: Air quality indices in Indian cities (e.g., Delhi, Mumbai,etc.).	8 Hrs
Unit 3	**Air Pollution Control Techniques** Control of particulate matter: cyclones, scrubbers, filters, electrostatic precipitators, Control of gaseous pollutants: absorption, adsorption, condensation, incineration, Industrial applications and case studies, Emerging technologies: biofilters, green roofs, and photo catalytic materials.	8 Hrs
Unit 4	**Noise Pollution** Sources and types of noise pollution: urban, industrial, and construction-related, Noise measurement: Sound level meters, frequency analysis, Impacts of noise pollution on health and productivity.	7 Hrs
Unit 5	**Noise Pollution Control Strategies** Noise barriers, insulation, and absorption techniques, Zoning laws and land use planning to mitigate noise, Noise standards and regulations in India (CPCB norms), Case studies: Noise management in urban infrastructure projects.	8 Hrs
Unit 6	**Policies, Legislation, and Sustainability in Pollution Control** Indian and international environmental laws for air and noise pollution, Role of civil engineers in policy implementation, Integration of sustainability in pollution control engineering, Public participation and awareness programs for pollution control.	7 Hrs

Reference Books:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science + science media LLC, 2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

Reference Books:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C. Stern, "Air Pollution (Vol.I - Vol. VIII)", Academic Press, 2006.
3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited, 2007.
5. C.S.Rao, "Environmental Pollution Control Engineering", New Age International(P) Limited Publishers, 2006.

Level	Semester	Course Code	Course Name	Credits
5	III	3CE245DH1	Smart Cities and Urban Innovation	4

Course Description:
Subject Code 3CE245DH1 Smart Cities and Urban Innovation under Smart City is optional course to be offered as Honours for Civil Engineering Discipline and for other major discipline it may be offered as Double Minor in Second Year.

Course Objectives:
The objective of this course is to develop the technical understanding related to urban challenges and the need for sustainable, smart urban development.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome
CO1	Identify key features, evolution, and digital transformation of smart cities.
CO2	Explain six core dimensions and their interlinking for sustainable development.
CO3	Identify the urban challenges and the need for resilience in urban development.
CO4	Describe the components, models, and tools of the Indian Smart Cities Mission.
CO5	Identify roles of key stakeholders and collaboration models in smart city ecosystems.
CO6	Compare global smart city models to derive lessons for Indian urban development.

Details of Syllabus:

Unit 1	**Introduction to Smart Cities:** Definition and origin of smart cities, importance of smart city, Characteristics of a smart city, smart cities: Need and benefits, Historical evolution of cities toward smart urbanism, Introduction to urban systems and digital transformation	7 Hrs
Unit 2	**Core Dimensions Smart Cities:** Introduction to six dimensions and their importance: Smart Governance, Smart People, Smart Economy, Smart Living, Smart Mobility, Smart Environment, Interlinking of dimensions for sustainable development, Examples from real-life projects and cities	8 Hrs
Unit 3	**Urbanization Trends and Challenges:** Urbanization in India and the world: Current trends, Common urban challenges: Traffic, waste, energy, housing, services, The digital divide and inclusive development, Urban-rural linkages and peri-urban development, Need for resilience and disaster preparedness in cities	7 Hrs
Unit 4	**Smart Cities Mission:** Overview of the Smart Cities Mission (India), Vision, planning model (pan-city and area-based development), Introduction to Financing and implementation mechanisms, Use of ICT, IoT, and e-Governance tools in Indian smart cities, Role of Smart City SPVs and Urban Local Bodies (ULBs)	8 Hrs
Unit 5	**Stakeholders in Smart City Ecosystem:**	8 Hrs

	Role of government (local, state, central), Role of private sector: Investors, developers, and tech providers, Citizen engagement: Awareness, participation, and innovation, Academia and research institutions in urban innovation, Public-Private Partnership (PPP) models and collaboration tools	
Unit 6	**Best Practices and Case Studies:** Smart city models from: **Barcelona** – Citizen engagement and governance, **Singapore** – Urban mobility and digital services, **Amsterdam** – Environmental and energy solutions, Lessons for Indian smart cities, Comparative analysis of strategies and outcomes	7 Hrs

Practicals

1. Concept Mapping of Smart City Components
2. Role-Play: Stakeholders in Smart City Ecosystem
3. Survey on Urban Challenges in Local Context
4. Six Dimensions of Smart Cities
5. Case Analysis of PPP Model in Smart Infrastructure
6. Case Study Report: Indian Smart City

Text Books:

1. Smart Cities: Foundations, Principles, and Applications by Houbing Song, Ravi Srinivasan
2. Smart Cities Unbundled: Ideas and Strategies for Urban India by Sameer Sharma

Reference Books:

1. Designing Smart and Resilient Cities for a Post-Pandemic World by Anthony M. Townsend
2. https://upskilldevelopment.com/urban-innovation-management-and-smart-cities-course

Level	Semester	Course Code	Course Name	Credits
5	III	3CE245DH2	Elements of Sustainable Engineering	4

Course Description:
Subject Code 3CE245DH2 Elements of Sustainable Engineering under Sustainability Engineering is optional course to be offered as Honours for Civil Engineering Discipline and for other major discipline it may be offered as Double Minor in Second Year.

Course Objectives:
The objective of the Elements of Sustainable Engineering course aims to impart knowledge of sustainable development principles, environmental management, renewable resources, and green engineering practices relevant to civil engineering for sustainable infrastructure planning.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome
CO1	Explain the core concepts of sustainability and its significance in civil engineering.
CO2	Apply sustainable engineering principles like cleaner production and triple bottom line in practical projects.
CO3	Analyze environmental pollution issues and propose waste minimization and carbon reduction strategies.
CO4	Interpret global standards like ISO 14001 and apply tools such as LCA and EIA in infrastructure planning.
CO5	Compare renewable and non-renewable energy systems and assess their potential in sustainable development.
CO6	Design solutions for sustainable cities, habitats, and transportation using green engineering practices.

Details of Syllabus:

Unit 1	Introduction to Sustainable Development in Civil Engineering: Definition and concept of sustainability, Three Pillars: Environmental, Economic, and Social sustainability, Brundtland Commission and Sustainable Development Goals (SDGs), Relevance of sustainability in the civil engineering profession, Case studies of sustainable infrastructure projects in India and globally	7 Hrs
Unit 2	Sustainable Engineering Principles: Role of engineers in sustainability, Triple bottom line approach, Interdisciplinary nature of sustainable engineering, Concept of resource efficiency and cleaner production	7 Hrs
Unit 3	Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits,	7 Hrs

	carbon trading and carbon foot print, legal provisions for environmental protection.	
Unit 4	Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.	8 Hrs
Unit 5	Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.	8 Hrs
Unit 6	Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.	8 Hrs

Text Books:

1. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, Wiley publication.

Reference Books:

1. Krishna R. Reddy, Claudio Cameselle, Jeffery A. Adams, Sustainability Engineering: Concepts, Design and Case Studies, Wiley Publication.
2. Olivier Jolliet, Myriam Saade-Sbeih, Shanna Shaked, Alexandre Jolliet, Environmental Life Cycle Assessment, CRC Press Publication.
3. Ram M. Pendyala, Sustainable Urban Transportation Systems, ASCE Publication.
4. National Building Code of India 2016 – Volume 1 & 2, Bureau of Indian Standards (BIS).
5. Bradley. A.S; Adebayo,A.O., Maria, P., Engineering applications in sustainable design and development, Cengage learning
6. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication

Minimum of Eight practical's from the list mentioned below.

1. Case Study Analysis of Sustainable Civil Infrastructure
2. Resource Flow Mapping and Cleaner Production Strategy Design
3. Air Quality Monitoring and Interpretation
4. Water Testing for Common Pollutants
5. Solid Waste Audit and 3R Strategy Plan
6. Life Cycle Assessment (LCA) using Open LCA/SimaPro (Demo)
7. ISO 14001:2015 Implementation Case Study
8. Renewable Energy Source Evaluation and Comparison
9. Design of a Basic Rooftop Solar System
10. Energy Audit of a Room/Building (Basic Level)
11. Sustainable Transport Mapping and Proposal
12. Green Building Feature Identification (Campus Survey)

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