SANT GADGE BABA AMRAVATI UNIVERSITY

DRAFT SYLLABUS OF SEM. V & VI OF B.E. [CIVIL ENGG.] {w.e.f. 2025-2026}

CIVIL ENGINEERING V TH SEM

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE220PC	Environmental Engineering	3	45	3 Hrs.	60

Course Description:
Subject Code: 5CE220PC Environmental Engineering is a compulsory Program core course for Third Year B.E. Civil Engineering.

Course Objectives:
The objective of the course is to provide knowledge about analyze water demand, quality, and treatment processes, and design sustainable water supply and wastewater systems meeting regulatory standards and public health requirements.

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

CO	Course Outcome
CO1	Analyze water demand, consumption factors, population forecasting, impurities, and water quality standards to design typical water treatment flow diagrams.
CO2	Apply principles of aeration, sedimentation, and filtration to design and analyze water treatment processes and components.
CO3	Evaluate and apply appropriate disinfection methods, including chlorination techniques, for effective water treatment.
CO4	Analyze wastewater characteristics, perform sampling and tests, and design conventional sewage treatment processes.
CO5	Design conventional sewage treatment processes with preliminary, primary, and secondary stages.
CO6	Design and evaluate low-cost wastewater treatment systems, sludge disposal methods, ensuring compliance with effluent standards for land, stream, and sewer disposal.

Details of Syllabus:

Unit I	**Water Demand & Water Quality Standards:** Demand of water. Consumption for various purposes. Fire Demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population. Impurities in water & their effects, Water analysis- physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Typical Flow line diagrams of water treatment work.	8 Hrs.
Unit II	**Sedimentation & Filteration:** Aeration: Purpose, types of gravity aerators & spray aerators. Sedimentation: Plain and with coagulation, different coagulants used, Flocculation, clarrifloculator, simple problems on design of sedimentation tanks. Filtration: Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process, Negative head	7 Hrs.
Unit III	**Disinfection:** Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, pre-chlorination, post chlorination. Break point chlorination and super chlorination, forms of chlorine. Use of bleaching powder.	8 Hrs.
Unit IV	**Strom Water & Sewerage System** Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers design of sewers. Testing & maintenance of sewers.	7 Hrs.
Unit V	**Wastewater Characteristics & Treatment:** Waste water characteristic, sampling of sewage, physical chemical and biological examinations, B.O.D. and C.O.D, problems on B.O.D Pollution due to domestic and industrial waste. Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant.	8 Hrs.
Unit VI	**Low-Cost Waste Treatments**:	7 Hrs.

	Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Effluent standards for disposal on land, into stream and into sewers.	

Text Books:

1. Dr. B. C. Punmia & Er. Ahok K. Jain, Water Supply Engineering, Laxmi Publication.
3. Dr. B. C. Punmia & Er. Ahok K. Jain, Wastewater Engineering, Laxmi Publication
4. Santosh kumar Garg, Water Supply Engineering, Khanna Publication

Reference Book:

1. Metcalf & Eddy, Wastewater Engineering treatment and Disposal, Tata Macgraw Hill

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE221PC	Geotechnical Engineering	3	45	3 Hrs.	60

Course Description:

Subject Code: 5CE221PC Geotechnical Engineering is a compulsory course for Third Year B.E. Civil Engineering.

Course Objectives:

The objective of course is to classify soil based on index properties, explain the principal of compaction, demonstrate quality control in field, permeability of soil, methods of dewatering, the quantity of seepage discharge, graded filter , to measure the shear strength of different types of soil , explain the concept of consolidation & stress distribution in soil mass.

Course Outcomes (COs)

After completing the course students will be able to:

COs	Course Outcomes
CO1	Classify soil based on index properties of soil.
CO2	Explain the principal of compaction and demonstrate quality control in field.
CO3	Determine the permeability of soil and explain methods of dewatering.
CO4	Evaluate the quantity of seepage discharge and design criteria of graded filter.
CO5	Measure the shear strength of different types of soil using various methods.
CO6	Explain the concept of consolidation and stress distribution in soil mass.

Details of Syllabus:

Unit I	**SOIL PROPERTIES:** History of development of soil mechanics, formation of soil, its significance to the field problems. Soil properties and its classification, Definition of soil, soil as a three phase system, weight volume relationship, Index properties of coarse and fine grained soil, BIS classification of fine grained and coarse grained soil.	8 Hrs.
Unit II	**COMPACTION OF SOIL:** Mechanics of compaction, factors affecting compaction, standard and modified Proctor test, their field Determination, zero air void line, concept of wet of optimum and dry of optimum, different structures of soil, field compaction and their control, CBR test and CBR values for soaked and unsoaked conditions.	7 Hrs.
Unit III	**PERMEABILITY OF SOIL:** Darcy's law and its validity, discharge and seepage velocity, factors affecting permeability, determination of coefficient of permeability in laboratory and field, permeability for stratified soil deposits, drainage and dewatering of soil and its various methods.	8 Hrs.
Unit IV	**SEEPAGE ANALYSIS:** Laplace equation and its derivation in Cartesian co-ordinate system, its application for the computation of discharge seepage, seepage pressure, quick sand condition, concept of flow net, characteristics and uses of flow net, preliminary problem of discharge,	7 Hrs.

	estimation of discharge through homogenous earthen embankment, Terzaghi's design criteria for graded filter, concept of piping and criteria of stability against piping.	
Unit V	**SHEAR STRENGTH OF SOIL:** A physical concept of shear strength, introduction of Mohr's stress diagram, Mohr's failure criteria, Mohr-Coulomb's theory and development of failure envelopes, unconfined compression test, laboratory measurement of shear strength for different drainage conditions by direct shear test, triaxial test, merits and demerits of various shear strength tests.	8 Hrs.
Unit VI	**STRESSES IN SOILS:** State of stress at a point, stress distribution in soil mass, Boussinesq's theory and its applications, point load and uniformly loaded area, Newmark's Influence Chart, its preparation and use. **CONSOLIDATION OF SOIL:** Definition, Spring analogy, Terzaghi's theory of one dimensional consolidation, Consolidometer test,	7 Hrs.

RECOMMENDED BOOKS:

1. Dr. Arora K. R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi.
2. Dr. B.C.Punmia, A.K.Jain "Soil Mechanics and Foundations", Laxmi Publications (P).
3. Murthy V. N. S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers & Distributors Pvt. Ltd. India
4. Venkatramaiah C. , "Geotechnical Engineering", New Age International (P) Ltd., Publishers, New Delhi
5. Terzaghi K. & Peck R.B, "Soil Mechanics in Engg. Practice", John Wiley.
6. Gulhati S. K. and Datta M, "Geotechnical Engineering", Tata McGraw Hill Publishing Company, New Delhi
7. Gopal Ranjan and A. V. S. Rao, "Basic and Applied Soil Mechanics", New Age International (P) Ltd., Publishers, New Delhi.

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE222PC	Design of Reinforced Concrete Structure	3	45	3 Hrs	60 Max Marks

Course Description:

Subject Code: 5CE222PC Design of Reinforced Concrete Structure is a compulsory Program core course for Third Year B.E. Civil Engineering.

Course Objective:

The objective of the course is to develop the capability of the students to understand design philosophy, apply Indian Standard design parameters and carry out designing of various RCC members that includes Beam, Column, Footing, Slab, Stair case and Water Tank .

Course Outcomes (COs)

After completing the course students will be able to:

CO	Course Outcome
CO1	Explain the properties of concrete and steel, behavior of RCC members, and the limit state method of design.
CO2	Understand Working Stress Design Philosophy and design RCC water tank for different shape and support conditions
CO3	Design singly and doubly reinforced RCC beams subjected to flexure and shear.
CO4	Design RCC slabs (one-way and two-way) considering serviceability requirements.
CO5	Analyze and design RCC columns subjected to axial load and combined bending.
CO6	Design RCC foundations such as isolated footings based on soil conditions and to design Stari case flights for Dog leg Shapes

Details of Syllabus :

UNIT I	**Introduction and Design Philosophy:-** Concrete as a structural material: advantages and limitations, Reinforced concrete: concept and necessity, Loads on structures: dead load, live load, wind load (IS Codes),Limit State Method –Philosophy, Characteristic strength of materials, Partial safety factors, Codal provisions as per IS 456:2000	8 Hrs

UNIT II	**Working Stress Method and Water Tank design philosophy** Working Stress Method, concept, IS code Provisions, Design of water tank – Rectangular and Circular for cases of Fixed , Hinged and Simply Supported cases using working stress method.	7 Hrs
UNIT III	**Design of Beams** Introduction to the concept of Under Reinforced, Over Reinforced & Balanced Section of Beams, Types of beams, Design of Singly reinforced rectangular beams and doubly reinforced beams, Detailing of reinforcement in beams	8 Hrs
UNIT IV	**Design of Slabs** Design and detailing of following slabs for Simply, fixed and hinged support conditions, subjected to self weight (Pressure load): One-way slabs Two-way slabs	7 Hrs
UNIT V	**Design of Columns and Stair case** Classification of columns, Effective length of columns, short and long columns, axially loaded columns, Columns subjected to Axial load with uniaxial bending and Axial load with biaxial bending. Staircase design – Flight and Landing (Dog Legged)	8 Hrs
UNIT VI	**Design of One way and two-way shear isolated footing** Types of footing and its suitable location, one way shear footing subjected to axial load, Two way shear footing subjected to axial and eccentric loading condition.	7 Hrs

Recommended IS Codes:

1. IS 456:2000 – Plain and Reinforced Concrete
2. IS 875 (Part 1 & 2) – Loads on Structures
3. IS 1786 – High Strength Deformed Bars
4. SP 16 – Design Aids for RCC

SUGGESTED TEXT BOOKS:

1. Ashok K Jain : Reinforced Concrete Limit state Design (Nem Chand & Bros Roorkee)
2. S.K.Sinha: Reinforced Concrete Design (M C Graw Hill Education India Pvt Ltd) 3. Devdas Menon, S. UnnikrishnaPillai : Reinforced concrete Design ;Third Edition; McGraw Hill Education
3. Dr.Shah V.L. & Karve S.R. : Limit State Theory & designof Reinforced concrete IS 456:2000 (Structures Publication)
4. Neelam Sharma: Reinforced Cement Concrete design (S.K.Kataria& Sons)
5. S.S.Bhavikatti :Design of R.C.C. Structural Element (R.C.C. Vol. I)(New Age International Publishers)

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5.5	V	5CE223PE1	**Repair and Re-habilitation of Structures**	3	45	3 Hours	60

Course Description:

Subject Code 5CE223PE1 Repair and Re-habilitation of Structures is Civil Engineering Program Elective Course-I for Third Year.

Course Objectives:

Students will gain a comprehensive understanding of distress and damage mechanisms in concrete and masonry structures, along with principles of structural health monitoring, durability, and quality assurance. The course enables students to conduct structural audits and investigations, communicate assessment findings effectively, and apply appropriate repair, rehabilitation, retrofitting, restoration, waterproofing, and demolition techniques, including safe material recycling practices.

Course Outcomes: On successful completion of the course the learner will be able to**:**

COs	Course Outcomes
1	Identify deterioration, plan maintenance, and suggest suitable repair and rehabilitation methods for durable structures.
2	Assess structural health, ensure quality and durability, and prevent corrosion.
3	Perform structural audits, analyze distress, manage investigations, and prepare professional evaluation reports.

4	Students can assess structures, select suitable restoration materials, and apply effective retrofitting and waterproofing techniques.
5	Apply suitable retrofitting methods, manage rehabilitation of damaged structures, and plan effective maintenance strategies.
6	Plan safe demolition operations, select suitable methods, and promote recycling of demolished materials.

Details of Syllabus:

Unit No.	Content	Contact Hr.
I	Maintenance, Repair and Rehabilitation Strategies. Definitions: maintenance, repair, rehabilitation, retrofitting. Elements of maintenance: routine, preventive, corrective, predictive. Importance of maintenance of structures. Inspection: types, stages, flow-chart for condition survey. Causes of deterioration in concrete, masonry and steel structures (intrinsic & extrinsic). Durability considerations, service life.	8
II	Structural health monitoring, various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion, fire safety. Various chemical NDT methods.	7
III	Structural Audit, Assessment of health of structure, study of structural drawings, nature of distress, visual observations, Collapse and investigation, limitations of investigator, tools for investigation, investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, communication gap among client, architect, consulting engineer & contractor.	8
IV	Retrofitting of Structures, parameters for assessment of restoration strategies, selection of construction chemicals during restoration, Specification for important items of work in restoration, Structural detailing for restoration, and various techniques of retrofitting. Waterproofing of RCC water retaining structures.	7
V	Repair, Rehabilitation & Retrofitting of Structures. Retrofitting for structural strengthening: Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing, addition of shear walls. Rehabilitation of structures affected by corrosion, fire, leakage, marine exposure. Case studies of building failures. Maintenance planning and management for structural systems.	8
VI	Demolition of Structure, study of structural system and structural drawings, need and importance for demolition, outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. Recycling of demolished materials.	7

Text Books:

1. Repair and Rehabilitation of Structures, Dr. K. Gunasekaran and J.S. Sudarsan, Tata Mc-Graw Hills.
2. "Repair and Rehabilitation of Structures", R. N. Krishna, Standard Book House.
3. “Concrete Structures Repair Rehabilitation And Retrofitting”, J. Bhattacharjee, cbspd.

Reference Books:

1. Fundamentals of Material Management, Gopalkrishnan, Tata Mc-Graw Hills.
2. Properties of Concrete, A M Neville, Longman.
3. "Repair and Rehabilitation of Concrete Structures", Poonam I. Modi and Chirag, PHI Learning Pvt Ltd.

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5.5	V	5CE223PE2	Waste Water Treatment Technology	3	45	3 Hours	60

Course Description:

Subject Code 5CE223PE2 Waste Water Treatment Technology is a compulsory Program Elective Course for Third Year under graduate engineering degree B.E. in Civil Engineering.

Course Objectives:

The objective of the course is to introduce students to principles, processes, and technologies for treatment, reuse, and sustainable management of wastewater.

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

COs	Course Outcomes
CO1	Explain wastewater characteristics, sewerage systems, pollution impacts, and discharge standards.
CO2	Apply preliminary and primary treatment principles for wastewater treatment design.
CO3	Analyze secondary treatment processes using biological performance parameters.
CO4	Evaluate biological nutrient removal processes for municipal wastewater treatment.
CO5	Apply appropriate tertiary and membrane-based advanced treatment technologies.
CO6	Assess sludge treatment, disposal, reuse, and groundwater recharge methods.

Details of Syllabus:

Unit I	**Fundamentals of Wastewater** Definitions of sewage, sludge, and types of sewerage systems, Need and objectives of wastewater treatment Types and sources of wastewater: domestic, industrial, storm water, Physical, chemical, and biological characteristics, Effects of wastewater discharge on streams, land, and groundwater, Indian standards for wastewater discharge	7 Hrs
Unit II	**Primary Treatment Processes** Preliminary treatment: Screens-Types and design criteria, Grit Chambers & removal Process, Primary Clarifiers: Principles of sedimentation, design of circular and rectangular Primary Sedimentation Tanks (PST), and surface loading rates,	8 Hrs
Unit III	**Secondary Treatment Processes** Activated sludge process- Process description, F/M ratio, Mean Cell Residence Time (MCRT), and sludge volume index (SVI). Design of ASP, Trickling filters-Principle of operation, types (Standard and High rate), Oxidation ponds Performance parameters: BOD, COD, TSS removal.	8 Hrs
Unit IV	**Biological Nutrient Removal** Nitrogen removal: nitrification and denitrification, Phosphorus removal mechanisms, biological nutrient removal processes, application of phostrip, bardenpho and phoredox process. Application and limitations in municipal treatment plants.	7 Hrs
Unit V	**Tertiary and Advanced Treatment Technologies** Tertiary treatment objectives, Filtration methods, Membrane processes :Membrane process terminology & classification Materials, membrane configuration, membrane operation Microfiltration, Ultra filtration, Nano filtration, Reverse osmosis, Membrane fouling and control, Introduction to membrane bioreactors (MBR).	7 Hrs
Unit VI	**Sludge handling and disposal:** Sludge processing steps- Preliminary operations, thickening, stabilization, conditioning, dewatering and heat drying and thermal reduction. Aerobic and anaerobic sludge digestion microbiology and design, land application of sludge and design consideration. Sludge storage, land application of domestic sewage and ground water recharge.	8 Hrs

Text Books:

1. Wastewater Engineering: Treatment, disposal, Reuse (4th ed.) - Metcalf & Eddy Inc. Tata McGraw-Hill, New Delhi, 2003.
2. Wastewater Treatment for Pollution Control (2nd ed.) – SJArceivala, Tata McGraw-Hill, 1998.

Reference Books:

1. Wastewater Treatment Plants: Planning, Design and Operation Holt - SR Qasim, Rinehart & Winston, NY, 1985
2. Wastewater Treatment – DW Sunderstorm and HE Klei, Prentice-Hall, Englewood Cliffs, NJ, 1979.
3. Biological Wastewater Treatment: Theory and Application - CLP Grady, and HC Lim, Marcel Dikker, NY, 1980.

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE223PE3	Highway Construction & Management	3	45	3 Hrs.	60

Course Description:

Subject Code: 5CE223PE3 Highway Construction & Management is a core program Course for Third Year B.E. Civil Engineering.

Course Objectives:

1. To know the development of transport, various road development plans and policies in India and test procedures for highway materials.
2. To understand the principles of highway geometric design as per IRC standards.
3. To study the different types of pavement its construction, maintenance & design by different methods.
4. To understand the Traffic engineering & different types of traffic control devices.
5. To study the causes, preventions, better planning & design of highway to prevent accidents.
6. To study various types of equipment's, their working principles & limitations for flexible and rigid pavement.

Course Outcomes (COs)

After completing the course students will be able to:

COs	Course Outcomes
CO1	Explain the basic concepts about highway engineering
CO2	To design geometric elements of the highway.
CO3	To design the various types of road pavements with construction and maintenance of highway.
CO4	To carry out traffic studies and implement traffic regulation and control measures and intersection design.
CO5	To apply the knowledge to prevent the road accidents.

Details of Syllabus:

Unit I	Highway: Development and Planning, Road Transport characteristics, classification of Roads, Road development plans & Salient features, Road pattern, Alignment principles, Engg. Survey for highway. Material and Testing. Various properties of aggregates and bituminous materials and Test, IRC, IS Specifications, bituminous mix design.	8 Hrs.
Unit II	Geometric Design : cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, Overtaking sight distance, Horizontal alignment - curves, super elevation, Extra widening, transition curves, vertical alignment, Design of summit and valley curves, IRC Standards for Geometric design.	7 Hrs.
Unit III	Pavement Design: Components of Flexible and Rigid pavement, Design factors, ESWL, Flexible pavement design by C.B.R. Method. Westergards analysis for wheel load & Temperature stresses in rigid pavement, Rigid pavement by IRC method (As per IRC-37), Combination of stresses, Joints in Rigid Pavement, Construction And Maintenance – WBM Surface dressing, Bituminous roads, cement concrete Pavement, construction procedure, construction of roads in expansive soil	8 Hrs.
Unit IV	Traffic Control Devices: Traffic signs, markings, islands and signals. Different methods of signal design redesign of existing signal including case studies. Signal system and co-ordination. Evaluation and design of road lighting.	7 Hrs.
Unit V	Road Safety: Road accidents, Causes, scientific investigations and data collection. Safety in Road Design – Accident prevention through better planning and design of roads – planning road networks by land use planning. Traffic calming techniques and innovative ideas in road safety.	8 Hrs.
Unit VI	Equipment in Highway Construction: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.	7 Hrs.

Recommended Books:

1. Kadiyali L.R., "Principles& Practice of Highway Engineering" Khanna Publisher
2. "Highway Engineering", Khanna& Justo, (Nem Chand &Poros, Roorkee.1997)
3. E.J. Yoder, "Principles of Pavement Design," John Wiley & Sons lnc., New York
4. Chakroborty P Das "Principles & Practice of Highway Engineering" (Khanna Publisher 2000)
5. Highway Material Testing – S K Khanna- C.E.G. Justo, Nemchand Bros- Rookee, 2000
6. S.K.Khanna& Justo C.E.G., Highway Material Testing Manual
7. A.K. Duggal and Vijay P.Puri, "Laboratory Manual in Highway Engineering,".

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Level	Semester	Course Code	Course Name	Credits	Practical Hours	Exam Duration	Max Marks
5.5	V	5CE224PC	Environmental Engineering- Lab.	1	2 hours/week	--	50

Course Description: Subject Code: 5CE224PC Environmental Engineering Lab is a compulsory Program core course for Third Year B.E. Civil Engineering.

Course Objectives:
The objective of the Environmental Engineering Lab is to provide hands-on experience on the determination of physical and chemical properties of water and wastewater.

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

COs	Course Outcomes
CO1	Measure of pH, Turbidity, & Electrical Conductivity, of water sample.
CO2	Analyzed Dissolved, Suspended and Total solids of water sample.
CO3	Identify optimum coagulant dose.
CO4	Analyze Biochemical Oxygen Demand (BOD & Chemical Oxygen Demand (COD) of wastewater sample.
CO5	Measure Chloride & Sulphate concentration of wastewater.
CO6	Identify the various units and their operations for Water/Wastewater treatment plant/Industrial effluent treatment plant

Details of Syllabus:

Minimum of Eight practical from the list mentioned below:

1. Determination of pH, Turbidity, & Electrical Conductivity, of water sample.
2. Analysis of Dissolved, Suspended and Total solids of water sample.
3. Analysis of Volatile and Fixed solids.
4. Determination of optimum coagulant dose of water sample.
5. Determination of residual chlorine in the given water sample.
6. Determination of Biochemical Oxygen Demand (BOD) of wastewater sample.
7. Determination of Chemical Oxygen Demand (COD) of wastewater sample.
8. Determination of Chloride concentration) of wastewater sample.
9. Determination of Sulphate concentration of wastewater sample.
10. Sludge volume index (SVI) determination.

Compulsory Field visit & Report writing to Municipal Water/Wastewater treatment plant/Industrial effluent treatment plant.

Level	Semester	Course Code	Course Name	Credits	Practical Hours	Exam Duration	Max Marks
5.5	V	5CE225PC	Geotechnical Engineering-Lab	1	2 hours / week	-	50

Course Objectives:
To enable students to determine the index and engineering properties of soils through standard laboratory and field tests and interpret the results for geotechnical analysis and design.

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

COs	Course Outcomes
CO1	Determine the index properties of soil such as specific gravity, moisture content, grain size distribution and Atterberg limits`
CO2	Evaluate the compaction characteristics and field density of soils and relate them to practical construction control.
CO3	Determine the permeability characteristics of soils and assess drainage and seepage behaviour.
CO4	Evaluate shear strength parameters of soils using direct shear, UCS and triaxial tests for stability analysis.
CO5	Determine consolidation characteristics and CBR value to assess settlement and pavement subgrade performance.
CO6	Interpret laboratory test results, prepare technical reports and apply the findings to real geotechnical engineering problems.

Minimum Eight Practical's to be performed from the list as below:

1. To find out specific gravity of soil solids by Pyconometer Method.
2. Determination of moisture content by oven drying method.
3. To detect field density of the soil by core cutter method.
4. To ensure grain size distribution by mechanical sieve analysis.

5. To work out Atterbergs limits (LL, PL and SL)
6. To determine compaction properties by Standard Proctor Test.
7. To figure out of permeability of soil by using falling head test.
8. To decide shear strength parameters by direct shear test.
9. To find out shear strength by unconfined compressive strength test.
10. To determine of shear strength parameters by Triaxial shear test.
11. Determination of C.B.R. value by conducting laboratory CBR test. (soaked/unsoaked)
12. To decide Coefficient of consolidation by conducting consolidation test.

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Level	Semester	Course Code	Course Name	Credits	Practical Hours	Exam Duration	Max Marks
5.5	V	5CE226PC	Design of Reinforced Concrete Structure - Lab.	1	2 hours/ week	--	50

Course Description:

Subject Code: 5CE226PC Design of Reinforced Concrete Structure Lab is a compulsory Laboratory course for Third Year B.E. Civil Engineering.

Course Objective:

The objective of the course is to develop the capability of the students to perform laboratory experiments related to RCC design of structural members.

Course Outcomes (COs)

After completing the course students will be able to:

CO	Course Outcome
CO1	Apply the IS code provisions for designing of RCC members
CO2	Design RCC structural members
CO3	Prepare working drawing as per the detailing of RCC design
CO4	Analyse design need as per actual filed work and site location

Practical's:

1. Candidates are required to prepare at least Three designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any RCC framed structure site & should submit the report of the same.

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE227MD	Building Construction and Planning	2	30	2 Hrs.	30

Course Description:

Subject Code: 5CE227MD **Building Construction and Planning is a Multidisciplinary Minor -III program Course** for Third Year B.E. Civil Engineering.

Course Objectives:

1. Understand the principles of building planning, construction practices, and the built environment as per the National Building Code
2. Explain concepts of green buildings, sustainability, and accessibility in residential and public buildings.
3. Apply planning principles to prepare building layouts, drawings, and service plans for various types of buildings.
4. Analyze building services such as water supply, drainage, electrical systems, fire protection, and HVAC for functional efficiency and safety.
5. Evaluate planning solutions considering inclusivity, energy efficiency, environmental quality, and statutory requirements.

Course Outcomes (COs)

After completing the course students will be able to:

COs	Course Outcomes
CO1	Explain the principles of building planning, green building concepts, and provisions of the National Building Code.
CO2	Apply planning concepts to prepare drawings such as plans, elevations, sections, and site layouts for residential and public buildings.
CO3	Analyze requirements of accessibility and inclusive design for differently-abled users in urban and rural built environments.
CO4	Apply building services design including water supply, drainage, electrical systems, fire protection, and renewable energy systems.
CO5	Evaluate building planning solutions based on safety, sustainability, functionality, and user comfort.

Details of Syllabus:

Unit I	**Principles of Residential and Public Buildings:** Concept of built environment and its application in planning. Recommendation of National building code., Green building, Introduction-Benefits, National priorities, rating system, check list, Site selection and planning, Water efficiency, Energy efficiency, Materials, Indoor environmental quality, Innovation and design process. **Principle of Planning for differently abled publics:** Standardization and Contextualization of accessibility in built environment, Overview of accessibility codes (National and International Perspectives), Design for Inclusion : A holistic Approach (User centric approach to design, WINIT Model), Accessibility Elements of Built Environment in urban and rural Contexts (Kerb Ramps, Bollards, Level and gratings, Ramps, Gradients and other relevant elements) Principle of site planning and approaches for accessibility, Accessibility in public Sanitation System (Washroom typologies and Accessibility perspectives emergency evacuation systems and codes)	12 Hrs.
Unit II	**Planning of Building: -** Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window. Planning of building such as Residential building –Load bearing structure, RCC framed structure. Building for Education – school, college. Library Building for health –Dispensary, Hospital Industrial structure Building for entertainment-Theatre, club house, sports club. Other structure-Office, Hostel, Guest house **Building's Water Supply and Drainage & Solid Waste Collection and Disposal System:** - Design of water supply, waste water and storm water collection system for various types of buildings. Pumps and Pump House. Accessibility in public Sanitation Systems.	10 Hrs.
Unit III	**Electrical Services: -** Domestic Supply, Distribution Circuits, basic wiring systems. Design and planning: - Lighting of staircase, corridors. Automatic Water Level controller, Closed Circuit Security Monitors with Intercom/ EPBX facility, Common Dish TV antenna, Use of Solar Panels as source of power, Lightening Conductor for High-rise Buildings **Fire Protection System: -** Introduction, Fire protection, requirement of water quantity estimation. Systems of firefighting external and internal. Wet and dry risers, smoke alarm, Sprinkler system. Safety corridors in Highrise structures. Elevators, Heating Ventilation and Air Conditioning, Building Management System: - Security Guard's Cabin, Postage collection boxes, Parking space	8 Hrs.

Recommended Books:

1. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).
2. Building Services Environmental and Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805)
3. Croome, J. D. & Roberts, B. M., "AIR-CONDITIONING AND VENTILATION OF BUILDINGS VOL-1". Pergamon Press, (ISBN: 0080247792)
4. SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095)
5. N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990)

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE228 MD	Property Acquisition and Legal Aspects	2	30	2 Hrs	30 Max Marks

Course Description:

Subject Code: 5CE228 MD is a **Property Acquisition and Legal Aspects compulsory Multidisciplinary Minor IV** for Third Year B.E. Civil Engineering.

Course Objective:

The objective of the course is make the student understand the process of Property acquisitions and the legal aspects , government rules and regulations related to it .

Course Outcomes (COs)

After completing the course students will be able to:

COs	Course Outcomes
CO1	Classify property and understand property registration process
CO2	Understand process of land acquisition and norms related to rehabilitation
CO3	Process of statutory approvals and dispute resolution methods

Details of Syllabus:

UNIT I	**Introduction to Property and Land Systems:** Meaning and classification of property, Movable and immovable property Difference between ancestral and self-acquired property, Rights and duties of property owners, Overview of land records in India, **Ownership, Transfer and Registration of Property** Types of ownership: freehold, leasehold, joint ownership, Transfer of property – sale, gift, lease, mortgage (basic idea), Registration of property – purpose, procedure and its importance. Process of property transfer (farmland, residential, commercial, industrial spaces)	10 Hrs
UNIT II	**Land Acquisition Laws and Procedures:** Need for land acquisition in public and private projects, Overview of Land Acquisition Act, 2013, Steps involved in land acquisition process (basic) **Compensation and rehabilitation:** basic principles, Social impact of land acquisition, Rights and responsibility of landowners and affected persons under land acquisition act	10 Hrs
UNIT III	**Statutory Approvals and Regulatory Framework** Need for statutory permissions in L.A., Role of Building permissions and land use zoning, Environmental clearance – basic awareness Role of local bodies and authorities **Dispute and resolution :** Common disputes in land and construction projects, Dispute resolution methods – arbitration, mediation, courts, Professional ethics and legal accountability	10 Hrs

Recommended Books :

1. K.K. Chitkara – *Construction Project Management*, Tata McGraw-Hill
2. Subba Rao, G.C.V., *Law of Contracts I & II*, 12th ed. (updated by Dr. V. Krishnamachari), Narender Gogia & Company, 2025
3. B. Sengupta, *Construction Planning and Management*, Tata McGraw-Hill Education, 2016.
4. Mitra, B.B., *Law Relating to Transfer of Property*, 21st ed. (edited by S.P. Sengupta), Kamal Law House, 2025.
5. V.G. Ramachandran – Law of Land Acquisition, Eastern Book Company.

Acts:

1. The Transfer of Property Act, 1882
2. The Registration Act, 1908
3. The Indian Stamp Act, 1899
4. The Indian Contract Act, 1872
5. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
6. The Arbitration and Conciliation Act, 1996
7. Environment (Protection) Act, 1986.

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE229ML	Building Construction and Planning - Lab	1	2Hrs/Week	-	50

Course Description:

Subject Code: 5CE227MD Building Construction and Planning - Lab is a Multidisciplinary Minor Lab - I Course for Third Year B.E. Civil Engineering.

Course Objectives:

The objectives of the Building Construction and Planning Laboratory course are to enable students to:

1. Enable students to understand principles of building planning and construction through preparation of detailed drawings.
2. Develop the ability to apply planning concepts in preparing residential and public building layouts using standard practices.)
3. Provide hands-on experience to prepare and interpret constructional drawings such as plans, elevations, sections, and service layouts.
4. Enhance skills to analyze building requirements related to water supply, drainage, solid waste management, and fire protection systems.
5. Encourage students to develop drafting and presentation skills using appropriate drawing techniques and tools.

Course Outcomes (COs)

After completing the course students will be able to:

COs	Course Outcomes
CO1	Prepare detailed constructional drawings of residential buildings including plans, elevations, sections, and site layouts.
CO2	Develop line plans and layouts for various public buildings such as educational, health, industrial, and recreational structures.
CO3	Apply perspective drawing techniques (one-point, two-point, and three-point) for effective visualization of buildings.
CO4	Analyze and prepare layouts for building services including water supply, drainage, solid waste management, and fire protection systems.

Details of Syllabus:

Minimum of Six practicals from the list mentioned below:

The practical examination shall consist of viva-voce based on theory & practical. Graphs are to be drawn wherever necessary.

1. Preparation of detailed constructional plan of a residential building.
2. Preparation of front elevation, detailed sectional view, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window.
3. Concept of perspective drawing- one point, two-point, three point and uses.
4. Preparation of line plans of various public buildings like:
   Building for Education – School, College. Library
   Building for health –Dispensary, Hospital Industrial structure
   Building for entertainment-Theatre, Club House, Sports Club. Other Structure- Office, Hostel, Guest house.
5. Prepare layout for water supply and drainage for a residential building and for multistoried buildings.
6. Building's Solid Waste Collection and disposal system: Wet and dry solid waste segregation, Vermi-composting etc. Provision of Chutes.
7. Fire Protection System: Design of emergency exits and emergency vehicle routes with fire protection symbols

Text Books:

1. Scott Onstott, AutoCAD 2018 and AutoCAD LT 2018 Essentials, Wiley (2017), (ISBN: 9788126569298)
2. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).
3. Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805)
4. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117)
5. Croome, J. D. & Roberts, B. M., "AIR-CONDITIONING AND VENTILATION OF BUILDINGS VOL-1". Pergamon Press, (ISBN: 0080247792)
6. SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095)
7. N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990)

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5.5	V	5CE230OE1	Introduction to Earthquake Engineering	2	30	2 Hours	30

Course Description:

Subject Code 5CE230OE1 **Introduction to Earthquake Engineering is Civil Engineering Program Open Elective Course-I** for Third Year.

Course Objectives:

The course aims to:

- Introduce fundamental concepts of earthquakes and seismology
- Familiarize students with earthquake effects on structures and ground
- Provide basic understanding of seismic design philosophy and Indian standards
- Develop awareness of earthquake-resistant construction practices

Course Outcomes: On successful completion of the course the learner will be able to:

COs	Course Outcomes
1	Explain the causes, characteristics, and measurement of earthquakes
2	Identify seismic hazards and earthquake effects on structures and soils.
3	Understand basic principles of earthquake-resistant design as per Indian codes.

Details of Syllabus:

Unit No.	**Content**	**Contact Hr.**
I	Basic concepts of earthquakes and earthquake engineering, causes of earthquakes including tectonic, volcanic, and induced seismicity along with the elastic rebound theory. Important earthquake terminology such as focus, epicenter, faults, and seismic waves is discussed. The characteristics and propagation of different types of seismic waves, namely P-waves, S-waves, Love waves, and Rayleigh waves, are explained. Methods of measurement of earthquakes including magnitude and intensity are covered with emphasis on the Richter scale, Moment Magnitude scale, and Modified Mercalli Intensity scale. An overview of global and Indian seismicity is provided along with the seismic zoning of India.	10
II	Effects of earthquakes and various seismic hazards associated with ground motion, characteristics of earthquake ground motion and factors influencing it. The qualitative response of structures to seismic forces and the nature of earthquake-induced forces acting on buildings are explained. The effects of earthquakes on different civil engineering structures such as buildings, bridges, and lifeline structures are covered, non-structural damage and lessons learned from past major earthquakes in India	10
III	Basic philosophy of earthquake-resistant design and the concept of performance-based design at an introductory level, importance of proper structural configuration, load paths, regularity, and ductility in seismic design. Fundamental concepts related to seismic design forces are discussed. An overview of relevant Indian Standard codes such as IS 1893 (Part 1), IS 4326, and IS 13920 is provided, basic earthquake-resistant construction practices and fundamental concepts of retrofitting and strengthening of existing structures.	10

Text Book/s:

1. Dynamics of Structures, Anil K. Chopra, Pearson Education..
2. Earthquake Resistant Design of Structures, Pankaj Agarwal and Manish Shrikhande, PHI Learning.
3. Earthquake Resistant Design of Structures, S.K. Duggal, Oxford University Press.
4. Earthquake Tips, C V R Murthy, IIT Gandhinagar.

Indian Standard Codes (Latest Editions):

- 1. IS 1893 (Part 1) BIS, New Delhi, BIS, New Delhi.
- IS 4326
- IS 13920

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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE230OE2	Green Building	2	30	2 Hrs.	30

Course Description:

Subject Code 5CE230OE2 Green Building is a Civil Engineering Open Elective course for Third Year B.E.

Course Objective:

The objective of this course is to equip students with foundational knowledge of sustainable building principles, rating systems, energy/water efficiency, materials, and design strategies for environmentally responsible structures

Course Outcomes (COs)

After completing the course students will be able to:

CO	Course Outcome
CO1	Apply green building principles to evaluate sustainability attributes of a building project.
CO2	Analyze water and energy efficiency strategies for sustainable building design
CO3	Apply waste management and indoor environmental quality strategies to building projects

Details of Syllabus:

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Maximum Marks
5.5	V	5CE230OE3	Construction Safety Management	2	30	2 Hours	30

Unit 1	**Introduction to Green Buildings & Rating Systems** Definition, principles, benefits of green buildings, Sustainable development and environmental impact of buildings, Overview of rating and certification systems (LEED, IGBC, GRIHA, ECBC), Key sustainability criteria and assessment processes, Case studies of green buildings in India.	8 Hrs.
Unit 2	**Sustainable Site Planning, Water & Energy Efficiency** Sustainable site selection, landscape planning, heat island mitigation, Water conservation: rainwater harvesting, wastewater reuse, efficient fixtures, Energy efficiency: passive design strategies (orientation, shading), building envelope, lighting and HVAC efficiency.	10 Hrs.
Unit 3	**Sustainable Materials, Waste and Lifecycle Considerations** Green building materials: recycled, renewable, low-embodied energy materials, Life Cycle Assessment (LCA) concepts, embodied and operational energy, Waste management: construction & demolition waste, recycling and reuse, Indoor environmental quality issues: VOCs, thermal comfort, acoustics, Integrated design approaches and project documentation for certification.	12 Hrs.

Reference Books:

1. TERI, Sustainable Building Design Manual – Volume II, The Energy and Resources Institute (TERI), New Delhi.
2. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons.
3. Francis D. K. Ching and Ian M. Shapiro, Green Building Illustrated, John Wiley & Sons.

Course Description:

Subject Code 5CE230OE3 Construction Safety Management is Civil Engineering Open Elective for Third Year.

Course Objectives:

The objective of this course is to focus on equipping individuals to identify hazards, assess risks, implement control measures (like PPE and permits-to-work), understand legal/regulatory requirements, and foster a strong safety culture to prevent injuries and ensure compliance on construction sites, ultimately reducing accidents and promoting worker well-being.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome
CO1	Understanding of safety regulations, hazard identification, and risk mitigation strategies in the construction industry.
CO2	Identify hazards, implement controls, manage risks, understand legal duties, and foster a strong safety culture through skills.
CO3	Recognize, assess, and manage construction hazards by applying relevant laws, developing risk mitigation plans and fostering a strong safety culture.

Details of Syllabus:

Unit	Description	Duration (Hrs)
1	**Introduction & Overview of Construction Safety** Introduction- Accidents, Nature and Causes of Accidents, Impact of Accidents, Evolution of Safety Concepts, Overview of Construction Safety - Construction Safety, Current Situation, Organizational Aspect, Behavioral Aspect. Important Safety Rules- Accident Reporting, Storage of Materials, Atmosphere in Confined Place, Prevention from Drowning, Fire Prevention and Protection, First Aid and Medical Care, Personal Protective Equipment	10 Hrs
2	**Site Safety Management** Site Safety Management- Workplace and Equipment, Structures and Equipment, Working Platforms, Safety Organizations, Safety in Construction Operations-Planning For Safety, Excavation, Blasting, Tunnelling, Building Works, Scaffolding, Lifting, Use of Electricity. Safety in the Use of Construction Equipment- Psychology of Construction Workers, Rights and Obligation of Parties, Health of Equipment Operators, Vehicles, Cranes, Lifting Gears, Temporary Power Supply.	10 Hrs
3	**Safety Legislation in Construction Industry** Safety Codes Applicable to Construction Industry, ILO Standards, OSHA Regulations, Contract Conditions on Safety in Civil Work Projects. Safety Management Role of Various Parties-Employers, Designers, Supervisors, Manufacturers/Dealers, Workers/employees, Motivating management, Contractual provisions. Human Factors in Construction Safety-Employee Selection, Placement, Motivation: Awareness and Training.	10 Hrs

Text Books:

1. Construction Safety Management & Engineering (2nd Ed) by Darryl C. Hill,: Covers design, legal issues, incident investigation, training, and program components.
2. Construction Project Safety by John Schaufelberger, Ken-Yu Lin: Focuses on project-level safety management.
3. SP 70 (2001): Handbook on Construction Safety Practices: From the Bureau of Indian Standards (BIS), focusing on Indian construction safety practices.
4. Design Risk Management: Contribution to Health and Safety by Stuart D. Summerhayes: For safety from the design stage.

Reference Books:

1. Grimaldi John. V. and Simonds R.H., "Safety Management', All India Traveller Book Seller, Fifth Edition.
2. Vaid, K.N. "Construction Safety Management', NICMAR Publication.
3. Safety Management in Construction (Principles & Practice) by S.K. Bhattacharjee: A foundational text for understanding core concepts.
4. Construction Safety Planning by David V. MacCollum: Focuses on proactive safety planning on site.

5. Principles of Construction Safety by Allan St John Holt: A broad overview of safety principles in construction.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE247DH1	Smart Mobility & Transportation System	4	60	3 Hrs.	60

Course Description:
Subject Code: 5CE247DH1 Smart Mobility & Transportation System is a Double Minor for Third Year All branches excluding Civil Engineering and Honors Course for Third Year Civil B.E. Engineering.

Course Objectives:
The objective of the course is to provide knowledge to apply smart mobility concepts, AI, and sustainable technologies to design integrated, efficient, and environmentally responsible transportation systems for smart cities.

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

CO	Course Outcome
CO1	Understand the principles and components of smart mobility and smart transportation systems.
CO2	Describe the role of smart transportation in smart city development.
CO3	Apply basic concepts of ITS and traffic management systems.
CO4	Understand the role of AI, IoT, and data analytics in transportation planning and operations.
CO5	Analyze and design sustainable smart mobility systems, integrating electric vehicles, shared transport, logistics, and addressing ethical, legal, and environmental challenges.
CO6	Analyze real-world smart mobility solutions and case studies

Details of Syllabus:

Unit 1	**Introduction to Smart Mobility:** Evolution of transportation systems, Challenges in conventional transportation, Concept of smart mobility, Comparison between Smart mobility & traditional mobility, Goals: safety, efficiency, sustainability, inclusivity, Smart transportation components	10 Hrs.
Unit 2	**Smart Cities and Transportation:** Concept and pillars of smart cities, Role of transportation in smart cities, Urban mobility challenges in Indian cities, Government initiatives (Smart Cities Mission – overview), Integrated land use and transport planning, Multimodal transportation systems.	10 Hrs.
Unit 3	**Intelligent Transportation Systems (ITS):** Introduction to architecture of ITS, Advanced Traffic Management Systems (ATMS), Traffic sensing technologies (loop detectors, cameras, GPS, RFID), Electronic toll collection and smart parking, Public transport management systems, Incident detection and road safety systems.	10 Hrs.
Unit 4	**Role of AI and Digital Technologies in Transportation:** Introduction to Artificial Intelligence (AI), Role of AI in traffic prediction and congestion management, Machine learning for demand forecasting, AI-based traffic signal control, Computer vision in traffic surveillance, IoT and big data in transportation	10 Hrs.
Unit 5	**Sustainable and Future Mobility Solutions:** Electric vehicles and charging infrastructure, Shared mobility (ride sharing, bike sharing), Smart logistics and freight transportation, Mobility as a Service (MaaS), Climate-resilient and green transportation, Ethical, legal, and social issues in smart mobility	10 Hrs.
Unit 6	**Case Studies and Applications**: Smart mobility solutions in Indian cities, International best practices (brief overview), AI-based traffic management case studies, Smart parking and toll systems.	10 Hrs.

Text Books:
1. “Intelligent Transportation Systems” – S. Siuhi & J. Mwakalonge
2. “Smart Cities: Foundations, Principles and Applications” – H. Chourabi et al.
3. “Intelligent Transport Systems” – Pradip Kumar Sarkar & Amit Kumar Jain

Reference Books:
1. Urban Transit Systems and Technology Hardcover – 16 February 2007 by Vukan R. Vuchic.

2. Smart Transportation: AI Enabled Mobility and Autonomous Driving by Guido Dartmann & Anke Schmeink, CRC Press

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	5CE247 DH2	Sustainable Mobility Solutions	4	60	3 Hrs	60 Max Marks

Course Description:

Subject Code: 5CE247 DH2 is a Sustainable Mobility Solutions Double Minor for Third Year B.E. Civil Engineering.

Course Objective :

The objective of the course is make the student understand the concept of Sustainable Mobility , tangible and intangible resources, rules , regulations and policies related to sustainable mobility .

Course Outcomes (COs)

After completing the course students will be able to:

CO	Course Outcome
CO1	Understand concept of Sustainable Mobility , need for resource optimization
CO2	Tangible and Intangible resources and challenges related to them
CO3	Apply strategy for managing tangible resources through sustainable mobility
CO4	Apply strategy for optimizing intangible resource like skills and efficiency
CO5	Application of recent technologies for sustainable mobility
CO6	Understand and follow various rules and regulations , policies related to sustainable mobility .

Details of Syllabus :

UNIT I	Introduction to Sustainable Mobility : Resources – Tangible and Intangible , 5 M- Man , Material , Machine , Money and Motivation , Present major materials demand and supply global scenario – Coal, Petroleum , Cement etc. Term Sustainability , Global Sustainable Goals – Need and purpose Meaning and concept of sustainable mobility Role of civil engineers in sustainable mobility Need to optimise resources through sustainable mobility	**10 Hrs**
UNIT II	Tangible mobility resources:- Fuel, vehicles, allied infrastructure Intangible mobility resources: time, cost, safety, comfort, accessibility Impact of poor planning on tangible and intangible mobility resources. Transport challenges in Indian urban and rural regions	**10 Hrs**
UNIT III	Strategy :- Public Transport Systems for Sustainability Importance of public transport in sustainable mobility Types of public transport: buses, BRT, metro, suburban rail Public transport planning basics, needs, advantages and disadvantages Public transportation and sustainable mobility	**10 Hrs**
UNIT IV	Intangible Resource Mobility :- Human working skill , Human resource management , Project cost management , optimizing efficiency. Strategy :- Human Resource Mobility – Work from Home culture , Hybrid working mode and its advantages over Office located work method.	**10 Hrs**
UNIT V	Emerging Technologies and Alternative Mobility Solutions :- Electric vehicles and charging infrastructure, Alternative fuels: CNG, biofuels, hydrogen (basic awareness),Intelligent Transport Systems (ITS) Role of AI, IoT, Machine Learning in sustainable mobility solutions	**10 Hrs**
UNIT VI	Policies, Planning and Case Studies National Urban Transport Policy (NUTP) Sustainable Urban Mobility Plans (SUMP) Case studies of successful sustainable mobility projects	**10 Hrs**

Reference books

1. Kadiyali, L.R., *Traffic Engineering and Transport Planning*, Khanna Publishers, New Delhi, 2016 (Reprint Edition).
2. hanna, S.K. and Justo, C.E.G., *Highway Engineering*, Nem Chand & Bros., Roorkee, 2019.
3. Partha Chakroborty and Animesh Das, *Principles of Transportation Engineering*, PHI Learning, New Delhi, 2017.
4. Shams Tanvir, Sustainable Mobility, Simple Book Publishing / Open Textbook Library, 2025.
5. Sudhakar Yedla, Urban Transportation and the Environment: Issues, Alternatives and Policy Analysis, Springer India, 2015, ISBN: 978-81-322-2313-9.
6. Rodney Tolley (Ed.), Sustainable Transport, Elsevier, 2003, ISBN: 978-1-85573-614-6.
7. Thomas Abdallah, Sustainable Mass Transit: Challenges and Opportunities in Urban Public Transportation, Elsevier, 2023, ISBN: 978-0443152719.
8. Dinesh Mohan and Geetam Tiwari (Eds.), Sustainable Approaches to Urban Transport, CRC Press, 2020, ISBN: 978-1032091761.
9. Oliver Lah (Ed.), Sustainable Urban Mobility Pathways, Elsevier / Academic Press, 2018, ISBN: 978-0-12-814897-6.
10. Henrik Gudmundsson, Rikke F. H. Nielsen, Anu Tennøy and Claus L. H. Hansen, Sustainable Transportation: Indicators, Frameworks, and Performance Management, Springer, 2016, ISBN: 978-3-662-46924-8.
11. Karel Martens, Transport Justice: Designing Fair Transportation Systems, Routledge, 2016, ISBN: 978-1317599586.
12. Amir Shakibamanesh, Mahshid Ghorbanian, Seyed Navid Mashhadi Moghadam Smart Growth and Sustainable Transport in Cities, Routledge, 2019, ISBN: 978-0367262242.

Acts/ Framework/ Rules

1. **Motor Vehicles Act, 1988** – Governs licensing, registration, road safety, emissions standards, and supports alternative fuel adoption such as EVs and CNG.
2. **Air (Prevention and Control of Pollution) Act, 1981** – Regulates air pollution including vehicle emissions; important for understanding environmental impacts of transport.
3. **Environment (Protection) Act, 1986** – Provides the framework for environmental clearance and regulatory compliance in transport and infrastructure projects.
4. **National Urban Transport Policy (NUTP), 2006** – National framework promoting sustainable urban mobility, public transport, non-motorized transport, and travel demand management.
5. **FAME India / National E-Mobility Programme** – Promotes electric vehicles, alternative fuels, and development of charging infrastructure to achieve low-emission mobility.