

PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637018

(AUTONOMOUS)

B.E., CIVIL ENGINEERING

REGULATIONS 2023

(CHOICE BASED CREDIT SYSTEM)

(Applicable to the students admitted during the academic year 2023 – 2024 onwards)

CURRICULUM AND SYLLABUS

SEMESTER - V

| S.No | Category | Course Code | Course Title | L | T | P | C |
|------------------|----------|-------------|--|-----------|----------|-----------|-----------|
| Theory | | | | | | | |
| 1 | PC | CE23501 | Design of Reinforced Concrete Structures | 3 | 1 | 0 | 4 |
| 2 | PC | CE23502 | Structural Analysis I | 3 | 0 | 0 | 3 |
| 3 | PC | CE23503 | Foundation Engineering | 3 | 0 | 0 | 3 |
| 4 | PC | CE23504 | Hydrology and Irrigation Engineering | 3 | 0 | 0 | 3 |
| 5 | PC | CE23505 | Highway Engineering | 3 | 0 | 0 | 3 |
| 6 | PE | CE23*** | Professional Elective I | 3 | 0 | 0 | 3 |
| Practical | | | | | | | |
| 7 | PC | CE23506 | Computer Aided Building Drawing | 0 | 0 | 4 | 2 |
| 8 | EE | CE23507 | Survey Camp | 0 | 0 | 2 | 1 |
| 9 | EE | CE23508 | Industrial Training | 0 | 0 | 2 | 1 |
| 10 | EE | GE23501 | Professional Development III | 0 | 0 | 2 | 1 |
| TOTAL | | | | 18 | 1 | 10 | 24 |



VERTICAL I – STRUCTURAL ENGINEERING

| Course Code | Category | Course Title | L | T | P | C |
|-------------|----------|---|---|---|---|---|
| CE23151 | PE | Prestressed Concrete Structures | 3 | 0 | 0 | 3 |
| CE23152 | PE | Structural Dynamics | 3 | 0 | 0 | 3 |
| CE23153 | PE | Finite Element Method | 3 | 0 | 0 | 3 |
| CE23154 | PE | Steel Concrete composite Structures | 3 | 0 | 0 | 3 |
| CE23155 | PE | Earthquake Resistant Structures | 3 | 0 | 0 | 3 |
| CE23156 | PE | Tall Structures | 3 | 0 | 0 | 3 |
| CE23157 | PE | Maintenance and Repair of Concrete Structures | 3 | 0 | 0 | 3 |

VERTICAL II – CONSTRUCTION TECHNIQUES AND MANAGEMENT

| Course Code | Category | Course Title | L | T | P | C |
|-------------|----------|--|---|---|---|---|
| CE23251 | PE | Modern Construction Materials | 3 | 0 | 0 | 3 |
| CE23252 | PE | Contract and Labour Laws | 3 | 0 | 0 | 3 |
| CE23253 | PE | Sustainable Construction and Lean Construction | 3 | 0 | 0 | 3 |
| CE23254 | PE | Prefabricated Structures | 3 | 0 | 0 | 3 |
| CE23255 | PE | Advanced Construction Techniques | 3 | 0 | 0 | 3 |
| CE23256 | PE | Building Information Modeling | 3 | 0 | 0 | 3 |
| CE23257 | PE | Construction Quality and Safety Management | 3 | 0 | 0 | 3 |

VERTICAL III – GEOTECHNICAL ENGINEERING

| Course Code | Category | Course Title | L | T | P | C |
|-------------|----------|--|---|---|---|---|
| CE23351 | PE | Geology and Rock Engineering | 3 | 0 | 0 | 3 |
| CE23352 | PE | Soil Dynamics and Machine Foundations | 3 | 0 | 0 | 3 |
| CE23353 | PE | Ground Improvement Techniques | 3 | 0 | 0 | 3 |
| CE23354 | PE | Geosynthetics and Reinforced Soil Structures | 3 | 0 | 0 | 3 |
| CE23355 | PE | Advanced Foundation Engineering | 3 | 0 | 0 | 3 |
| CE23356 | PE | Soil Exploration and Investigation | 3 | 0 | 0 | 3 |
| CE23357 | PE | Geo-Environmental Engineering | 3 | 0 | 0 | 3 |



VERTICAL IV – ENVIRONMENTAL ENGINEERING

| Course Code | Category | Course Title | L | T | P | C |
|-------------|----------|---|---|---|---|---|
| CE23451 | PE | Climate Change and Adaptation | 3 | 0 | 0 | 3 |
| CE23452 | PE | Municipal Solid Waste Management | 3 | 0 | 0 | 3 |
| CE23453 | PE | Environmental Impact Assessment | 3 | 0 | 0 | 3 |
| CE23454 | PE | Models for Air and Water Quality | 3 | 0 | 0 | 3 |
| CE23455 | PE | Industrial Waste Water Management | 3 | 0 | 0 | 3 |
| CE23456 | PE | Air and Noise Pollution Control Engineering | 3 | 0 | 0 | 3 |
| CE23457 | PE | Environmental Policy and Legislation | 3 | 0 | 0 | 3 |

VERTICAL V - TRANSPORTATION AND INFRASTRUCTURE

| Course Code | Category | Course Title | L | T | P | C |
|-------------|----------|---|---|---|---|---|
| CE23551 | PE | Harbour and Dock Engineering | 3 | 0 | 0 | 3 |
| CE23552 | PE | Mass Rapid Transportation Systems | 3 | 0 | 0 | 3 |
| CE23553 | PE | Rigid Pavement Analysis and Design | 3 | 0 | 0 | 3 |
| CE23554 | PE | Smart Cities | 3 | 0 | 0 | 3 |
| CE23555 | PE | Traffic Engineering and Management | 3 | 0 | 0 | 3 |
| CE23556 | PE | Sustainable Urban and Transportation Development | 3 | 0 | 0 | 3 |
| CE23557 | PE | Transportation Planning | 3 | 0 | 0 | 3 |

VERTICAL VI – GEOINFORMATICS

| Course Code | Category | Course Title | L | T | P | C |
|-------------|----------|---|---|---|---|---|
| CE23651 | PE | Remote Sensing | 3 | 0 | 0 | 3 |
| CE23652 | PE | Laser and Lidar surveying in Airborne and Terrestrial Applications | 3 | 0 | 0 | 3 |
| CE23653 | PE | Satellite Image Processing | 3 | 0 | 0 | 3 |
| CE23654 | PE | Urban Geoinformatics | 3 | 0 | 0 | 3 |
| CE23655 | PE | Geographical Information Systems | 3 | 0 | 0 | 3 |
| CE23656 | PE | Total Station and GPS Surveying | 3 | 0 | 0 | 3 |
| CE23657 | PE | Geoinformatics for Natural Disasters | 3 | 0 | 0 | 3 |



MINOR IN BUILDING CONSTRUCTION

| Course Code | Category | Course Title | L | T | P | C |
|-------------|----------|--------------------------------------|---|---|---|---|
| CE23851 | MDC | Construction Technology | 3 | 0 | 0 | 3 |
| CE23852 | MDC | Basics Surveying | 3 | 0 | 0 | 3 |
| CE23853 | MDC | Contract and Labour Laws | 3 | 0 | 0 | 3 |
| CE23854 | MDC | Basics of Transportation Engineering | 3 | 0 | 0 | 3 |
| CE23855 | MDC | Green Building Technology | 3 | 0 | 0 | 3 |
| CE23856 | MDC | Environmental Policy and Legislation | 3 | 0 | 0 | 3 |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23501 | DESIGN OF REINFORCED CONCRETE STRUCTURES | 3 | 1 | 0 | 4 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the basic concepts of various design methods. | | | | | |
| 2 | design beams for shear, bond, and torsion and serviceability. | | | | | |
| 3 | determine the reinforcement for slabs and staircase using IS codes. | | | | | |
| 4 | get the knowledge in the concept of RC columns and footings. | | | | | |
| 5 | calculate the different pressures acting on retaining wall and water tank. | | | | | |
| UNIT I | METHODS OF DESIGN OF CONCRETE STRUCTURES | | | | 12 | |
| Concept of Elastic method, ultimate load method and limit state method - Working stress method as detailed in IS code - Design of Singly Reinforced beam by working stress method; Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods; Analysis and design of singly and doubly reinforced rectangular beams by limit State Method. | | | | | | |
| UNIT II | LIMIT STATE METHOD - FLANGED BEAM, SHEAR AND TORSION | | | | 12 | |
| Analysis and design of flanged beams - Use of design aids for Flexure; Behaviour of RC members in bond and Anchorage - Design requirements as per current code; Behaviour of RC beams in shear and torsion; Design of RC members for combined bending, shear and torsion; serviceability. | | | | | | |
| UNIT III | LIMIT STATE DESIGN OF SLABS AND STAIRCASE | | | | 12 | |
| Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions; Types of Staircases - Design of dog-legged Staircase; Introduction to Flat Slab (only). | | | | | | |
| UNIT IV | LIMIT STATE DESIGN OF COLUMNS AND FOOTING | | | | 12 | |
| Types of columns - Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending; Design of wall footing - Design of axially and eccentrically loaded rectangular pad and sloped footings - Design of combined rectangular footing for two columns only. | | | | | | |
| UNIT V | DESIGN OF MISCELANEOUS STRUCTURES | | | | 12 | |
| Design of earth retaining structures - cantilever and counterfort retaining wall; RC water tanks - circular and rectangular water tanks - underground tanks and ground-level tanks. | | | | | | |
| | | | | | TOTAL PERIODS | 60 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | discuss the various design concepts and design RC rectangular beams by working stress and limit state methods. | | | | Understanding (K2) | |
| CO2 | know the design for shear and torsion, and anchorage and development length. | | | | Applying (K3) | |
| CO3 | design a RC slabs and staircase and draw the reinforcement detailing. | | | | Applying (K3) | |
| CO4 | design short columns for axial, uni-axial, bi-axial eccentric loadings and footings. | | | | Analyzing (K4) | |
| CO5 | examine the earth pressure on various structures. | | | | Analyzing (K4) | |

TEXT BOOKS

1. Gambhir.M.L, Design of concrete structures, McGraw Hill Education India Pvt.Limited, 2017.
2. Krishnaraju.N “Reinforced Concrete design”, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2015.

REFERENCES

1. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 2021.
2. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of Reinforced Concrete”, Laxmi Publication Pvt. Ltd., New Delhi, 2016.
4. Shah V L & Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publications, Pune, 2013.
5. IS456:2000 Plain and Reinforced Concrete -Code of Practice.
6. IS 875(1-5):1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.
7. Structures.
8. SP16:1980, Design Aids for Reinforced Concrete to IS456:1978.
9. SP34: 1987, Hand book of concrete reinforcement and detailing.
10. IS 3370 (1 & 2):2021, Code of Practice for Concrete Structures for Retaining Aqueous Liquids.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | 3 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | - | 3 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 |
| CO3 | 3 | - | 3 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 |
| CO4 | 3 | - | 3 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | - | 3 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 |



| | | | | | | | |
|---|--|--|--|---|---|--------------------------------------|-----------|
| CE23502 | STRUCTURAL ANALYSIS I | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand the derivation and application of slope deflection equations. | | | | | | |
| 2 | learn the step by step procedure of the Moment Distribution Method. | | | | | | |
| 3 | apply the direct flexibility method to analyse indeterminate structures | | | | | | |
| 4 | apply equilibrium conditions in matrix form for analysing indeterminate structures. | | | | | | |
| 5 | apply the method of tension coefficients to solve for forces in trusses. | | | | | | |
| UNIT I | SLOPE DEFLECTION METHOD | | | | | | 9 |
| Slope deflection equations - Equilibrium conditions - Analysis of continuous beams and rigid frames - Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings. | | | | | | | |
| UNIT II | MOMENT DISTRIBUTION METHOD | | | | | | 9 |
| Stiffness - distribution and carry over factors - Analysis of continuous Beams - Plane rigid frames with and without sway - Support settlement - symmetric frames with symmetric and skew-symmetric loadings. | | | | | | | |
| UNIT III | FLEXIBILITY METHOD | | | | | | 9 |
| Primary structures - Compatibility conditions - Formation flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach. | | | | | | | |
| UNIT IV | STIFFNESS METHOD | | | | | | 9 |
| Restrained structure - Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method. | | | | | | | |
| UNIT V | ANALYSIS OF TRUSSES | | | | | | 9 |
| Determinate and indeterminate trusses - analysis of determinate trusses - method of joints - method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature method of tension coefficient - Application to space trusses. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | formulate and apply equilibrium conditions for multi-span and rigid structures. | | | | | Applying (K3) | |
| CO2 | apply the moment distribution method to analyse continuous beams and rigid frames. | | | | | Applying (K3) | |
| CO3 | analyse continuous beams and rigid-jointed plane frames using the flexibility matrix approach. | | | | | Analyzing (K4) | |
| CO4 | analyse equilibrium conditions in matrix form to solve for unknown displacements and forces. | | | | | Analyzing (K4) | |
| CO5 | apply the method of tension coefficients for the analysis of space trusses. | | | | | Analyzing (K4) | |

TEXT BOOKS

1. Bhavikatti S.S, Structural Analysis, Vol. 1 and 2, Vikas Publishing House Pvt.Ltd. New Delhi-4, 2021 (fifth edition)
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2017

REFERENCES

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers and Distributors, Second Edition, Delhi, 2004
2. Reddy .C.S, "Basic Structural Analysis", Tata McGraw Hill Publishing Company, 2005.
3. Negi L.S. and Jangid R.S., Structural Analysis, Tata McGraw Hill Publishing. Co. Ltd. 2004
4. Bhavikatti, S.S, Matrix Method of Structural Analysis, I.K. International Publishing House Pvt.Ltd., New Delhi-4, 2014.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 3 | 2 |
| CO2 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | 2 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 |



| | | | | | | | |
|--|--|--|--|---|---|----------------------|-----------|
| CE23503 | FOUNDATION ENGINEERING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | plan and execute a detail site investigation programme | | | | | | |
| 2 | select geotechnical design parameters and type of foundations | | | | | | |
| 3 | design of different type of footings and special foundations | | | | | | |
| 4 | know the types of pile foundation and its load carrying capacity | | | | | | |
| 5 | get knowledge of various earth pressure theories and design of retaining walls | | | | | | |
| Prerequisite: Soil Mechanics | | | | | | | |
| UNIT I | SITE INVESTIGATION AND SELECTION OF FOUNDATION | | | | | | 9 |
| Site investigation - Scope and objectives; Methods of exploration - Auguring and boring, Wash boring and rotary drilling, Depth and spacing of bore holes; Soil samples - Representative and undisturbed; Sampling methods - Split spoon sampler, Thin wall sampler, Stationary piston sampler; Penetration tests (SCPT, DCPT); Selection of foundation based on soil condition - Bore log report. | | | | | | | |
| UNIT II | BEARING CAPACITY OF SHALLOW FOUNDATION | | | | | | 9 |
| Shallow foundation - Location and depth of foundation, Codal provisions, bearing capacity of shallow foundation on homogeneous deposits, Terzaghi's formula and BIS formula, Factors affecting bearing capacity, Bearing capacity from in-situ tests (SPT, SCPT and plate load), Allowable bearing pressure, Seismic considerations in bearing capacity evaluation; Determination of Settlement of foundations on granular and clay deposits, Total and differential settlement, Allowable settlements, Codal provision, Methods of minimizing total and differential settlements. | | | | | | | |
| UNIT III | FOOTINGS AND RAFTS | | | | | | 9 |
| Footings - Types of Isolated footing, Combined footing, Mat foundation, Contact pressure and settlement distribution, Proportioning of foundations for conventional rigid behaviour, Minimum depth for rigid behaviour, Applications; Floating foundation; Special foundations; Seismic force consideration – Codal provision, | | | | | | | |
| UNIT IV | PILE FOUNDATION | | | | | | 9 |
| Types of piles and their functions - Factors influencing the selection of pile, Carrying capacity of single pile in granular and cohesive soil, Static formula, Dynamic formulae (Engineering news and Hileys), Capacity from insitu tests (SPT, SCPT), Negative skin friction, Uplift capacity, Group capacity by different methods (Field's rule, Converse - Labarra formula and block failure criterion); Settlement of pile groups - Interpretation of pile load test, Under reamed piles, Capacity under compression and uplift, Codal provision. | | | | | | | |
| UNIT V | RETAINING WALLS | | | | | | 9 |
| Plastic equilibrium in soils - Active and passive states; Rankine's theory - Cohesionless and cohesive soil; Coulomb's wedge theory - Condition for critical failure plane; Earth pressure on retaining walls of simple configurations - Culmann Graphical method, Pressure on the wall due to line load, Stability analysis of retaining walls - Codal provision. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |

| COURSE OUTCOMES | | BT Mapped (Highest Level) | | | | | | | | | | | | |
|--|--|------------------------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| At the end of this course, students will be able to | | | | | | | | | | | | | | |
| CO1 | explain the process of site investigation and select geotechnical design parameters and type of foundation | Understanding(K2) | | | | | | | | | | | | |
| CO2 | calculate the bearing capacity of shallow foundations using Terzaghi's and BIS formulas for homogeneous soil deposits. | Applying (K3) | | | | | | | | | | | | |
| CO3 | design combined footings and raft foundations, its component or process as per the needs and specifications | Applying (K3) | | | | | | | | | | | | |
| CO4 | calculate the load carrying capacity and settlement of pile foundation | Applying (K3) | | | | | | | | | | | | |
| CO5 | estimate the pressures on the earth retaining structures | Applying (K3) | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors Ltd., New Delhi, 2018 | | | | | | | | | | | | | | |
| 2. Arora K. R "Soil Mechanics and Foundation Engineering", 7th edition Standard Publishers, New Delhi, 2020 | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2017 | | | | | | | | | | | | | | |
| 2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P) Ltd, New Delhi, 2006. | | | | | | | | | | | | | | |
| 3. Michael Tomlinson and John Woodward., "Pile design and Construction Practice" 6 th edition CRC press Taylor and Francis group. | | | | | | | | | | | | | | |
| 4. IS 6403:2021 Code of practice for determination of bearing capacity of shallow foundations | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | 3 | - | 2 | - | - | - | - | - | 2 | 1 | 3 |
| CO2 | 2 | 2 | 2 | 2 | - | 3 | - | - | - | - | - | 2 | 1 | 2 |
| CO3 | 3 | 2 | 3 | 2 | - | 3 | - | - | - | - | - | 1 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | - | 3 | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 3 | 2 | 1 | - | 3 | - | - | - | - | - | 1 | 2 | 3 |



| | | | | | | |
|---|---|--|---|---|----------------------------------|-----------|
| CE23504 | HYDROLOGY AND IRRIGATION ENGINEERING | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand various forms of precipitation in the hydrological cycle.. | | | | | |
| 2 | learn the concept of runoff and methods for runoff estimation and hydrograph development. | | | | | |
| 3 | learn the needs of irrigation and related efficiencies in agricultural water management. | | | | | |
| 4 | understand the types and functions of various water diversion structures in irrigation. | | | | | |
| 5 | explore irrigation techniques and management strategies for efficient water usage. | | | | | |
| UNIT I | PRECIPITATION AND ABSTRACTIONS | | | | | 9 |
| Hydrological cycle - Forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen polygon and Isohyetal methods; Interception - Evaporation - Estimation of evaporation using Evaporimeter, Empirical evaporation equation and Analytical methods and Evaporation suppression methods; Infiltration - Measurement of Infiltration. | | | | | | |
| UNIT II | RUNOFF | | | | | 9 |
| Runoff - Definition, Factors affecting runoff, Run off volume estimation using Strange's table and SCS-CN method; Flow - Duration Curve; Hydrograph - Factors Affecting Hydrograph and Components, Unit Hydrograph and Instantaneous Unit Hydrograph - Application and Limitations. | | | | | | |
| UNIT III | IMPORTANCE OF IRRIGATION | | | | | 9 |
| Need - Merits and Demerits; Duty, Delta and Base period - Factors affecting duty; Irrigation efficiencies; Crops and Seasons; Crop water Requirement - Standards for Irrigation, Classes and Availability of Soil water and Crop Rotation; Estimation of Consumptive use of water. | | | | | | |
| UNIT IV | DIVERSION AND IMPOUNDING STRUCTURES | | | | | 9 |
| Types of Impounding structures - Weir and Barrage, Gravity dam, Earthen dam and Arch dam; Diversion Head works; Cross drainage works; Canal regulators; Canal Falls; Canal lining; Kennady's and Lacey's Regime theory. | | | | | | |
| UNIT V | IRRIGATION METHODS AND MANAGEMENT | | | | | 9 |
| Lift irrigation - Tank irrigation and Well irrigation; Irrigation methods - Surface and Sub-Surface and Micro Irrigation - Merits and demerits; Irrigation scheduling; Water distribution; Participatory irrigation management. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | identify different forms of precipitation and types of rain gauges | | | | Remembering (K1) | |
| CO2 | list out the applications and limitations of unit hydrographs. | | | | Remembering (K1) | |
| CO3 | interpret irrigation efficiencies and their influencing factors. | | | | Understanding (K2) | |
| CO4 | describe the functions of canal regulators and canal falls. | | | | Understanding (K2) | |
| CO5 | apply appropriate irrigation methods based on site conditions.. | | | | Applying (K3) | |
| TEXT BOOKS | | | | | | |
| 1. Subramanya .K. "Engineering Hydrology", 5th Edition, McGraw Hill, 2020. | | | | | | |
| 2. Garg, S.K., "Irrigation Engineering and Hydraulic Structures," Khanna Publishers, New Delhi, 2009. | | | | | | |

REFERENCES

1. Punmia, B.C., Pande B. B. Lal, "Irrigation and Water Power Engineering", Laxmi Publishers, 17th Edition, New Delhi, 2021.
2. Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard P and D, New Delhi, 2018.
3. Raghunath .H.M., "Hydrology: Principles, Analysis, Design", New Age International Publishers, 3rd Edition, 2015,
4. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill, 2013

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | - |
| CO2 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | - | 2 | 2 | 3 |
| CO3 | 2 | 2 | 1 | - | - | 2 | - | - | - | - | - | 2 | 2 | - |
| CO4 | 3 | 1 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 2 | 3 | - |



| | | | | | | | |
|--|---|--|--|---|---|--------------------------------------|-----------|
| CE23505 | HIGHWAY ENGINEERING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand the concept of highway planning and alignment. | | | | | | |
| 2 | impart knowledge on the concepts of geometric design of highways. | | | | | | |
| 3 | evaluate about pavement design. | | | | | | |
| 4 | understand about highway materials and maintenance. | | | | | | |
| 5 | gain knowledge of highway economics and finance. | | | | | | |
| UNIT I | PLANNING AND DEVELOPMENT | | | | | | 9 |
| Importance of Highway Transportation; Highway Planning - Principle of Highway planning, Highway alignment requirements, Engineering surveys for Highway locations; Road developments - Jayakar committee and recommendations, Twenty-year road development plan; IRC Institutions - HRB, NHAI, MORTH and CRRI - Financing, Privatization of Highways. | | | | | | | |
| UNIT II | GEOMETRIC ENGINEERING DESIGN OF HIGHWAYS | | | | | | 9 |
| Highway cross sectional elements - Right of way, Carriage way, Medians, Camber, Kerbs, Shoulders and Footpaths (IRC Standards); Sight distances - Factors affecting sight distances, PIEV theory, Stopping Sight Distance, Overtaking Sight Distance, Sight Distance at Intersections, Intermediate Sight Distance; Design of horizontal alignments - Super elevation, Widening of pavements, Gradient - Horizontal curves and Transition curves; Design of vertical alignments. | | | | | | | |
| UNIT III | STRUCTURAL DESIGN OF HIGHWAY PAVEMENTS | | | | | | 9 |
| Flexible pavements - Components and functions, Factors affecting design and performance of flexible pavements, Stresses in flexible pavements, Flexible pavement design methods as per IRC guidelines. | | | | | | | |
| UNIT IV | HIGHWAY MATERIALS AND MAINTENANCE | | | | | | 9 |
| Materials used in Highway Construction - Desirable properties and testing of Highway materials, Portland cement and cement concrete; Objectives of Highway maintenance - Classification of Highway Maintenance Works, Maintenance Requirement in Different Road Components; Applications of AI in Highway maintenance. | | | | | | | |
| UNIT V | HIGHWAY ECONOMICS AND FINANCE | | | | | | |
| Highway User Benefits - General Benefits, Motor Vehicle Operation Cost; Highway Costs - Components, Annual Highway Cost; Economics Analysis - Basis of Analysis, Method of analysis, Road User Cost Studies in India; Highway finance - Principle, Highway Financing in India. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | determine the highway planning and alignment | | | | | Understanding (K2) | |
| CO2 | analyze geometric design of roads. | | | | | Applying (K3) | |
| CO3 | design various types of pavements as per standards. | | | | | Applying (K3) | |

| | | |
|-----|--|---------------|
| CO4 | identify various materials used and discuss the methods of pavement maintenance. | Applying (K3) |
| CO5 | explain the economic analysis of highways. | Applying (K3) |

TEXT BOOKS

1. Khanna, S. K., Justo, C. E. G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Khanna Publishers, Roorkee, 2021.
2. Kadiyali.L.R, "Principles and Practices of Highway Engineering", 6th Edition, Khanna technical publications, New Delhi, 2023.

REFERENCES

1. Yang H. Huang, "Pavement Analysis and Design", 9th edition, Pearson Edition Inc, South Asia, 2012.
2. Ian D.Waish., "ICE manual of highway design and management", ICE Publishers, 1st Edition, USA, 2011.
3. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010.
4. Rangwala. "Highway Engineering", 12th Revised and Enlarged Edition, Charotar Publishing House, Anand, 2022.
5. Indian Road Congress (IRC), "Guidelines for the Design of Flexible Pavements", 3rd Edition, IRC: 37-2018.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | 1 | 1 | 2 | 1 |
| CO2 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 1 | 1 | - | 1 | - | - | - | - | 1 | 2 | 1 |
| CO5 | 3 | 3 | 2 | 2 | - | 2 | 2 | 1 | - | 1 | 1 | 2 | 2 | 1 |



| | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|----|----|----|-------|----------------------------------|---|-----------|--|
| CE23506 | COMPUTER AIDED BUILDING DRAWING | | | | | | | | | | | | 0 | 0 | 4 | 2 | |
| COURSE OBJECTIVES | | | | | | | | | | | | | | | | | |
| To enable the students to | | | | | | | | | | | | | | | | | |
| 1 | familiarize students with basic CAD commands and tools. | | | | | | | | | | | | | | | | |
| 2 | prepare detailed plans, sections, and elevations. | | | | | | | | | | | | | | | | |
| 3 | develop skills in site layout, key plan, and building services drawings. | | | | | | | | | | | | | | | | |
| 4 | prepare approval drawings as per by-laws. | | | | | | | | | | | | | | | | |
| Prerequisite: Nil | | | | | | | | | | | | | | | | | |
| LIST OF EXPERIMENTS | | | | | | | | | | | | | | | | | |
| 1. Computer Aided Design and Drafting - Basic Commands. | | | | | | | | | | | | | | | | | |
| 2. Preparation of a site plan with orientation - setting up of drawing template, scales and layers. | | | | | | | | | | | | | | | | | |
| 3. Plan, section and elevation of single room load bearing structure. | | | | | | | | | | | | | | | | | |
| 4. Plan, section and elevation of 1 BHK framed structures. | | | | | | | | | | | | | | | | | |
| 5. Preparation of Key plan and Site layout plan. | | | | | | | | | | | | | | | | | |
| 6. Plan, section and elevation of septic tank with soak pit. | | | | | | | | | | | | | | | | | |
| 7. Preparation of plumbing and drainage layout of a residential building. | | | | | | | | | | | | | | | | | |
| 8. Preparation of electrical fittings layout of a residential building. | | | | | | | | | | | | | | | | | |
| 9. Preparation of an approval drawing of a 1 BHK framed building. | | | | | | | | | | | | | | | | | |
| 10. Preparation of an approval drawing of a 1 BHK Load bearing building. | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | TOTAL PERIODS | | 60 | |
| COURSE OUTCOMES | | | | | | | | | | | | | | | | | |
| At the end of this course, students will be able to | | | | | | | | | | | | | | BT Mapped (Highest Level) | | | |
| CO1 | identify and explain the function of basic CAD tools and commands used in civil engineering drafting. | | | | | | | | | | | | | Understand (K2) | | | |
| CO2 | apply appropriate CAD commands to create 2D plans, sections, and elevations of residential buildings. | | | | | | | | | | | | | Applying (K3) | | | |
| CO3 | develop key plan, site layout, and service drawings (plumbing & electrical) using CAD as per civil standards. | | | | | | | | | | | | | Applying (K3) | | | |
| CO4 | analyze and organize various building components in CAD software to meet submission drawing requirements. | | | | | | | | | | | | | Analyzing (K4) | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | | | |
| CO1 | 2 | 1 | 2 | - | 3 | | - | | | | | | 3 | 3 | | | |
| CO2 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | 3 | 3 | | | |
| CO3 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | 3 | 3 | | | |
| CO4 | 2 | 3 | 2 | 2 | 3 | | 1 | - | - | - | - | - | 3 | 3 | | | |



| | | | | | | | | | | | | | | | |
|--|---|-------------|---|---|---|---|---|---|---|----|---------------|--------------------------------------|--------------|---|---|
| CE23507 | | SURVEY CAMP | | | | | | | | | | 0 | 0 | 2 | 1 |
| COURSE OBJECTIVES | | | | | | | | | | | | | | | |
| To enable the students to | | | | | | | | | | | | | | | |
| 1 | understand the importance of Triangulation and their applications in surveying. | | | | | | | | | | | | | | |
| 2 | acquire practical knowledge on handling survey instruments like Theodolite to measure horizontal and vertical angles. | | | | | | | | | | | | | | |
| 3 | appreciate practical difficulties in surveying on the field. | | | | | | | | | | | | | | |
| 4 | Providing an opportunity and develop team spirit. | | | | | | | | | | | | | | |
| Prerequisite: Surveying | | | | | | | | | | | | | | | |
| LIST OF EXPERIMENTS | | | | | | | | | | | | | | | |
| 1. Theodolite Surveying A. Triangulation B. Trilateration | | | | | | | | | | | | | | | |
| 2. Levelling A. Block contouring B. Radial contouring C. Longitudinal and cross section | | | | | | | | | | | | | | | |
| 3. GPS A. Traversing B. Determine latitude and longitude | | | | | | | | | | | | | | | |
| 4. Total station A. Calculation of Area using Total Station | | | | | | | | | | | | | | | |
| 5. Foundation Marking | | | | | | | | | | | | | | | |
| 6. Demonstration of Drone Operation | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | TOTAL PERIODS | 30 | | |
| COURSE OUTCOMES | | | | | | | | | | | | | | | |
| At the end of this course, students will be able to | | | | | | | | | | | | BT Mapped (Highest Level) | | | |
| CO1 | calculate the horizontal, vertical angles by triangulation and trilateration method. | | | | | | | | | | Applying (K3) | | | | |
| CO2 | determine the Reduced levels and area by theodolite and total station. | | | | | | | | | | Applying (K3) | | | | |
| CO3 | apply different survey adjustment techniques. | | | | | | | | | | Applying (K3) | | | | |
| CO4 | handle the modern surveying instruments like Total station and GPS. | | | | | | | | | | Applying (K3) | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | |
| CO1 | 3 | - | - | - | 1 | 3 | 2 | 3 | 3 | - | 3 | 3 | 2 | 3 | |
| CO2 | 3 | 2 | - | - | 3 | 3 | 2 | 3 | 3 | - | 3 | 3 | 3 | 2 | |
| CO3 | 3 | 2 | - | - | 3 | 3 | 2 | 3 | 3 | - | 3 | 3 | 3 | 3 | |
| CO4 | 3 | - | - | - | 3 | 3 | 2 | 3 | 3 | - | 3 | 3 | 3 | 3 | |



| | | | | | | | | | | | | | | | |
|--|---|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|--------------------------------------|-------------|---|
| CE23508 | INDUSTRIAL TRAINING | | | | | | | | | | | 0 | 0 | 2 | 1 |
| COURSE OBJECTIVES | | | | | | | | | | | | | | | |
| To enable the students to | | | | | | | | | | | | | | | |
| 1 | practice in different fields connected to Civil Engineering, like design, several aspects of construction, and management of a project | | | | | | | | | | | | | | |
| 2 | develop skills of problem-solving and decision-making, teamwork and communication within a real engineering setting. | | | | | | | | | | | | | | |
| 3 | focused in specialized knowledge of industry standards, norms, and rules, gained at construction sites or working at an engineering company. | | | | | | | | | | | | | | |
| 4 | develop mentorship for professional and academic advancement in the field of Civil Engineering. | | | | | | | | | | | | | | |
| DESCRIPTION | | | | | | | | | | | | | | | |
| <ul style="list-style-type: none"> The students individually undertake training in reputed Industries during the summer vacation of fourth semester for a specified period of two weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. Assessment of Industrial Training will be based on viva-voce, report and certificate of Industrial Training or Institutional Project Work obtained by the student from the industry or Institute. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | TOTAL PERIODS | 30 | |
| COURSE OUTCOMES | | | | | | | | | | | | | | | |
| At the end of this course, students will be able to | | | | | | | | | | | | | BT Mapped (Highest Level) | | |
| • | apply theoretical knowledge to generally related real-world civil engineering problems to strengthen our understanding of fundamental engineering concepts. | | | | | | | | | | | | Applying (K3) | | |
| • | determine familiarity with effective use of critical tools and software in the field for design, analysis, and project management processes. | | | | | | | | | | | | Applying (K3) | | |
| • | develop critical thinking and problem-solving skills by involving them in project planning, development, and Completion processes. | | | | | | | | | | | | Applying (K3) | | |
| • | employ professional skills and develop teamwork and communication skills by engaging with multi-disciplinary teams and industry stakeholders. | | | | | | | | | | | | Applying (K3) | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | | |
| | PO's | | | | | | | | | | | | PSO's | | |
| CO's | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | |
| CO1 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | |
| CO2 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 2 | 3 | 3 | |
| CO3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 3 | 3 | 2 | 3 | |
| CO4 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 3 | 3 | 2 | 3 | |



| | | | | | |
|---|---|----------|----------|----------|--|
| GE23501 | PROFESSIONAL DEVELOPMENT III | 0 | 0 | 2 | 1 |
| COURSE OBJECTIVES | | | | | |
| To enable students to | | | | | |
| 1. | enhance their Resume writing skills and improving corporate vocabularies to survive in the corporate world. | | | | |
| 2. | evaluate their interview skills and improve their interview presentation. | | | | |
| 3. | solve the quantitative aptitude problems and improve their mental ability. | | | | |
| 4. | improve critical thinking and reasoning skills. | | | | |
| UNIT I | RESUME WRITING SKILLS | | | | 6 |
| Updated Resume Building III – Self Introduction III – Dressing Etiquette – JAM V – Corporate Vocabulary. | | | | | |
| UNIT II | INTERVIEW SKILLS | | | | 6 |
| Interview skills – General guidelines - Work Ethics – Group Discussion III – JAM VI – Presentation Competence – Mock Interview. | | | | | |
| UNIT III | QUANTITATIVE APTITUDE | | | | 9 |
| Cube Root and Square Root - Time and Work - Ages - Permutation and Combination - Probability – Calendar. | | | | | |
| UNIT IV | LOGICAL REASONING | | | | 9 |
| Series Completion - Blood Relations - Coding and Decoding - Data Sufficiency - Statements and Assumptions. | | | | | |
| TOTAL PERIODS: | | | | | 30 |
| COURSE OUTCOMES Upon completion of the course, the students will be able to | | | | | BT MAPPED (Highest Level) |
| CO1 | excel in drafting Resumes and speaking. | | | | Applying (K3) |
| CO2 | demonstrate the participative skills in group discussions and Interviews. | | | | Applying (K3) |
| CO3 | solve problems based on quantitative aptitude. | | | | Applying (K3) |
| CO4 | enhance their logical and verbal reasoning. | | | | Analyzing (K4) |
| TEXTBOOKS | | | | | |
| 1. Aggarwal, R. S. A Modern Approach to Verbal & Non-Verbal Reasoning. Revised ed., 2024–25, S. Chand & Company Ltd., 2024. | | | | | |
| 2. Aggarwal, R. S. Objective General English: Fully Revised Video Edition. S. Chand & Company Ltd., 2022. | | | | | |
| REFERENCES | | | | | |
| 1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hil1.2015. | | | | | |
| 2. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications.2016. | | | | | |
| 3. Johnson, D.W. Reaching out — Interpersonal Effectiveness and self- actualisation. Boston: Allyn and Bacon.2019. | | | | | |
| 4. Infosys Campus Connect Program — students' guide for soft skills.2015. | | | | | |

| CO/PO MAPPING: | | | | | | | | | | | | | | |
|---|---------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | Programme Outcomes (PO's) | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PS02 |
| CO1 | 3 | 2 | 2 | 3 | 3 | 1 | - | - | - | - | - | - | 3 | 2 |
| CO2 | - | 2 | 3 | - | 2 | - | 2 | - | - | - | - | - | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | - | - | 1 | - | - | - | - | - | 2 | 3 |
| CO4 | 3 | 2 | 2 | - | - | 1 | - | - | - | - | 2 | - | 2 | 3 |



| | | | | | | |
|---|---|---|---|---|--------------------------------------|-----------|
| CE23151 | PRESTRESSED CONCRETE STRUCTURES | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the basic principles and types of prestressing in structural elements. | | | | | |
| 2 | design the prestressed concrete member subjected to flexure and shear. | | | | | |
| 3 | explain about anchorage zone stresses and design the anchorage reinforcement. | | | | | |
| 4 | analyze and design of the composite members for stresses. | | | | | |
| 5 | understand the concept of partial prestressing and design the tension and compression member. | | | | | |
| UNIT I | INTRODUCTION - THEORY AND BEHAVIOUR | | | | 9 | |
| Basic principles of prestressing - Classification and types, Advantages over ordinary reinforced concrete, Materials, High strength concrete and high tensile steel; Methods of prestressing - Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems, Analysis of sections of stresses by stress concept, strength concept and load balancing concept; Losses of prestress in post-tensioned and pre-tensioned members. | | | | | | |
| UNIT II | DESIGN FOR FLEXURE AND SHEAR | | | | 9 | |
| Basic assumptions of flexural design - Permissible stresses in steel and concrete as per I.S.1343 Code - Different Types of sections, Design of sections of Type I and Type II post-tensioned and pre-tensioned beams; Check for flexural capacity based on I.S. 1343 Code, Influence of Layout of cables in post-tensioned beams, Location of wires in pre-tensioned beams; Design for shear based on I.S. 1343 Code. | | | | | | |
| UNIT III | DEFLECTION AND DESIGN OF ANCHORAGE ZONE | | | | 9 | |
| Factors influencing deflections - Short-term deflections of uncracked members, Prediction of long term deflections due to creep and shrinkage, Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by I.S.1343 code, design of anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams - design of anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams. | | | | | | |
| UNIT IV | COMPOSITE BEAMS AND CONTINUOUS BEAMS | | | | 9 | |
| Analysis and design of composite beams - Shrinkage strain and its importance, Differential shrinkage, Methods of achieving continuity in continuous beams, Analysis for secondary moments, Concordant cable and linear transformation; Calculation of stresses - Principles of design. | | | | | | |
| UNIT V | MISCELLANEOUS STRUCTURES | | | | 9 | |
| Role of prestressing in members subjected to Tensile forces and compressive forces - Design of Tension members and Compression members, Design of Tanks, Pipes, Partial prestressing, methods of achieving partial prestressing, merits and demerits of partial prestressing. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | design a prestressed concrete beam accounting for losses. | | | | Applying (K3) | |
| CO2 | design for flexure and shear. | | | | Applying (K3) | |

| CO3 | design the anchorage zone for post-tensioned members and estimate the deflection in beams. | Applying (K3) | | | | | | | | | | | | |
|--|--|----------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| CO4 | design composite members and continuous beams. | Applying (K3) | | | | | | | | | | | | |
| CO5 | design water tanks, pipes, poles and sleepers. | Analyzing (K4) | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Krishna Raju N., "Prestressed concrete", 5 th Edition, Tata McGraw Hill Company, New Delhi, 2012. | | | | | | | | | | | | | | |
| 2. Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributors Pvt. Ltd, 2014. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013. | | | | | | | | | | | | | | |
| 2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017. | | | | | | | | | | | | | | |
| 3. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2017. | | | | | | | | | | | | | | |
| 4. Sinha.N.C. and Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 1 | - | - | - | 2 | - | 1 | - | 2 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 1 | - | - | - | 2 | - | 1 | - | 2 | 3 | 2 |
| CO3 | 3 | 2 | 3 | - | 1 | - | - | 2 | - | 1 | - | 2 | 3 | 3 |
| CO4 | 2 | 2 | 3 | - | 1 | - | - | 2 | - | 1 | - | 2 | 3 | 2 |
| CO5 | 2 | 2 | 3 | 1 | - | - | - | 2 | - | 1 | - | 2 | 3 | 2 |



| | | | | | | | |
|---|---|--|--|---|---|----------------------------------|-----------|
| CE23152 | STRUCTURAL DYNAMICS | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | impart knowledge on vibration analysis of single degrees of freedom under free and forced vibration. | | | | | | |
| 2 | gain knowledge on vibration analysis of two degrees of freedom under free and forced vibration. | | | | | | |
| 3 | impart knowledge on dynamic analysis of multi degrees of freedom under free and forced vibration.. | | | | | | |
| 4 | gain knowledge on dynamic analysis of continuous system under free and forced vibration. | | | | | | |
| 5 | know about the direct integration method for dynamic analysis. | | | | | | |
| UNIT I | PRINCIPLES OF VIBRATION ANALYSIS | | | | | | 9 |
| Mathematical models of single degree of freedom systems - Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Evaluation of damping, Transmissibility, vibration control, Tuned mass damper, examples related to structural engineering. | | | | | | | |
| UNIT II | TWO DEGREE OF FREEDOM SYSTEMS | | | | | | 9 |
| Mathematical models of two degree of freedom systems - Free and forced vibrations of two degree of freedom systems, normal modes of vibration, Applications. | | | | | | | |
| UNIT III | DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS | | | | | | 9 |
| Mathematical models of Multi-degree of freedom systems - Orthogonality of normal modes, Free and forced vibrations of multi degree of freedom systems, Mode superposition technique, Response spectrum method, Applications. | | | | | | | |
| UNIT IV | DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS | | | | | | 9 |
| Mathematical models of continuous systems - Free and forced vibration of continuous systems; Rayleigh - Ritz method - Formulation using conservation of energy, Formulation using virtual work, Applications | | | | | | | |
| UNIT V | DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE | | | | | | 9 |
| Introduction - Damping in MDOF systems, Nonlinear MDOF systems, Step-by-step numerical integration algorithms, Substructure technique, Applications | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | explain about vibration analysis of system/structures with single degree of freedom and can explain the method of damping systems | | | | | Applying (K3) | |
| CO2 | describe about dynamic analysis of system/structures with two degrees of freedom under free and forced vibration | | | | | Applying (K3) | |
| CO3 | explain about dynamic analysis of system/structures with multi-degrees of freedom under free and forced vibration | | | | | Applying (K3) | |

| | | |
|-----|--|---------------|
| CO4 | derive a mathematical model of continuous system and do a dynamic analysis under free and forced vibration | Applying (K3) |
| CO5 | derive the direct integration method for dynamic response. | Applying (K3) |

TEXT BOOKS

1. Mario Paz, Structural Dynamics -Theory and Computation, Kluwer Academic Publishers, Fifth Edition, 2013.
2. Anil K Chopra, Dynamics of structures - Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007

REFERENCES

1. Madhujit Mukhopadhyay, "Structural Dynamics - Vibrations and Systems", ANE Books Publisher, 2008.
2. Roy R.Craig, Jr, Andrew J. Kurdila, "Fundamentals of Structural Dynamics", John Wiley and Sons, 2011
3. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
4. D G Jones, Handbook of Viscoelastic vibration damping, John Wiley, Chichester, 2001.

CO-PO MAPPING :

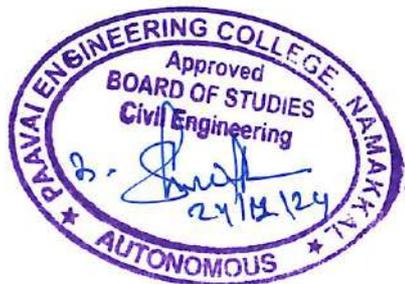
Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 2 | - | 1 | 1 | 1 | - | - | - | - | 3 | 2 |
| CO2 | 3 | 2 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | - | 3 | 2 | 1 | - | - | - | - | 2 | 3 |
| CO4 | 3 | 3 | 3 | 2 | - | 2 | 3 | 1 | - | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | - | 3 | 3 | 1 | - | - | - | - | 1 | 2 |



| | | | | | | | |
|--|---|--|--|---|---|--------------------------------------|-----------|
| CE23153 | FINITE ELEMENT METHOD | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | obtain knowledge on element strain and stress with their relationship. | | | | | | |
| 2 | gain knowledge on beam elements. | | | | | | |
| 3 | know the application to structural elements. | | | | | | |
| 4 | understand iso - parametric and axis-symmetric formulations. | | | | | | |
| 5 | understand the commercial FEA Software. | | | | | | |
| UNIT I | FUNDAMENTALS OF FINITE ELEMENT METHOD | | | | | | 9 |
| History and Applications; Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix; Element Strain and Stress. | | | | | | | |
| UNIT II | BEAM ELEMENTS | | | | | | 9 |
| Flexure Element; Strain displacement matrix - Element stiffness matrix and Element load vector; Natural frequencies of longitudinal vibration and mode shapes. | | | | | | | |
| UNIT III | METHOD OF WEIGHTED RESIDUALS | | | | | | 9 |
| Galerkin Finite Element Method - Application to Structural Elements; Interpolation Functions, Compatibility and Completeness Requirements; Polynomial Forms - Applications. | | | | | | | |
| UNIT IV | TYPES OF ELEMENTS | | | | | | 9 |
| Triangular Elements - Rectangular Elements, Three-Dimensional Elements; Iso-parametric Formulation, Axis-Symmetric Elements, Numerical Integration - Gaussian Quadrature. | | | | | | | |
| UNIT V | APPLICATION AND COMPUTATION TECHNIQUE | | | | | | 9 |
| Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi-Symmetric Stress Analysis, Strain and Stress Computations; Computer techniques of FEM procedure, Pre-Processing, Post-Processing; Use of Commercial FEA Software. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | determine the element strain and stress with their relationship. | | | | | Understanding (K2) | |
| CO2 | apply the element stiffness matrix and element load vector in beam. | | | | | Applying (K3) | |
| CO3 | familiarize the applications to structural elements. | | | | | Applying (K3) | |
| CO4 | analyze complex structural problems using iso - parametric and axis-symmetric formulations. | | | | | Analyzing (K4) | |
| CO5 | perform FEA by commercial software. | | | | | Analyzing (K4) | |
| TEXT BOOKS | | | | | | | |
| 1. Krishnamoorthy, C.S, Finite Element Analysis Theory and Programming, McGraw- Hill, 2017. | | | | | | | |
| 2. Finite Element Analysis, Seshu P., Prentice-Hall of India, 2005. | | | | | | | |

| REFERENCES | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, Butterworth Heinemann, 2018. | | | | | | | | | | | | | | |
| 2. Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier, 2000. | | | | | | | | | | | | | | |
| 3. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2016. | | | | | | | | | | | | | | |
| 4. S. S. Bhavikatti, Finite Element Analysis, New Age Publishers, 2015. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 | - | - | - | - | 2 | 2 | 1 | 3 |
| CO2 | 3 | - | 1 | 2 | 1 | 2 | - | - | - | - | 2 | 2 | 1 | 2 |
| CO3 | 3 | - | 1 | - | 1 | 2 | - | - | - | - | 2 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 1 | 2 | 1 | 2 | - | - | - | - | 2 | 2 | 1 | 2 |
| CO5 | 3 | - | 1 | 2 | 1 | 2 | - | - | - | - | 2 | 2 | 1 | 2 |



| | | | | | | |
|---|---|---|---|---|----------------------------------|-----------|
| CE23154 | STEEL CONCRETE COMPOSITE STRUCTURES | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | learn the concepts of steel concrete composite construction, including design principles, codes, and shear connections. | | | | | |
| 2 | understand the behavior and design of composite beams, including the location of neutral axes, shear stud strength, and deflection. | | | | | |
| 3 | determine the design principles for composite columns, including encased and in-filled types subjected to axial, uni-axial, and bi-axial loads. | | | | | |
| 4 | learn the fundamentals of composite slabs, including profiled sheeting arrangements for various spans. | | | | | |
| 5 | analyze case studies on steel-concrete composite construction and the seismic behavior of composite structures. | | | | | |
| UNIT I | INTRODUCTION TO COMPOSITE ACTION | | | | 9 | |
| Introduction to steel - concrete composite construction codes, composite design; shear connectors - types of shear connectors, degrees of shear connections - partial and full shear connections. | | | | | | |
| UNIT II | DESIGN OF COMPOSITE BEAM | | | | 9 | |
| Introduce composite beams, including shear studs - Determine the location of a beam's neutral axis/axes depending on the level of composite action; Calculate shear stud strength and understand strength modifiers - deflection of composite beams | | | | | | |
| UNIT III | DESIGN OF COMPOSITE COLUMN | | | | 9 | |
| Types of Composite columns - design of encased columns; design of in-filled columns - axial, uni- axial and bi-axially loaded columns. | | | | | | |
| UNIT IV | DESIGN OF COMPOSITE SLAB | | | | 9 | |
| Composite slabs - Introduction, profiled sheeting, sheeting parallel to span, sheeting perpendicular to span. | | | | | | |
| UNIT V | CASE STUDIES | | | | 9 | |
| Case studies on steel concrete composite construction in buildings - seismic behaviour of composite structures. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | apply principles, codes of steel-concrete composite construction. | | | | Applying (K3) | |
| CO2 | evaluate the composite beams. | | | | Applying (K3) | |
| CO3 | design the types of composite columns | | | | Applying (K3) | |
| CO4 | assess the design fundamentals of composite slabs. | | | | Applying (K3) | |
| CO5 | analyze and design the composite bridge structures. | | | | Analyzing (K4) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Johnson R.P., "Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings", Vol.I, Fourth Edition, Blackwell Scientific Publications, 2018. | | | | | | | | | | | | | | |
| 2. Oehlers D.J. and Bradford M.A., "Composite Steel and Concrete Structural Members, Fundamental behaviour", Revised Edition, Pergamon press, Oxford, 2000. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Owens.G.W and Knowles.P, "Steel Designers Manual", Seventh Edition, Steel Concrete Institute(UK), Oxford Blackwell Scientific Publications, 2011. | | | | | | | | | | | | | | |
| 2. Teaching resource for, "Structural Steel Design," Volume 2 of 3, Institute for Steel Development and Growth (INSDAG), 2002. | | | | | | | | | | | | | | |
| 3. Narayanan R, "Composite steel structures – Advances, design and construction", Elsevier, Applied science, UK, 2007. | | | | | | | | | | | | | | |
| 4. Segui, W.T. LRFD Steel Design. 6th Edition, Brooks/Cole Publishing Company, Pacific Grove, California.2017 | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | - | 2 | 3 | 1 | 1 | 1 | - | - | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | - | 2 | 3 | 1 | 1 | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | - | 2 | 3 | 1 | 1 | - | - | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | - | 2 | 3 | 1 | 1 | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | - | 2 | 3 | 1 | 1 | - | - | - | 1 | 3 |



| | | | | | | | |
|--|--|--|--|---|---|----------------------------------|-----------|
| CE23155 | EARTHQUAKE RESISTANT STRUCTURES | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | learn the basic concepts of vibration of single degree of freedom systems. | | | | | | |
| 2 | know the elements of earthquake ground motion characteristics. | | | | | | |
| 3 | learn the Seismo Resistant Building Architecture. | | | | | | |
| 4 | introduce architectural features of buildings to resist earthquakes. | | | | | | |
| 5 | introduce Geo-technical earthquake engineering. | | | | | | |
| UNIT I | ELEMENTS OF STRUCTURAL DYNAMICS | | | | | | 9 |
| Sources of vibrations; Types of vibrations; Degrees of freedom; Spring action and damping; Free vibration of undamped system having single degree of freedom; Free vibration of viscous damped system having single degree of freedom; Forced vibration of a viscous damped single degree freedom system subjected to harmonic excitation; Earthquake excitation (Base excitation) of a single degree freedom system. | | | | | | | |
| UNIT II | ELEMENTS OF EARTHQUAKE GROUND MOTION | | | | | | 9 |
| Earthquake size - Intensity and magnitude; Seismic Zoning-Introduction; Strong Motion Earthquakes - Introduction; Response spectrum (elastic); Local site effect (Effect of type of soil). | | | | | | | |
| UNIT III | SEISMO-RESISTANT BUILDING ARCHITECTURE | | | | | | 9 |
| Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration - Problems and solutions; Building characteristics - Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/liquefaction. Foundations; Quality of construction and materials - quality of concrete, construction joints, general detailing requirements | | | | | | | |
| UNIT IV | ANALYSIS OF SINGLE STOREY AND SINGLE BAY RCC PLANE FRAME | | | | | | 9 |
| Calculation of lateral force due to earthquake using equivalent static method; Analysis for different load combinations; Design forces and moments in beam and columns. (As per IS:1893 (part-I)-2002); Design of column; Design of beam; Design of footing ; Detailing of entire frame (As per IS:456-2000 and IS13920-1993 | | | | | | | |
| UNIT V | ELEMENTS OF GEOTECHNICAL EARTHQUAKE ENGINEERING | | | | | | 9 |
| Liquefaction – Definition and types, Effect of liquefaction on built environment, Evaluation of liquefaction susceptibility, Liquefaction hazard mitigation; Seismic slope stability - Introduction, Pseudo-static analysis, Sliding block methods. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | select the fundamentals vibration of single degree freedom systems | | | | | Applying (K3) | |

| | | |
|-----|---|---------------|
| CO2 | explain the earthquake ground motion characteristics | Applying (K3) |
| CO3 | calculate the lateral forces on a building using equivalent static method | Applying (K3) |
| CO4 | analyse and design a single storey and single bay RC framed building | Applying (K3) |
| CO5 | identify the behavior of soil beneath a foundation during an earthquake | Applying (K3) |

TEXT BOOKS

1. Earthquake Resistant Design of Structures by Pankaj Agarwal, and Manish Shrikhande , PHI Learning, 2006
2. Geotechnical Engineering by S.K.Gulhati & Manoj Datta, Tata McGraw-Hill,2010

REFERENCES

1. Elements of Earthquake Engineering by Jai Krishna, A.R.Chandrasekaran and Brijesh Chandra, Second Edition, South Asian Publishers, 1994.
2. Dynamics of Structures by A.K.Chopra, 3rd Edition, Person Education, 2007.
3. IS 456: 2000 Indian Standard Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standard, New Delhi.
4. IS 1893 (Part 1): 2016, Indian Standard “Criteria for Earthquake Resistant Design of Structures, Part 1, General provisions and Buildings (six revision) Bureau of Indian Standard, New Delhi.
5. IS 13920: 2016 Indian Standard “Ductile Design and Detailing of Reinforced Concrete Structures, subjected to Seismic forces - Code of Practice, Bureau of Indian Standard, New Delhi.
6. IS 4326: 2013 Indian Standard “Earthquake Resistant Design and Construction of Buildings - Code of Practice, Bureau of Indian Standard, New Delhi.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | 2 | 2 | 1 | 3 | - | - | - | - | - | 3 | 2 | 1 |
| CO2 | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - | 3 | 3 | 2 |
| CO3 | 3 | - | 2 | - | 1 | 3 | - | - | - | - | - | 3 | 1 | 3 |
| CO4 | 3 | - | 2 | 2 | 1 | 3 | - | - | - | - | - | 3 | 3 | 1 |
| CO5 | 3 | - | 2 | 2 | 1 | 3 | - | - | - | - | - | 3 | 1 | 2 |



| | | | | | | | |
|---|--|--|--|---|---|--------------------------------------|-----------|
| CE23156 | TALL STRUCTURES | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | design and analyse the various methodologies of tall structures | | | | | | |
| 2 | perform stability analysis of tall structures. | | | | | | |
| 3 | impose the knowledge on the performance of structure under different loading conditions | | | | | | |
| 4 | know the concepts behind the analysis and design of buildings | | | | | | |
| 5 | study about different stability considerations | | | | | | |
| UNIT I | DESIGN CRITERIA AND MATERIALS | | | | | | 9 |
| Design Philosophy Modern concepts - working stress method, limit state method and plastic design; Materials used, High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self-compacting concrete, High strength steel, Composites. | | | | | | | |
| UNIT II | LOADING | | | | | | 9 |
| Gravity Loading, Dead load, Live load, Live load reduction techniques, Impact load, Construction load, Sequential loading; Wind Loading - Static and dynamic approach, Analytical method, Wind tunnel experimental methods; Earthquake Loading Equivalent lateral load analysis, Dynamic analysis, Combination of Loads. | | | | | | | |
| UNIT III | BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS | | | | | | 9 |
| Introduction - Factors affecting the growth, height and structural form; Behaviour of braced frames, Rigid frames, infilled frames; Shear walls, Coupled shear walls, Wall - Frames, Tubular and outrigger - Hybrid systems. | | | | | | | |
| UNIT IV | ANALYSIS | | | | | | 9 |
| Modeling for approximate analysis - accurate analysis and reduction techniques, Analysis of structures as an integral unit; Analysis of buildings as total structural system considering overall integrity and major subsystem interaction; Analysis for drift and twist; Computerized 3D analysis - Assumptions in 3D analysis - Simplified 2D analysis. | | | | | | | |
| UNIT V | DESIGN PARAMETERS | | | | | | 9 |
| Sectional shapes - properties and resisting capacity, design, deflection, cracking, prestressing, shear flow; Design for differential movement Creep and shrinkage effects, Temperature effects and fire resistance; Stability of tall structures - PA Effects, Buckling analysis of tall buildings. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | explain the design aspects and the various innovative materials | | | | | Applying (K3) | |
| CO2 | apply the knowledge of engineering fundamentals to characterize various types of loading considered for the analysis of tall building. | | | | | Applying (K3) | |
| CO3 | identify various structural systems, their behavior and performance under different loading conditions. | | | | | Applying (K3) | |

| CO4 | analyze the structures as an integral unit for drift and twist | Analyzing (K4) | | | | | | | | | | | | |
|--|---|----------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| CO5 | design tall structures under different stability considerations | Analyzing (K4) | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 2011. | | | | | | | | | | | | | | |
| 2. Taranath B.S, Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, McGraw Hill, 2011. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Lin.T.Y, StotesBurry.D, "Structural Concepts and systems for Architects and Engineers" John Wiley, 2008 | | | | | | | | | | | | | | |
| 2. Lynn S.Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi, 2006. | | | | | | | | | | | | | | |
| 3. Wolfgang Schueller, "High Rise Building Structures", John Wiley and Sons, New York 1997 | | | | | | | | | | | | | | |
| 4. Coull. A. and Smith, Stafford, B. " Tall Buildings", Pergamon Press, London, 1997. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 2 | - | 2 | 3 | 1 | - | - | - | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | - | 2 | 3 | 1 | - | - | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | - | 2 | 3 | 1 | - | - | - | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | 3 | 3 |



| | | | | | | | |
|---|---|--|--|---|---|----------------------|-----------|
| CE23157 | MAINTENANCE AND REPAIR OF CONCRETE STRUCTURES | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | gain knowledge on causes of deterioration in concrete structures. | | | | | | |
| 2 | study of the concrete structures are subjected to constant deterioration. | | | | | | |
| 3 | generate awareness about various types of repair materials used in structural repair. | | | | | | |
| 4 | know the methodologies used for structural defects. | | | | | | |
| 5 | learn about the different types of maintenance techniques for structures. | | | | | | |
| UNIT I | INTRODUCTION TO STRUCTURAL REPAIR AND MAINTENANCE | | | | | | 9 |
| Introduction to repair and maintenance - Causes of structural deterioration, Maintenance and its classifications, Necessity, objectives and importance of maintenance and repair; Types of maintenance; Factors influencing, advantages and limitations of maintenance and repairs. | | | | | | | |
| UNIT II | DETERIORATION OF CONCRETE STRUCTURE | | | | | | 9 |
| Types of deterioration - signs, causes and symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability and micro-structure of concrete; Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, efflorescence, exposure to severe environment like marine exposure; Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced); Corrosion mechanism; alkali-silica reaction, sulphate attack, Acid attack. | | | | | | | |
| UNIT III | CONDITION ASSESSMENT and EVALUATION OF STRUCTURES | | | | | | 9 |
| Necessity and importance of structural audit and assessment; Distress survey and detailed inspection of structures; Steps involved in structure assessment and audit; Nondestructive test methods for concrete including Rebound hammer, Ultrasonic pulse velocity, Rebar locator, Corrosion meter, Penetration resistance and pull-out test, Core cutting; Corrosion - Methods for corrosion measurement and assessment including half-cell potential and resistivity, Mapping of data. | | | | | | | |
| UNIT IV | REPAIR MATERIALS | | | | | | 9 |
| Repair materials - various repair materials, criteria for material selection, methodology of selection, Health and safety precautions for handling and applications of repair materials; Special mortars and concretes Polymer - Concrete and Mortar, Quick setting compounds; Grouting materials - Gas forming grouts, Salfoalumate grouts, Polymer grouts; Bonding agents - Latex emulsions, Epoxy bonding agents; Protective coatings - Protective coatings for Concrete and Steel; Fiber Reinforced Polymers - Types, properties and application; Other Repair materials for concrete, steel and masonry. | | | | | | | |
| UNIT V | MAINTENANCE AND REPAIR TECHNIQUES | | | | | | 9 |
| Critical locations of cracks in RCC elements; various causes of failure, causes of dampness in roof slab and its repair techniques; various types of repair methods like epoxy injection, grooving and sealing, stitching, grouting, shotcrete, and gunniting; Repairs methods for honeycombing and larger voids; Corrosion mitigation techniques to protect the structure from corrosion. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |

| COURSE OUTCOMES | | | | | | | | | | | | | | | |
|--|---|----------------------------------|---|---|---|---|---|---|---|----|----|----|-------|---|--|
| At the end of this course, students will be able to | | BT Mapped (Highest Level) | | | | | | | | | | | | | |
| CO1 | identify the causes and mechanisms of deterioration in concrete structures. | Understanding (K2) | | | | | | | | | | | | | |
| CO2 | determine the mechanism of deterioration in concrete structures. | Applying (K3) | | | | | | | | | | | | | |
| CO3 | assess the various types of repair materials used in structural repair. | Applying (K3) | | | | | | | | | | | | | |
| CO4 | apply appropriate repair materials and methodologies for different types of structural defects. | Analyzing (K4) | | | | | | | | | | | | | |
| CO5 | implement repair and retrofitting techniques to enhance the structural integrity and extend the service life of structures. | Analyzing (K4) | | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | | |
| 1. M. Palanisamy, A. J. Thoriya, H. M. Rangwala, M. S. Rawat, Maintenance, Repair and Rehabilitation of Structures, 2023. | | | | | | | | | | | | | | | |
| 2. Concrete Technology by M.L.Gambhir, Tata McGraw-Hill Education, Third Edition, 2017. | | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | | |
| 1. Concrete technology – A.R.Shanthakumar, Oxford University Press, India, 2006. | | | | | | | | | | | | | | | |
| 2. J.H.Bungey, S.G.Millard & M.G.Grantham , Testing of Concrete in Structures, 4th Edition, Taylor & Francis, London & New York, 2006. | | | | | | | | | | | | | | | |
| 3. Appraisal and Repair of Reinforced concrete by R.Holland, Thomas Telford Ltd. London, 1997. | | | | | | | | | | | | | | | |
| 4. Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India. | | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | |
| CO1 | 2 | 3 | - | 2 | - | 3 | 2 | - | 1 | - | 2 | 2 | 2 | 3 | |
| CO2 | 2 | 2 | - | 3 | - | 2 | 2 | - | 1 | - | 2 | 2 | 2 | 1 | |
| CO3 | 3 | 2 | - | 2 | - | 2 | 3 | - | 1 | - | 2 | 3 | 3 | 1 | |
| CO4 | 2 | 2 | - | 2 | - | 2 | 2 | - | 1 | - | 2 | 2 | 2 | 1 | |
| CO5 | 2 | 2 | - | 2 | - | 2 | 2 | - | 1 | - | 3 | 2 | 2 | 3 | |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23251 | MODERN CONSTRUCTION MATERIALS | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand composite materials such as plastics and fibre reinforced polymers (FRP), including their properties and applications. | | | | | |
| 2 | learn about different metals, their manufacturing processes, and their relevance in architectural and structural applications. | | | | | |
| 3 | introduce smart and intelligent materials and their applications in modern architectural practices through case studies. | | | | | |
| 4 | understand the properties, classification, and applications of basic architectural materials such as wood, glass, tiles, and paint. | | | | | |
| 5 | explore various other advanced construction materials including water-proofing agents, facade materials, and construction chemicals. | | | | | |
| UNIT I | COMPOSITES | | | | 9 | |
| Types of Plastics - Properties and Manufacturing process, Advantages of Reinforced polymers; Types of FRP - FRP on different structural elements, Applications of FRP, Cellular Core, Geo synthetics, Polymers; Fibre reinforced plastic in sandwich panels -Adhesives and Sealants. | | | | | | |
| UNIT II | METALS | | | | 9 | |
| Types of Steels - Manufacturing process of steel, Advantages of new alloy steels, Properties and advantages of aluminum and its products; Types of Coatings and Coatings to reinforcement, Applications of Coatings | | | | | | |
| UNIT III | SMART AND INTELLIGENT MATERIALS | | | | 9 | |
| Intelligent materials - Types, Piezoelectric materials, Self-healing coatings; Differences between Smart and Intelligent Materials; Special features - Case studies showing the applications of smart and Intelligent Materials. | | | | | | |
| UNIT IV | ARCHITECTURAL MATERIALS | | | | 9 | |
| Architectural Materials - Wood and Wood Product, Glass, Floor Finishes, Paints, Tiles, Thermal insulation and acoustic absorption materials, decorative panels and laminates, architectural glass and ceramics; Ferro cement | | | | | | |
| UNIT V | OTHER MATERIALS | | | | 9 | |
| Recycled materials; Types and properties of Water Proofing Compounds; Types of Non-weathering Materials and its uses; Types of Flooring and Facade Materials and its application; Bituminous materials; Sustainable building materials from waste. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | compare various types of composites and their applications in structural elements. | | | | Understanding (K2) | |
| CO2 | explain the properties and advantages of metals and metal coatings used in architecture. | | | | Understanding (K2) | |

| | | |
|-----|---|---------------|
| CO3 | distinguish between smart and intelligent materials and assess their real-world architectural applications using case studies. | Applying (K3) |
| CO4 | identify and classify traditional architectural materials (wood, glass, tiles, etc.) and their characteristics. | Applying (K3) |
| CO5 | describe the functions and applications of water-proofing compounds, flooring and facade materials, and construction chemicals. | Applying (K3) |

TEXT BOOKS

1. Duggal S. K., "Building Materials", New Age International Publishers, Delhi. 3rd edition, New Age International, 2009.
2. Santhakumar.A.R., Concrete Technology, Oxford University press, New Delhi, 2nd edition, 2018.

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1. Ganapathy, C., Modern Construction Materials, Eswar Press, 2015.
2. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 4th edition, Pearson, 2016.
3. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
4. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand and Company Ltd., 8th edition 2024.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | - | 2 | 1 | 1 | 2 | - | - | - | - | 1 | 3 |
| CO2 | 3 | 3 | 2 | - | 3 | 2 | 1 | 2 | - | - | - | - | 3 | - |
| CO3 | 3 | 2 | 3 | - | 3 | 2 | 1 | 2 | - | - | - | - | 2 | - |
| CO4 | 3 | 2 | 2 | - | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 2 |
| CO5 | 3 | 3 | 3 | - | 3 | 2 | 3 | 2 | - | - | - | - | 1 | 1 |



| | | | | | | | |
|---|---|--|--|---|---|----------------------------------|-----------|
| CE23252 | CONTRACT AND LABOUR LAWS | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | learn about various construction contracts. | | | | | | |
| 2 | know about tender and bidding process. | | | | | | |
| 3 | understand about arbitration and appointment of arbitrators | | | | | | |
| 4 | gain knowledge on labour regulations | | | | | | |
| 5 | define about the legal requirements. | | | | | | |
| UNIT I | CONSTRUCTION CONTRACTS | | | | | | 9 |
| Elements of Contracts - Types of Contracts, Features, Suitability; Design of Contract Documents - International Contract Document, Standard Contract Document, Law of Torts; Indian Contracts Act | | | | | | | |
| UNIT II | TENDERS | | | | | | 9 |
| Prequalification - Bidding, Accepting, Evaluation of Tender from Technical, Contractual and Commercial Points of View; Contract Formation and Interpretation - Potential Contractual Problems, World Bank Procedures and Guidelines; Tamilnadu Transparency in Tenders Act. | | | | | | | |
| UNIT III | ARBITRATION | | | | | | 9 |
| Comparison of Actions and Laws - Agreements, Subject Matter, Violations, Appointment of Arbitrators, Conditions of Arbitration, Powers and Duties of Arbitrator; Rules of Evidence - Enforcement of Award, Costs. | | | | | | | |
| UNIT IV | LABOUR REGULATIONS | | | | | | 9 |
| Social Security - Welfare Legislation, Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration; Insurance and Safety Regulations - Workmen's Compensation Act; Indian Factory Act, Tamilnadu Factory Act, Child Labour Act, Other Labour Laws. | | | | | | | |
| UNIT V | LEGAL REQUIREMENTS | | | | | | 9 |
| Insurance and Bonding - Laws Governing Sale, Purchase and Use of Urban and Rural Land, Land Revenue Codes; Tax Laws - Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs; Legal Requirements for Planning - Property Law, Agency Law, Local Government Laws for Approval, Statutory Regulations. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | explain the types of contract and contract document. | | | | | Understanding (K2) | |
| CO2 | summarize the bidding and accepting of tenders. | | | | | Understanding (K2) | |
| CO3 | examine the powers and duties of arbitrators. | | | | | Applying (K3) | |
| CO4 | identify the various laws and regulations. | | | | | Applying (K3) | |
| CO5 | assess the laws related to land and tax. | | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, 2022. | | | | | | | | | | | | | | |
| 2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2021. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2018. | | | | | | | | | | | | | | |
| 2. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.M.M.Tripathi Private Ltd., Bombay, 2013. | | | | | | | | | | | | | | |
| 3. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2019. | | | | | | | | | | | | | | |
| 4. C.S. Venkata Ratnam, Globalisation and labour management relations, Response Books 2015. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 1 | 1 | - | - | - | 2 | 3 | 3 | - | 3 | - | 1 | 2 | 1 |
| CO2 | 3 | - | - | - | - | 2 | 2 | 3 | - | 3 | - | - | 1 | 1 |
| CO3 | 3 | 1 | - | - | - | 3 | 2 | 3 | - | 3 | - | 1 | 3 | 1 |
| CO4 | 1 | - | - | - | - | 2 | 3 | 3 | - | 3 | - | - | 1 | 2 |
| CO5 | 1 | 2 | - | - | - | 3 | 3 | 3 | - | 3 | - | 1 | 3 | 3 |



| | | | | | | | |
|--|---|--|--|---|---|----------------------------------|-----------|
| CE23253 | SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | know the materials used in sustainable construction. | | | | | | |
| 2 | gain the knowledge on energy calculations | | | | | | |
| 3 | learn the concept of green buildings | | | | | | |
| 4 | know the Lean working structures and lean methods. | | | | | | |
| 5 | activities for implementation in the construction industry. | | | | | | |
| UNIT I | INTRODUCTION AND MATERIALS USED IN SUSTAINABLE CONSTRUCTION | | | | | | 9 |
| Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO ₂ contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability | | | | | | | |
| UNIT II | ENERGY CALCULATIONS | | | | | | 9 |
| Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use. | | | | | | | |
| UNIT III | GREEN BUILDINGS | | | | | | 9 |
| Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building. | | | | | | | |
| UNIT IV | CORE CONCEPTS IN LEAN | | | | | | 9 |
| Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS). | | | | | | | |
| UNIT V | LEAN CONSTRUCTION TOOLS AND TECHNIQUES | | | | | | 9 |
| Sampling/ Work Sampling; Survey/Foreman delay survey; Value Stream/ Process Mapping – 5S , Collaborative Planning System (CPS)/ Last Planner System (LPS) - Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Site. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | describe the various sustainable materials used in construction. | | | | | Understanding (K2) | |
| CO2 | explain the method of estimating the amount of energy required for building | | | | | Understanding (K2) | |
| CO3 | describe the features of LEED, TERI and GRIHA ratings of buildings. | | | | | Applying (K3) | |

| | | |
|-----|--|---------------|
| CO4 | explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity. | Applying (K3) |
| CO5 | apply lean tools and techniques to achieve sustainability in construction projects. | Applying (K3) |

TEXT BOOKS

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFERENCES

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011
2. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
3. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.
4. Lincoln H. Forbes, Syed M. Ahmed., "Modern Construction: Lean Project Delivery and Integrated Practices (Industrial Innovation Series)", Hardcover 2010.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | 3 | - | 3 | 3 | - | - | 2 | 2 | 2 | 1 | 2 | 3 |
| CO2 | 2 | - | 3 | - | 2 | 3 | - | - | 2 | 2 | 2 | 1 | 3 | 2 |
| CO3 | 2 | - | 3 | - | 3 | 3 | - | - | 2 | 2 | 2 | 1 | 2 | 3 |
| CO4 | 1 | - | 2 | - | 2 | 3 | - | - | 2 | 2 | 2 | 1 | 3 | 2 |
| CO5 | 3 | - | 3 | - | 3 | 3 | - | - | 2 | 2 | 2 | 1 | 3 | 3 |



| | | | | | | |
|--|--|---|---|---|----------------------------------|-----------|
| CE23254 | PREFABRICATED STRUCTURES | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | introduce the basic concepts of prefabrication. | | | | | |
| 2 | acquire the knowledge of prefabrication components and systems. | | | | | |
| 3 | understand the design principles in prefabrication. | | | | | |
| 4 | perceive the types of joints and connections in structural members. | | | | | |
| 5 | impart knowledge about the structural stability. | | | | | |
| UNIT I | INTRODUCTION TO PREFABRICATED STRUCTURES | | | | 9 | |
| Need for prefabrication - Advantages and limitations; Principles of prefabrication - Modular coordination, Standardization, Loads and load combinations; Materials - Production, Transportation, Erection. | | | | | | |
| UNIT II | PREFABRICATED COMPONENTS AND SYSTEMS | | | | 9 | |
| Behaviour and types of structural components - roof and floor slabs, Walls panels, Shear walls; Beams Columns - Skeletal system, Portal frame system, Large panel systems, Block system. | | | | | | |
| UNIT III | DESIGN PRINCIPLES | | | | 9 | |
| Types of Joints; Based on action of forces - Compression joints, Shear joints, Tension joints; Based on function - Construction joints, Contraction joints, Expansion joints; Design of expansion joints - Dimensions and detailing ; Types of sealants; Types of structural connections - Beam to Column, Column to Column, Beam to Beam, Column to foundation. | | | | | | |
| UNIT IV | JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS | | | | 9 | |
| Construction Project organization - Planning Project work, Scope and integration Processes, Defining Project Activities; Scheduling Project - CPM, PERT; Precedence Network Analysis Planning and organizing project resources such as manpower material equipment Time and cost for construction site. | | | | | | |
| UNIT V | DESIGN FOR ABNORMAL LOADS | | | | 9 | |
| Progressive collapse; Codal provisions - Equivalent design loads for considering abnormal effects such as earthquakes, cyclones; Importance of avoidance of progressive collapse - case study. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | understand concepts about principles of prefabrication, production, transportation and erection. | | | | Understanding (K2) | |
| CO2 | acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction. | | | | Applying (K3) | |
| CO3 | acquire knowledge about design of cross section, joint flexibility.. | | | | Applying (K3) | |
| CO4 | acquire knowledge about joints and connection in precast construction. | | | | Applying (K3) | |
| CO5 | acquire knowledge about structural stability. | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991. | | | | | | | | | | | | | | |
| 2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage ,CRC Press, 2019 | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift . "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019. | | | | | | | | | | | | | | |
| 2. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976. | | | | | | | | | | | | | | |
| 3. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016. | | | | | | | | | | | | | | |
| 4. " Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 1 | 2 | - | 2 | 3 | - | - | - | - | - | 3 | 1 | 3 |
| CO2 | 3 | 3 | 2 | - | 1 | 3 | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | - | 3 | 3 | - | - | - | - | - | 3 | 2 | 1 |
| CO4 | 2 | 1 | 2 | - | 2 | 3 | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 3 | 3 | 2 | - | 1 | 3 | - | - | - | - | - | 3 | 3 | 1 |



| | | | | | | |
|--|---|---|---|---|--------------------------------------|-----------|
| CE23255 | ADVANCED CONSTRUCTION TECHNIQUES | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | learn the substructure construction and dewatering for underground. | | | | | |
| 2 | understand the concept of superstructure construction techniques. | | | | | |
| 3 | know the erection of towers, transmission line structures and bridges. | | | | | |
| 4 | identify the strengthening techniques for beams, columns and masonry. | | | | | |
| 5 | know the demolition techniques and safety precaution in demolition and dismantling. | | | | | |
| UNIT I | SUB STRUCTURE CONSTRUCTION | | | | 9 | |
| Box jacking - Pipe jacking; Under water construction of diaphragm walls and basement; Tunneling techniques- Piling technique, Driving well and caisson, sinking cofferdam, cable anchoring and grouting, Driving diaphragm walls, Sheet piles, Laying operations for built up offshore system, Shoring for deep cutting, Large reservoir construction, well points, Dewatering for underground open excavation. | | | | | | |
| UNIT II | SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS | | | | 9 | |
| Vacuum dewatering of concrete flooring, Concrete paving technology, Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections, Erection techniques of tall structures, Large span structures - launching techniques for heavy decks, in-situ prestressing in high rise structures, Post tensioning of slab, aerial transporting, Handling and erecting lightweight components on tall structures, metal deck concrete flooring/roofing | | | | | | |
| UNIT III | CONSTRUCTION OF SPECIAL STRUCTURES | | | | 9 | |
| Erection of lattice towers - Rigging of transmission line structures, Construction sequence in cooling towers, Silos, chimney, sky scrapers- Bow string bridges, Cable stayed bridges, Launching and pushing of box decks, Construction of jetties and break water structures, Construction sequence and methods in domes, Support structure for heavy equipment and machinery in heavy industries, Erection of articulated structures and space decks, precast concrete erection/temporary propping/connections | | | | | | |
| UNIT IV | REHABILITATION AND STRENGTHENING TECHNIQUES | | | | 9 | |
| Seismic retrofitting; Strengthening - Strengthening of beams, Strengthening of columns, Strengthening of slab, Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation, Micro piling and underpinning for strengthening floor and shallow profile, Sub grade water proofing, Soil Stabilization techniques. | | | | | | |
| UNIT V | DEMOLITION | | | | 9 | |
| Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | explain the substructure construction techniques. | | | | Understanding (K2) | |

| | | |
|-----|--|--------------------|
| CO2 | interpret the modern construction techniques to be used superstructures | Understanding (K2) |
| CO3 | understand the construction techniques of special structures. | Understanding (K2) |
| CO4 | identify the rehabilitation and strengthening techniques for beam, columns and masonry structures. | Applying (K3) |
| CO5 | identify the Safety precaution in Demolition and Dismantling. | Applying (K3) |

TEXT BOOKS

1. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 2018
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 2012.

REFERENCES

1. Peter.H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., Press, 2008.
2. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 2005
3. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008
4. Dr.R.Vigneshwaran and Dr.A.Ravi " Advanced Construction Techniques", Sruthi publishers.2015

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | 3 | 3 | - | 2 | - | - | - | - | - | 3 | 3 | 3 |
| CO2 | 3 | - | 3 | 2 | - | 2 | - | - | - | - | - | 3 | 3 | 2 |
| CO3 | 2 | - | 3 | 3 | - | 3 | - | - | - | - | - | 3 | 2 | 3 |
| CO4 | 3 | - | 2 | 2 | - | 2 | - | - | - | - | - | 3 | 1 | 2 |
| CO5 | 1 | - | 3 | 3 | - | 2 | - | - | - | - | - | 3 | 2 | 2 |



| | | | | | | |
|---|--|---|---|---|----------------------------------|-----------|
| CE23256 | BUILDING INFORMATION MODELING | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | know the evolution of BIM. | | | | | |
| 2 | characterize BIM – based Workflows. | | | | | |
| 3 | select appropriate tooling for BIM. | | | | | |
| 4 | design and document the data for various building projects. | | | | | |
| 5 | familiarize the emerging digital trends in Information collection and modelling. | | | | | |
| UNIT I | EVOLUTION OF BIM AND DATA MANAGEMENT | | | | 9 | |
| Overview of BIM - Brief History and development of different technologies of AEC, Project Life cycle, Role of BIM in Pre-Construction Collaborative Engagement Challenges and Opportunities in implementing BIM, Component Presentation Style and Data Organization Common Data Environment (CDE) Naming Conventions, Model Hierarchy and Data Structures, Drawing and Compliance Checking Interdisciplinary checks (IDC) Current Standards for implementing BIM. | | | | | | |
| UNIT II | WORKFLOWS IN BIM | | | | 9 | |
| BIM-based workflows in the construction process, Assets and Asset management, Collaboration platforms, Established Standards, Information Security and standards, Interoperability of Data, Standards for workflow. | | | | | | |
| UNIT III | TOOLS AND MATURITY LEVELS OF BIM | | | | 9 | |
| People, Technology and Processes in BIM Tools for Architecture, Structural analysis and detailing, Construction sequencing, HVAC, Plumbing and Drainage, Electrical Studies, climate studies Project documentation in BIM. BIM Maturity levels - Overview of 3D, 4D, 5D, 6D and 7D BIM, Level of Detail (LOD), LOD Responsibility Matrix. | | | | | | |
| UNIT IV | CONSTRUCTION MODELLING | | | | 9 | |
| Site Model Architecture Model Mechanical ventilation and Air conditioning Model, Plumbing and Water Supply Model, Drainage and Sewerage Model, Fire Services Model Electrical Model Specialist Systems Model | | | | | | |
| UNIT V | EMERGING TRENDS | | | | 9 | |
| LIDAR, Photogrammetry, GIS, Satellite imagery, Drone-based surveys, as inputs for the BIM Model - BIM for: Additive manufacturing, prefabrication, construction automation, Internet of Things (IoT), Augmented Reality / Virtual Reality / Mixed Reality for Operation efficiency. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | implement the principle of BIM in construction. | | | | Applying (K3) | |
| CO2 | generate suitable workflows executing a BIM- based project. | | | | Applying (K3) | |
| CO3 | choose the appropriate BIM tool in projects. | | | | Analyzing (K4) | |
| CO4 | design a safe and sustainable building as per needs using BIM. | | | | Analyzing (K4) | |

| | | |
|-----|---|---------------|
| CO5 | effectively integrate emerging technologies to enhance the construction efficiency. | Applying (K3) |
|-----|---|---------------|

TEXT BOOKS

1. Hardin, B. and McCool, D., BIM and construction management: proven tools, methods, and work flows. John Wiley and Sons, 2015
2. Issa, R. R. and Olbina, S. (Eds.), Building Information Modeling: Applications and Practices, American Society of Civil Engineers, 2015.

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1. Rafael Sacks, Charles Eastman, Ghang Lee and Paul Teicholz, BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 2018, 3rd Edition, Wiley, USA.
2. Eur Ing Albert Lester, Project Management, Planning and Control - Managing Engineering, Construction and Manufacturing Projects to PMI, APM and BIS Standards, 2017, 7th Edition, Butterworth-Heinemann, 2017
3. Eastman, C., Teicholz, P., Sacks, R. and Liston, C., BIM handbook: A guide to building information. 2011
4. UK. Krygiel, E., and Nies, B., Green BIM: successful sustainable design with building information modeling, John Wiley and Sons, 2008.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 3 | - | - | - | - | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | 1 | 1 | 3 | - | 1 | - | - | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | 1 | 1 | 3 | - | 1 | - | - | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | 1 | 1 | 3 | - | - | - | - | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | 1 | 1 | 3 | - | 3 | - | - | - | 1 | 1 | 3 | 2 |



| | | | | | | | |
|--|--|--|--|---|---|--------------------------------------|-----------|
| CE23257 | CONSTRUCTION QUALITY AND SAFETY MANAGEMENT | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand about quality management in construction. | | | | | | |
| 2 | gain knowledge of quality assurance and control. | | | | | | |
| 3 | learn safety programmes in construction. | | | | | | |
| 4 | impart knowledge about designing of construction safety. | | | | | | |
| 5 | understand about construction accidents. | | | | | | |
| UNIT I | QUALITY MANAGEMENT | | | | | | 9 |
| Introduction; Definitions and objectives - Factors influencing construction quality, Responsibilities and authority, Quality plan, Quality Management Guidelines, Quality circles Quality Policy, Objectives and methods in Construction industry, Consumers satisfaction, Ergonomics; Time of Completion -Statistical tolerance, Taguchi's concept of quality, Codes and Standards, Documents; Contract and construction programming - Inspection procedures, Processes and products, Total QA / QC programme and cost implication. | | | | | | | |
| UNIT II | QUALITY ASSURANCE AND CONTROL | | | | | | 9 |
| Objectives - Regularity agent, owner, design, contract and construction oriented objectives; Methods, Techniques and needs of QA/QC; Different aspects of quality - Appraisals, Factors influencing construction quality, Critical, major failure aspects and failure mode analysis; Stability methods and tools; optimum design - Reliability testing, reliability coefficient and reliability prediction. | | | | | | | |
| UNIT III | SAFETY PROGRAMMES | | | | | | 9 |
| Problem Areas in Construction Safety; Elements of an Effective Safety Programme; Job Site Safety Assessment - Safety Meetings, Safety Incentives. | | | | | | | |
| UNIT IV | DESIGNING FOR SAFETY | | | | | | 9 |
| Safety Culture - Safe Workers, Safety and First Line Supervisors, Safety and Middle Managers, Top Management Practices; Company Activities and Safety - Safety Personnel, Sub contractual Obligation, Project Coordination and Safety Procedures; Workers Compensation. | | | | | | | |
| UNIT V | CONSTRUCTION ACCIDENTS | | | | | | |
| Accidents and their Causes; Human Factors in Construction Safety; Costs of Construction Injuries; Occupational and Safety Hazard Assessment; Legal Implications. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | apply quality control aspects in planning and management. | | | | | Applying (K3) | |
| CO2 | learning concepts of quality assurance and control techniques in construction. | | | | | Applying (K3) | |
| CO3 | explain the various safety concepts and requirements applied to construction projects. | | | | | Applying (K3) | |

| CO4 | applying design for safety in construction industry. | Applying (K3) | | | | | | | | | | | | |
|--|---|---------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| CO5 | learn to avoid construction accidents, suggest safety programmes. | Applying (K3) | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", McGraw Hill, 2018. | | | | | | | | | | | | | | |
| 2. Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 2019. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Hutchins.G, ISO 9000:2018 A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification, Viva Books Pvt. Ltd., 2018. | | | | | | | | | | | | | | |
| 2. James, J.O' Brian, "Construction Inspection Handbook"--Total Quality Management, Van Nostrand, 2013. | | | | | | | | | | | | | | |
| 3. John L. Ashford, "The Management of Quality in Construction", E & F.N.Spon, 2001. | | | | | | | | | | | | | | |
| 4. Steven McCabe, "Quality Improvement Techniques in Construction", Addison Wesley Longman Ltd, 2016. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | 2 | 1 | 1 | 1 | - | 2 | 1 | 2 | 3 |
| CO2 | 3 | 3 | - | - | - | 2 | 1 | 2 | 1 | - | 3 | 2 | 3 | 1 |
| CO3 | 2 | 3 | - | - | - | 3 | 2 | 2 | 2 | - | 3 | 2 | 2 | 1 |
| CO4 | 2 | 2 | - | - | - | 3 | 2 | 3 | 2 | - | 3 | 2 | 1 | 1 |
| CO5 | 2 | 2 | - | - | - | 3 | 1 | 3 | 2 | - | 2 | 1 | 1 | 3 |



| | | | | | | | |
|--|--|--|--|---|---|--------------------------------------|-----------|
| CE23351 | GEOLOGY AND ROCK ENGINEERING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand geology's role in civil engineering | | | | | | |
| 2 | know the properties of common rock-forming minerals. | | | | | | |
| 3 | classify rocks and understand their mechanical behavior. | | | | | | |
| 4 | learn geological structures and rock engineering properties. | | | | | | |
| 5 | analyze and stabilize rock slopes and foundations. | | | | | | |
| UNIT I | PHYSICAL GEOLOGY | | | | | | 9 |
| Significance of Geology in Civil Engineering; Internal structure of the Earth; Weathering: types, engineering classification of weathered rocks and relevance to Civil Engineering; Plate tectonics and its relevance to earthquakes. | | | | | | | |
| UNIT II | MINERALOGY | | | | | | 9 |
| Physical and Chemical properties of common rock forming minerals: Quartz family, Feldspar family, Mica (Muscovite, Biotite and Vermiculite), Pyroxene (Augite and Hypersthene), Amphibole (Hornblende), Calcite, Gypsum and Clay minerals and their significance. | | | | | | | |
| UNIT III | CLASSIFICATION OF ROCKS | | | | | | 9 |
| Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock , Behaviour of rock under hydrostatic compression and deviatric loading; Hock and brown strength criteria for rocks with discontinuity sets. | | | | | | | |
| UNIT IV | ROCK ENGINEERING | | | | | | 9 |
| Attitudes of beds: Strike and Dip measurements; Different types of folds, faults, and joints in rocks; Geomechanical properties of rocks: Rock Quality Designation (RQD), Rock Mass Rating (RMR) and Geological Strength Index (GSI) . | | | | | | | |
| UNIT V | SLOPE STABILITY OF ROCKS | | | | | | 9 |
| Rock slopes - role of discontinuities in slope failure, slope analysis, and factor of safety; remedial measures for critical slopes; bearing capacity of foundations on rocks; stabilization of rocks – rock support and rock reinforcement - active and passive supports. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | recall Earth structure, weathering, and geological processes. | | | | | Remembering (K1) | |
| CO2 | understand mineral properties and their civil engineering relevance. | | | | | Understanding (K2) | |
| CO3 | apply rock classification and behavior analysis. | | | | | Applying (K3) | |
| CO4 | analyze geological features and their impact on rocks. | | | | | Analyzing (K4) | |
| CO5 | evaluate and stabilize rock slopes and foundations. | | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|--|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Parbin Singh, A Textbook of Engineering and General Geology, S. K. Kataria and Sons, 2021 | | | | | | | | | | | | | | |
| 2. Ramamurthy, T. - Engineering in Rocks for slopes, foundations and tunnels, Prentice Hall of India 2007. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Hoek, E. and Brown, E. T. - Underground Excavation in Rock, Institution of Mining and Metallurgy, 1982. | | | | | | | | | | | | | | |
| 2. Venkat Reddy, D. "Engineering Geology", Vikas Publishing House Pvt. Ltd, 2021. | | | | | | | | | | | | | | |
| 3. Goodman, R.E., Introduction to rock mechanics, John Willey and Sons, 1989. | | | | | | | | | | | | | | |
| 4. Jaeger, Cook, Zimmerman, Fundamentals of Rock Mechanics, Fourth Edition, Blackwell Publishing, USA, 2007 | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | 2 | 3 | - | 1 | 3 | 2 | - | 2 | - | - | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | - | 2 | 2 | 1 | - | 1 | - | - | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | - | 3 | 2 | 1 | - | - | - | - | 3 | 2 |
| CO4 | 3 | 3 | 3 | 2 | - | 3 | 3 | 1 | - | - | - | - | 3 | 3 |
| CO5 | 2 | 2 | 3 | 1 | - | 3 | 3 | 3 | - | - | - | - | 3 | 3 |



| | | | | | | |
|---|---|---|---|---|--------------------------------------|-----------|
| CE23352 | SOIL DYNAMICS AND MACHINE FOUNDATIONS | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the fundamentals of vibration | | | | | |
| 2 | learn concept of wave propagation and the dynamic properties of soil | | | | | |
| 3 | understand soil modelling for cyclic loading | | | | | |
| 4 | analyze and design the machine foundation | | | | | |
| 5 | understand the principles of vibration isolation | | | | | |
| UNIT I | THEORY OF VIBRATION | | | | 9 | |
| Introduction - Nature of dynamic loads, Basic definitions, Simple harmonic motion, Fundamentals of vibration, Single degree and multi degree of freedom systems, Free vibrations of spring, Mass systems, Forced vibrations, Resonance, Viscous damping, Principles of vibrations measuring systems, Effect of transient and pulsating loads. | | | | | | |
| UNIT II | DYNAMIC SOIL PROPERTIES | | | | 9 | |
| Dynamic stress-strain characteristics - Principles of measuring dynamic properties, Laboratory techniques, Field tests, Block vibration test, Factors affecting dynamic properties, Typical values. Mechanism of liquefaction, Influencing factors, Evaluation of liquefaction potential, Analysis from SPT test, Dynamic bearing capacity, Dynamic earth pressure. | | | | | | |
| UNIT III | MACHINE FOUNDATIONS | | | | 9 | |
| Introduction - Types of machine foundations - General requirements for design of machine foundations, Design approach for machine foundation, Vibration analysis, Elastic Half-Space theory, Mass-spring, dashpot model, Permissible amplitudes, Permissible bearing pressures. | | | | | | |
| UNIT IV | DESIGN OF MACHINE FOUNDATIONS | | | | 9 | |
| Evaluation of design parameters – Types of Machines and foundations, General requirements, Analysis and design of block type and framed type machine foundations, Modes of vibration of a rigid foundation, Foundations for reciprocating machines, impact machines, Two Cylinder vertical compressor, Double-acting steam hammer, Codal recommendations, Empirical approach, Barken's method, Bulb of pressure concept, Pauw's analogy, Vibration table studies. | | | | | | |
| UNIT V | VIBRATION ISOLATION | | | | 9 | |
| Vibration isolation - Types of isolation, Transmissibility, Passive and active isolation, Methods of isolation, Use of springs and damping materials, Properties of isolating materials, Vibration control of existing machine foundation. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | acquire knowledge to apply theories of vibration to solve dynamic soil problems | | | | Understanding (K2) | |

| | | |
|-----|---|----------------|
| CO2 | evaluate the dynamic properties of soil using laboratory and field tests. | Analyzing (K4) |
| CO3 | acquire basic knowledge about machine foundations and design various types of machine foundation. | Analyzing (K4) |
| CO4 | know and capable of selecting the types of vibration isolation materials. | Analyzing (K4) |
| CO5 | apply vibration isolation techniques for various field problems. | Analyzing (K4) |

TEXT BOOKS

1. Das B.M and Ramanna G.V., Principles of soil dynamics 2nd Edition, Cengage learning, Stanford, USA, 2011.
2. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd. New Delhi, 2010.

REFERENCES

1. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International series, Pearson Education (Singapore) Pvt Ltd, 2004.
2. Prakash, S. and Puri, V. K., Foundation for machines: Analysis and Design, John Wiley & Sons, New York, 2008.
3. Bowles, J.E., "Foundation Analysis and Design", McGraw Hill Education, 5th Edition, 2015.
4. K. G. Bhatia, Foundations For Industrial Machines, D-CAD Publishers, 2008.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | 2 | 2 | - | - | - | - | 3 | 2 | 3 |
| CO2 | 2 | 2 | 2 | 2 | - | 2 | - | - | 2 | - | - | 3 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 2 | - | 3 | 2 | - | - | - | - | 3 | 2 | 3 |
| CO4 | 2 | 2 | 2 | 2 | - | 2 | 2 | - | - | - | - | 3 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 2 | - | 2 | 2 | - | 2 | - | - | 3 | 2 | 2 |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23353 | GROUND IMPROVEMENT TECHNIQUES | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the processes involved in the formation of rocks, soils and soil profiles. | | | | | |
| 2 | know the techniques adopted for ground improvement with respect to hydraulic modification. | | | | | |
| 3 | learn the methodologies and applications of compaction techniques. | | | | | |
| 4 | explore the different types of soil reinforcement techniques and applications. | | | | | |
| 5 | study the mechanism and concept related to grouting techniques. | | | | | |
| UNIT I | FORMATION AND DEVELOPMENT OF GROUND | | | | 9 | |
| Formation of Rock, Soil and Soil Profile - Types of weathering; Soil Distribution in India; Alterations of Ground after formation; Reclaimed Soils; Natural Offshore Deposits; Ground Improvement Potential; Classifications of Ground Improvement Techniques. | | | | | | |
| UNIT II | HYDRAULIC METHOD | | | | 9 | |
| Dewatering - Objectives; Dewatering methods - Well points system, Vacuum method, Electro osmotic method; Groundwater and Seepage Control; Compressibility of Soils and Consolidation; Preloading and Surcharge Fills; Monitoring of Compression; Vertical drains. | | | | | | |
| UNIT III | MECHANICAL METHOD | | | | 9 | |
| Compaction mechanics - Densification; Surface compaction - Static compaction and Dynamic compaction; Selection of field compaction procedure; Compaction quality control; Vibro compaction - Vibro displacement compaction. | | | | | | |
| UNIT IV | EARTH REINFORCEMENT | | | | 9 | |
| Soil Reinforcement - Materials, Columns formed In-situ; Reinforced Earth wall - Mechanism, ; Applications of reinforced earth - Ground anchors, Soil nailing and Micropiles; Geosynthetics - Types and Properties of Geosynthetics; Application of Geosynthetics | | | | | | |
| UNIT V | GROUTING TECHNIQUES | | | | 9 | |
| Grouting - Necessity, Materials, Types of grouts, Suspension, Solution grouts and Compaction grouting; Grouting procedure - Pre-grouting Site Investigation; Grout Characteristics; Grout Injection methods - Grout Injection measurements and monitoring; Modifications using admixtures; Applications. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | identify different types of weathering and their effects on soil. | | | | Remembering (K1) | |
| CO2 | recognize the concept of soil compressibility and consolidation. | | | | Remembering (K1) | |
| CO3 | interpret the process of vibro-compaction and displacement. | | | | Understanding (K2) | |
| CO4 | describe the applications of ground anchors, soil nailing, and micropiles. | | | | Understanding (K2) | |
| CO5 | apply appropriate grouting methods based on site conditions. | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Purushothama Raj , "Ground Improvement Techniques", Tata McGraw Hill Publishing Company, New Delhi, 2016. | | | | | | | | | | | | | | |
| 2. Satyendra Mittal , "An Introduction to Ground Improvement Engineering", Scientific International Private Limited, New Delhi, 2013. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Joseph E Bowles , "Foundation Analysis and Design", McGraw Hill Companies. Inc., New York, 2011. | | | | | | | | | | | | | | |
| 2. Shashi K Gulhati , Manoj Datta , "Geotechnical Engineering", Tata McGraw Hill Education (P) Ltd., New Delhi, 2010. | | | | | | | | | | | | | | |
| 3. Kenneth D Weaver , Donald A Bruce , "Dam Foundation Grouting", ASCE Press, Virginia, 2007. | | | | | | | | | | | | | | |
| 4. Han,J., Principles and Practice of Ground Improvement, John Wiley and Sons, New Jersey, Canada 2015. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO2 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO3 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | - | - | - | 2 | 3 | - |
| CO4 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | - | - | - | 2 | 2 | - |



| | | | | | | |
|---|--|---|---|---|----------------------------------|-----------|
| CE23354 | GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the history and mechanism of reinforced soil. | | | | | |
| 2 | explore various reinforcing materials and their impact on soil reinforcement. | | | | | |
| 3 | learn the design of reinforced soil retaining structures. | | | | | |
| 4 | know the various types of geosynthesis, their function and applications. | | | | | |
| 5 | develop the reinforced slopes for static and seismic loading. | | | | | |
| UNIT I | PRINCIPLES AND MECHANISMS OF SOIL REINFORCEMENT | | | | 9 | |
| Historical Background – Principles, Concepts and Mechanisms of reinforced earth; Soil - Geosynthetics interaction mechanism, Interface resistance, Factors influencing interaction; Strain compatibility. | | | | | | |
| UNIT II | REINFORCING MATERIALS AND THEIR PROPERTIES | | | | 9 | |
| Materials used in reinforced soil structures - Fill materials, Reinforcing materials metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojutes; Geofoam, Natural fibers - Facing elements; Influence of environmental factors on the performance of Geosynthetic materials - Physical, Mechanical, Hydraulic and Endurance properties testing. | | | | | | |
| UNIT III | DESIGN FOR SOIL REINFORCEMENT | | | | 9 | |
| Reinforcing the soil; Geotextiles and Geogrids; Retaining wall - Embankment; Unpaved roads - Paved roads; Railway tracks - Shallow foundations; Seismic aspects - Dynamic response improvement of reinforced soil systems. | | | | | | |
| UNIT IV | DESIGN FOR FILTRATION, DRAINAGE AND CONTAINMENT | | | | 9 | |
| Geotextile filter - Filtration Mechanism - Factors affecting filter behaviour, Filtration design; Drains - Drainage in embankments, Erosion control silt fences, Containment ponds; Reservoirs and Canals; Hydraulic tunnels; River bed and bank protection. | | | | | | |
| UNIT V | DESIGN OF REINFORCED SLOPES | | | | 9 | |
| Type and orientation of Geosynthetics; Function of reinforcement against slope failure - Stability analysis - Design aspects; Embankments - Basal reinforcement; Seismic aspects - General construction aspects. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | identify the mechanisms involved in soil-geosynthetics interaction. | | | | Remembering (K1) | |
| CO2 | recognize the effects of environmental conditions on geosynthetic performance. | | | | Remembering (K1) | |
| CO3 | interpret seismic aspects and dynamic response of reinforced soil systems. | | | | Understanding (K2) | |
| CO4 | describe the drainage design for embankments using geosynthetics. | | | | Understanding (K2) | |
| CO5 | apply geosynthetics for enhancing slope stability under static loads. | | | | Applying (K3) | |

TEXT BOOKS

1. John, N.W.M., Geotextiles, John Blackie and Sons Ltd., London, 2007.
2. Sivakumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics University Press (India), Pvt. Ltd., Hyderabad, 2006.

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1. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.
2. Jones, C.J.F.P., Earth Reinforcement and Soil Structures, Earthworks, London, 1998.
3. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.
4. Muller, W.W. HDPE Geomembranes in Geotechnics, Springer, New York 2007.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | - | 1 | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | - | 1 | 2 | 2 | - | - | - | - | 2 | 3 | - |
| CO3 | 3 | 1 | 2 | - | 1 | 3 | 2 | - | - | - | - | 2 | 2 | - |
| CO4 | 3 | 2 | 2 | - | 1 | 2 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | 1 | 3 | - | 1 | 2 | 2 | - | - | - | - | 2 | 2 | 1 |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23355 | ADVANCED FOUNDATION ENGINEERING | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | analyze the sheet pile wall under different support conditions. | | | | | |
| 2 | evaluate the overall stability of well foundations. | | | | | |
| 3 | apply the fundamentals of soil dynamics to machine foundation analysis. | | | | | |
| 4 | investigate problems related to expansive soils and solutions to overcome them. | | | | | |
| 5 | analyze slope stability under various conditions using graphical methods. | | | | | |
| UNIT I | SHEET PILE STRUCTURES AND COFFERDAMS | | | | 9 | |
| Sheet pile structures - cantilever sheet pile walls in granular and cohesive soils, Anchored bulk heads, Free earth support and fixed earth support methods, Anchors. | | | | | | |
| UNIT II | COFFERDAMS AND WELL FOUNDATIONS | | | | 9 | |
| Cofferdams - types, cellular cofferdam, uses; Design by Tennessee Valley Authority method and Cumming's method; Well foundations - Types of caissons, Analysis of well foundations, determination of scour depth, staining thickness, well sinking. | | | | | | |
| UNIT III | MACHINE FOUNDATIONS AND VIBRATIONS | | | | 9 | |
| Foundations subjected to vibrations - elements of vibrations, Free, damped, free and forced vibrations; Design criteria - Pauw's analogy, IS Code of practice for impact and reciprocating machines. | | | | | | |
| UNIT IV | FOUNDATION DRAINAGE AND EXPANSIVE SOILS | | | | 9 | |
| Foundation drainage and water proofing - Dewatering well points system, sand drains; Foundations in expansive soils – Mechanism, factors influencing swelling - Use of Geo synthetics. | | | | | | |
| UNIT V | SLOPE STABILITY AND EARTH RETAINING STRUCTURES | | | | 9 | |
| Stability analysis of slopes - infinite slopes in sand and clays, finite slope, Swedish circle, stability of earth dam slope during steady and sudden draw down, friction circle method, Taylor's stability number; Sheet pile structures - Anchored bulk heads. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | illustrate the forces acting on sheet pile walls under different loading conditions. | | | | Understanding (K2)) | |
| CO2 | recognize the different types of well foundations and their functional applications. | | | | Applying (K3) | |
| CO3 | validate soil parameter estimations through field and laboratory testing methods. | | | | Applying (K3) | |
| CO4 | identify the characteristics and challenges associated with expansive, collapsible, and loose soils. | | | | Applying (K3) | |
| CO5 | examine slope behavior using graphical techniques | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. "Advanced Foundation Engineering" by V.N.S. Murthy: 2007 ISBN: 978-8123915067 | | | | | | | | | | | | | | |
| 2. "Advanced Foundation Engineering" by T.G. Sitharam Edition 2020 ISBN: 978-1498796859 Publisher: Taylor and Francis Group | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. "Foundation Engineering Handbook" edited by Robert W. Day Edition 2 nd Edition 2010. | | | | | | | | | | | | | | |
| 2. "Pile Design and Construction Practice" by Michael Tomlinson and John Woodward 6th Edition 2014. | | | | | | | | | | | | | | |
| 3. Das, B.M., Principles of Geotechnical Engineering, Fourth Edition, The PWS series in Civil Engineering, 1998. | | | | | | | | | | | | | | |
| 4. "Foundation Engineering: Analysis and Design" by An-Bin Huang and Hai-Sui Yu 2018. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | - | 2 | 2 | 1 | 1 | - | - | - | - | 1 |
| CO2 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 | 1 | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 1 | 1 | - | - | - | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | - | 2 | 2 | 1 | 1 | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 1 | 1 | - | - | - | 1 | 3 |



| | | | | | | |
|--|--|---|---|---|------------------------|-----------|
| CE23356 | SOIL EXPLORATION AND INVESTIGATION | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the planning and methods of exploration. | | | | | |
| 2 | study the appropriate technique for soil exploration. | | | | | |
| 3 | classify soil strata using direct and in direct methods. | | | | | |
| 4 | gain knowledge on field testing in soil exploration. | | | | | |
| 5 | study about instrumentation in soil engineering. | | | | | |
| UNIT I | PLANNING OF EXPLORATION AND GEOPHYSICAL METHODS | | | | 9 | |
| Scope and objectives - planning an exploration program; methods of exploration - exploration for preliminary and detailed design, spacing and depth of bores, data presentation; Geophysical exploration and interpretation; seismic and electrical methods - cross bore hole, single bore hole, up hole, down hole methods. | | | | | | |
| UNIT II | EXPLORATION TECHNIQUES | | | | 9 | |
| Methods of boring and drilling - non-displacement and displacement methods; drilling in difficult subsoil conditions; limitations of various drilling techniques, stabilization of boreholes; bore logs. | | | | | | |
| UNIT III | SOIL SAMPLING | | | | 9 | |
| Sampling Techniques - quality of samples, factors influencing sample quality; disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples. | | | | | | |
| UNIT IV | FIELD TESTING IN SOIL EXPLORATION | | | | 9 | |
| Field tests - penetration tests, Field vane shear - Insitu shear and bore hole shear test, pressure meter test, dilatometer test, plate load test, monotonic and cyclic; field permeability tests; Block vibration test - Procedure, limitations, correction and data interpretation of all methods. | | | | | | |
| UNIT V | INSTRUMENTATION | | | | 9 | |
| Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements; slope indicators, sensing units; case studies. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped | |
| | | | | | (Highest Level) | |
| CO1 | relate different methods of soil exploration. | | | | Understanding (K2) | |
| CO2 | illustrate the appropriate techniques for soil exploration.. | | | | Understanding (K2) | |
| CO3 | identify soil strata using direct and in direct methods. | | | | Applying (K3) | |
| CO4 | utilize the field testing in soil exploration. | | | | Applying (K3) | |
| CO5 | apply various instruments in soil engineering. | | | | Applying (K3) | |

TEXT BOOKS

1. Gopal Ranjan and Rao, A.S.R, Basic and Applied Soil Mechanics, Wiley Eastern Limited, 2016.
2. Dunicliff, J. and Green, G.E, Geotechnical Instrumentation for Monitoring Field Performance, John Wiley and Sons, 1993.

REFERENCES

1. Bowles, J.E, Foundation Analysis and Design, McGraw-Hill International edition, 1997.
2. Bowles, J.E, Physical and Geotechnical Properties of Soil, McGraw-Hill Book Company, 1985.
3. Lunne, T., Robertson, P.K. and Powell, J.J.M, Cone Penetration Testing in Geotechnical Practice, Blackie Academic and Professional, 1997.
4. All related ASTM codes and Eurocode 7 - Part 2.

CO-PO MAPPING :

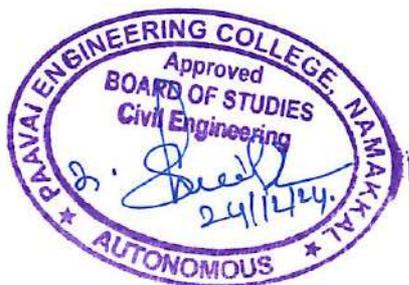
Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | - | 2 | 2 | 1 | 1 | - | - | - | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 | 1 | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 1 | 1 | - | - | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | - | 2 | 2 | 1 | 1 | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 1 | 1 | - | - | - | 3 | 3 |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23357 | GEO-ENVIRONMENTAL ENGINEERING | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | introduce the role and significance of geoenvironmental engineering. | | | | | |
| 2 | describe advection, diffusion, and dispersion processes. | | | | | |
| 3 | understand the working of barrier and cover systems. | | | | | |
| 4 | differentiate between liner materials and leachate systems. | | | | | |
| 5 | compare different waste materials for soil improvement. | | | | | |
| UNIT I | SOIL WASTE INTERACTION | | | | 9 | |
| Role of Geo-Environmental Engineering; Sources, Generation and Classification of wastes; Causes and Consequences of soil pollution - Case studies in soil failure - Factors influencing soil pollutant interaction; Modification of index, chemical and Engineering properties; Physical and physiochemical mechanisms. | | | | | | |
| UNIT II | CONTAMINANT TRANSPORT AND SITE CHARACTERISATION | | | | 9 | |
| Transport of contaminant in subsurface - Advection, Diffusion and Dispersion; Chemical process and Biological process - Sorption, Desorption, Precipitation, Dissolution, Oxidation, Complexation, Ion exchange, Volatization and Biodegradation; Characterization of contaminated sites - Soil and rock data - Hydrological and Chemical data - Analysis and evaluation. | | | | | | |
| UNIT III | REMEDICATION OF CONTAMINATED SITES | | | | 9 | |
| In-situ containment - Vertical and Horizontal barrier - Surface cover; Ground water pumping system on subsurface drain; Soil remediation - Soil vapour extraction, Soil waste stabilization, Solidification of soils, Electrokinetic remediation, Soil heating, Vitrification, Bio remediation, Phyto-remediation; Ground water remediation - Pump and treat, In-situ flushing, Permeable reacting barrier and In-situ air sparging. | | | | | | |
| UNIT IV | LANDFILLS AND SURFACE IMPOUNDMENTS | | | | 9 | |
| Source and Characteristics of waste; Site selection for landfills - Components of landfills; Liner soil, Geomembrane, Geosynthetic clay, Geo-composite liner system; Leachate collection; Final cover design; Monitoring landfill - Environmental laws and regulations. | | | | | | |
| UNIT V | STABILISATION OF WASTE | | | | 9 | |
| Evaluation of waste materials - Flyash, Municipal sludge, Plastics, Scrap tire, Blast furnace slag, Construction waste and Wood waste; Physical, Chemical and Biological characteristics; Potential reuse - Utilization of waste and soil stabilization. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | list changes in index and engineering properties of polluted soil. | | | | Remembering (K1) | |
| CO2 | recognize methods used for site characterization. | | | | Remembering (K1) | |
| CO3 | comprehend the integration of remediation systems. | | | | Understanding (K2) | |
| CO4 | interpret environmental laws related to landfills. | | | | Understanding (K2) | |
| CO5 | apply sustainable engineering practices using waste. | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004. | | | | | | | | | | | | | | |
| 2. Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London, 1993. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England,1995. | | | | | | | | | | | | | | |
| 2. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989. | | | | | | | | | | | | | | |
| 3. Lagrega, M.d., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore, 1994. | | | | | | | | | | | | | | |
| 4. Ott, W.R., Environmental Indices, Theory and Practice, Ann Arbor, 1978. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO2 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO3 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO4 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 3 | - |
| CO5 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 1 | - |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23451 | CLIMATE CHANGE AND ADAPTATION | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | identify and classify earth's climate system including ozone dynamics, greenhouse gases, and global warming. | | | | | |
| 2 | understand atmospheric properties and their impact on climate and pollution dispersion. | | | | | |
| 3 | apply climate change causes, effects, and risks across key sectors. | | | | | |
| 4 | examine global and national climate policies and agreements. | | | | | |
| 5 | understand clean development mechanisms, carbon credits, and sustainable technologies. | | | | | |
| UNIT I | EARTHS CLIMATE SYSTEM | | | | 9 | |
| Role of ozone in environment ozone layer- ozone depleting; gases- Green House Effect, Radioactive effects of Greenhouses Gases; Hydrological Cycle, Green House Gases and Global Warming Carbon Cycle. | | | | | | |
| UNIT II | ATMOSPHERE AND ITS COMPONENTS | | | | 9 | |
| Importance of Atmosphere, Physical Chemical Characteristics of Atmosphere, Vertical structure of the atmosphere, Composition of the atmosphere, Atmospheric stability, Temperature profile of the atmosphere; Lapse rates, Temperature inversion , effects of inversion on pollution dispersion. | | | | | | |
| UNIT III | IMPACTS OF CLIMATE CHANGE | | | | 9 | |
| Causes of Climate change, Change of Temperature in the environment Melting of ice Pole, sea level rise, Impacts of Climate Change on various sectors Agriculture, Forestry and Ecosystem; Water Resources Human Health Industry, Settlement and Society Methods and Scenarios Projected Impacts for Different Regions Uncertainties in the Projected Impacts of Climate Change Risk of Irreversible Changes. | | | | | | |
| UNIT IV | CLIMATE CHANGES AND ITS CAUSES | | | | 9 | |
| Causes of Climate change, Change of Temperature in the environment Melting of ice Pole, sea level rise, Impacts of Climate Change on various sectors Agriculture, Forestry and Ecosystem; Water Resources Human Health Industry, Settlement and Society Methods and Scenarios Projected Impacts for Different Regions Uncertainties in the Projected Impacts of Climate Change Risk of Irreversible Changes. | | | | | | |
| UNIT V | CLIMATE CHANGE AND MITIGATION MEASURES | | | | 9 | |
| Clean Development Mechanism Carbon Trading, Examples of future Clean Technology, Biodiesel, Natural Compost, Eco-Friendly Plastic, Alternate Energy, Hydrogen, Bio-fuels, Solar Energy, Wind Hydroelectric Power, Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices, Energy Supply, Transport, Buildings, Industry, Agriculture Forestry, Carbon sequestration, Carbon capture and storage (CCS), Municipal solid Waste (MSW) and Bio-waste, Biomedical, Industrial waste International and Regional cooperation; AI application in climate management. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | understand climate system, ozone layer, greenhouse gases, and global warming. | | | | Understanding (K2) | |
| CO2 | understand atmospheric structure, composition, and pollution dispersion mechanisms. | | | | Understanding (K2) | |

| | | |
|-----|---|---------------|
| CO3 | apply knowledge to assess climate change impacts on agriculture, water, health, and ecosystems. | Applying (K3) |
| CO4 | explain global and national climate change protocols and policies. | Applying (K3) |
| CO5 | identify the clean technologies, carbon credits, and climate mitigation strategies. | Applying (K3) |

TEXT BOOKS

1. Sangam Shrestha, Mukand S. Babel and Vishnu Prasad Pandey, 2014, Climate Change and Water Resources, CRC Press an imprint of the Taylor and Francis Group.
2. Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.

REFERENCES

1. Maximilian Lackner, Baharak Sajjadi, Wei-Yin Chen Handbook of Climate Change Mitigation and Adaptation, reference work, 2022.
2. The Climate Crisis: What Scientists Need You to Know! by Rahmstorf, S, Columbia University Press, New York, NY, 2018.
3. Climate Change Impacts on Agriculture: Mitigation and Adaptation by Manish Sinha, Springer, 2021.
4. Adaptation and mitigation of climate Scientific Technical Analysis, Cambridge University Press, Cambridge, 2006.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | 2 | 3 | - | - | - | - | 1 | 2 | 2 |
| CO2 | 3 | 2 | - | - | - | 2 | 3 | - | - | - | - | 1 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 1 | 2 | 3 | - | - | 1 | 1 | 2 | 3 | 3 |
| CO4 | 2 | 2 | - | - | - | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 3 |
| CO5 | 3 | 2 | - | - | - | 2 | 3 | - | - | - | - | 1 | 3 | 2 |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23452 | MUNICIPAL SOLID WASTE MANAGEMENT | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand sources, types, and effects of solid waste. | | | | | |
| 2 | explain segregation, storage, collection, and transport methods. | | | | | |
| 3 | describe recycling, recovery, and composting techniques. | | | | | |
| 4 | identify health and environmental impacts of waste and safe practices. | | | | | |
| 5 | understand sanitary landfill design and controls. | | | | | |
| UNIT I | SOLID WASTE GENERATION AND MANAGEMENT SYSTEM | | | | 9 | |
| solid wastes - Sources and types of municipal solid wastes, Generation rate, Factors affecting generation rates characteristics, methods of sampling and characterization, Effects of improper disposal of solid wastes public health and environmental effects; Solid Waste Management - Goals and objectives, Functional Elements in a Solid Waste Management; Municipal Solid Waste (M&H) rules 2016. | | | | | | |
| UNIT II | SEGREGATION, STORAGE, COLLECTION AND TRANSPORTATION | | | | 9 | |
| Segregation and storage of solid waste at source - Onsite handling, collection systems and services, vehicles and equipment for collection, Factors affecting collection, community involvement and role of informal sector in waste collection; transfer stations - types of transport and location of transfer stations. | | | | | | |
| UNIT III | RECYCLING AND RECOVERY | | | | 9 | |
| Processing Techniques - Advantages of recycling, important recycling materials, stages of material recovery in solid waste management chain, principle of unit operations and equipment employed at material recovery facilities; Composting - Aerobic and anaerobic composting, benefits of composting, factors affecting composting process, windrow, aerated static pile, in-vessel and decentralized composting technologies, vermicomposting. | | | | | | |
| UNIT IV | HEALTH ASPECTS AND HOSPITAL WASTE MANAGEMENT | | | | 9 | |
| Impact solid waste during collection and separation - need of public participation, Categories and classification of biomedical waste, Need for disposal, waste segregation, labelling, handling and disposal of biomedical waste Mercury in biomedical waste-Radioactive waste; Thermal treatment technologies - Alternative treatment technologies, Secured landfill - Pandemic effects on waste management. | | | | | | |
| UNIT V | SANITARY LAND FILLING | | | | 9 | |
| Definitions, types of wastes to be accepted at landfills, site selection, essential components of municipal sanitary landfill, landfilling methods, sanitary landfill design, leachate management, active and passive control of landfill gases. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | explain solid waste, sources, types, and impacts. | | | | Understanding (K2) | |
| CO2 | apply segregation, storage, collection, and community roles. | | | | Applying (K3) | |
| CO3 | identify and apply recycling, recovery, and composting techniques | | | | Applying (K3) | |

| | | |
|-----|---|---------------|
| CO4 | apply health and environmental impacts of waste and suggest safe practices. | Applying (K3) |
| CO5 | explain and analyze sanitary landfill components and suitability. | Applying (K3) |

TEXT BOOKS

1. Cherry P .M, "Solid and Hazardous Waste Management", CBS publishers and distributors Pvt Ltd, 2018.
2. Rao M.N, Razia Sultana, Sri Harsha Kota, "Solid and hazardous Waste management-Science and Engineering ,Butterworth-H.einemann, 2016.

REFERENCES

1. Municipal Solid Waste Management Manual", Central Public Health and Environmental Engineering Organisation, Ministry of Urban Development, New Delhi. "CPHEEO 2016.
2. Techobanoglous G., Frank Kreith, "Hand Book of Solid Waste Management", 2nd Ed., McGraw Hill, USA 2002.
3. Qian X, Koerner RM and Gray DH., "Geotechnical Aspects of Landfill Design and Construction", 1st Ed., Prentice Hall, USA 2002.
4. Bhide, A D and Sundaresan B.B, NEERI, "Solid waste management: Collection, Processing and Disposal" Nagpur, 2001.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | 2 | 2 | - | 3 | 2 | 3 | 1 | - | - | 3 | 2 |
| CO2 | 3 | 3 | - | 2 | 3 | - | 2 | 1 | 1 | 1 | - | - | 2 | 1 |
| CO3 | 3 | 3 | - | 2 | 3 | - | 2 | 2 | 2 | 1 | - | - | 1 | 1 |
| CO4 | 3 | 3 | - | 2 | 3 | - | 2 | 2 | 2 | 2 | - | - | 1 | - |
| CO5 | 3 | 3 | - | 2 | 3 | - | 2 | 2 | - | - | - | - | - | 2 |



| | | | | | | |
|---|--|---|---|---|--------------------------------------|-----------|
| CE23453 | ENVIRONMENTAL IMPACT ASSESSMENT | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | impart the knowledge impacts of developmental projects on environment. | | | | | |
| 2 | examine different project options for minimizing environmental impacts. | | | | | |
| 3 | know the concepts of environmental impacts prediction and assessment. | | | | | |
| 4 | make a plan for environmental assessment and management. | | | | | |
| 5 | study the framework for preparedness and risk management in infrastructure planning. | | | | | |
| UNIT I | INTRODUCTION TO IMPACT ASSESSMENT | | | | 9 | |
| Impact of development projects; Sustainable development; Need for Environmental Impact Assessment (EIA); Environmental Impact statement (EIS); EIA Capability and limitations - Legal provisions on EIA - Stages of EIA; Types of EIA; EIA Process. | | | | | | |
| UNIT II | METHODOLOGIES | | | | 9 | |
| Methods of EIA - Impact Identification - Uses; Checklist methodologies - Categories of checklists; Matrices methods - Simple matrices and Stepped matrices; Network methods; Cost benefit analysis - Analysis of alternatives. | | | | | | |
| UNIT III | IMPACT PREDICTION AND ASSESSMENT | | | | 9 | |
| Assessment of impact on land, water, soil, noise, air, flora and fauna; Prediction tools for EIA; Mathematical modeling for impact prediction; Public involvement in the EIA processes - Methods of public involvement. | | | | | | |
| UNIT IV | ENVIRONMENTAL MANAGEMENT PLAN | | | | 9 | |
| Plan for mitigation of adverse impact on Environment - Options for mitigation of impact on land, water, soil noise, air, flora and fauna - Addressing the issues related to the project affected people; Post project monitoring. | | | | | | |
| UNIT V | CASE STUDIES | | | | 9 | |
| EIA for Infrastructure projects - Dams, Highways, Multi storey buildings, Water supply and Drainage projects and Wastewater treatment plants. Preparedness Plans - Design of risk management programs. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | identify the purpose and scope of environmental impact assessment. | | | | Remembering (K1) | |
| CO2 | list out the various methods used for environmental impact identification. | | | | Remembering (K1) | |
| CO3 | illustrate the use of mathematical models in predicting environmental impacts. | | | | Understanding (K2) | |
| CO4 | interpret the importance of post project environmental monitoring. | | | | Understanding (K2) | |
| CO5 | apply the EIA process to evaluate infrastructure projects such as dams and highways. | | | | Applying(K3) | |
| TEXT BOOKS | | | | | | |
| 1. V.S. Kulkarni, "A Handbook of Environment Impact Assessment", Scientific Publishers (P) Ltd., 2023. | | | | | | |
| 2. Anji Reddy, "Environmental Impact Assessment: Theory and Practice", BS Publications, 2014. | | | | | | |

REFERENCES

1. EIA Notification 2006 including recent amendments, by Ministry of Environment, Forest and Climate Change, Government of India.
2. Becker H. A., Frank Vanclay., The International handbook of social impact assessment: conceptual and methodological advances, Edward Elgar Publishing, 2003
3. Lawrence, D.P., Environmental Impact Assessment - Practical solutions to recurrent problems, Wiley - Interscience, New Jersey, 2003.
4. Lee N. and George C., Environmental Assessment in Developing and Transitional Countries. Chichester: Willey, 2000

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | 1 | 2 | - | 2 | 3 | - | - | - | - | 2 | 2 | - |
| CO2 | 2 | 2 | 1 | 2 | 1 | 2 | 3 | - | - | - | - | 2 | 2 | - |
| CO3 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | - | - | - | - | 2 | 2 | - |
| CO4 | 2 | 2 | 1 | 2 | - | 2 | 3 | - | - | - | - | 2 | 2 | - |
| CO5 | 2 | 2 | 1 | 2 | - | 2 | 3 | - | - | - | 2 | 2 | 2 | - |



| | | | | | | |
|---|--|---|---|---|--------------------------------------|-----------|
| CE23454 | MODELS FOR AIR AND WATER QUALITY | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the role and types of models used in environmental management. | | | | | |
| 2 | learn how to sample, measure, and analyze air pollutants and control them effectively. | | | | | |
| 3 | study the design and working of air pollution control devices and dispersion modelling. | | | | | |
| 4 | understand water quality models for rivers, lakes, and estuaries using flow and mixing concepts. | | | | | |
| 5 | learn groundwater pollution modelling, mass transport, and seawater intrusion analysis. | | | | | |
| UNIT | MODELLING CONCEPT | | | | 9 | |
| Environmental management - Role of mathematical models, types of models, model development and validation, model sensitivity, assessing model performance. | | | | | | |
| UNIT II | INTRODUCTION TO SAMPLING, MEASUREMENT, METHODS AND ANALYSIS | | | | 9 | |
| Identify the sources and effect of Air pollution - standards and legislation in India, Role of Meteorology and Natural Purification Processes, Transport and dispersion of air pollutants, Source correction methods; Vehicular pollution control, indoor air quality monitoring and control, Control of specific gaseous pollutants- Control of sulphur dioxide, nitrogen oxides emission. | | | | | | |
| UNIT III | DESIGN AND MODELLING PROTOCOLS FOR AIR | | | | 9 | |
| Principle and design of particulate matter control devices - gravitational settling chambers, cyclone separators, bag house filters, electrostatic precipitators, wet and dry scrubbers, design of gaseous pollutant control devices; Dispersion Modelling and Plume behaviour. | | | | | | |
| UNIT IV | DESIGN AND MODELLING PROTOCOLS FOR WATER | | | | 9 | |
| Historical development of water quality models; rivers and streams water quality modelling - river hydrology depth and velocity and flow - low flow analysis - dispersion and mixing - estuarine transport, Models for lakes - Models for dissolved oxygen; Streeter - Phelps models. | | | | | | |
| UNIT V | GROUNDWATER QUALITY MODELLING | | | | 9 | |
| Mass transport of solutes - application of concepts to predict groundwater contaminant movement - seawater intrusion - basic concepts and modelling | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the types of environmental models and how they are developed and validated. | | | | Understanding (K2) | |
| CO2 | identify air pollution sources, know Indian air quality standards, and apply control methods. | | | | Applying (K3) | |
| CO3 | implement air pollution control devices and explain dispersion and plume behaviour. | | | | Applying (K3) | |

| | | |
|-----|---|---------------|
| CO4 | know about water quality in rivers, lakes, and estuaries using models like Streeter Phelps. | Applying (K3) |
| CO5 | apply groundwater models to study pollutant movement and evaluate seawater intrusion. | Applying (K3) |

TEXT BOOKS

1. Peavy, H., and Rowe, R., "Environmental Engineering", Mc-Graw Hill Publication, 2017.
2. Rao, C.S. "Environmental Pollution Control Engineering", Wiley Eastern Ltd, Delhi 3rd Revised Edition, 2007.

REFERENCES

1. DeNevers., "Air Pollution Control Engineering", McGraw-Hill 3rd Edition, 2017.
2. Metcalf and Eddy, Inc., "Waste water Engineering Treatment and Reuse", 5th Edition, McGraw-Hill 2004.
3. Mark L. Thomann and John A. Mueller "Principles of Surface Water Quality Modeling and Control" Wiley, 3rd Ed., 2012
4. Stern, A.C., "Air pollution Control: Vols 1, 2, 3". 3rd Edition.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | 3 | - | - | 2 | - | - | - | - | 2 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | - | 2 | - | - | - | - | 2 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 2 | - | 2 | - | - | - | - | 2 | 3 | 3 |



| | | | | | | |
|---|---|---|---|---|----------------------------------|-----------|
| CE23455 | INDUSTRIAL WASTE WATER MANAGEMENT | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the sources, characteristics and impacts of industrial wastewater on the environment. | | | | | |
| 2 | impart knowledge on pollution prevention strategies and waste minimization in industries. | | | | | |
| 3 | learn the principles and processes used in the treatment of industrial waste water. | | | | | |
| 4 | gain insight into reuse of wastewater and handling of treatment residues. | | | | | |
| 5 | study industrial processes and wastewater characteristics across sectors. | | | | | |
| UNIT I | SOURCES AND ENVIRONMENTAL ASPECTS | | | | 9 | |
| Industrial scenario in India - Industrial activity and Environment; Uses of water by industry - Sources and types of industrial waste water; Nature and Origin of Pollutants; Industrial waste water and Environmental impacts; Regulatory requirements for treatment of industrial waste water; Industrial waste survey - Industrial wastewater monitoring and sampling - Generation rates, Characterization and variables; Toxicity of industrial effluents and Bioassay tests; Major issues on water quality management. | | | | | | |
| UNIT II | INDUSTRIAL POLLUTION PREVENTION AND MINIMISATION | | | | 9 | |
| Prevention and Control of Industrial Pollution; Benefits and Barriers; Waste Management Hierarchy - Source reduction techniques, Periodic Waste Minimisation Assessments, Evaluation of Pollution Prevention Options; Cost benefit analysis - Pay-back period; Implementing and Promoting Pollution Prevention Programs in Industries. | | | | | | |
| UNIT III | INDUSTRIAL WASTEWATER TREATMENT | | | | 9 | |
| Flow and Load Equalisation; Solids Separation - Removal of Fats, Oil & Grease; Neutralisation; Removal of Inorganic Constituents - Precipitation, Heavy metal removal, Nitrogen and Phosphorous removal, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis and Evaporation; Removal of Organic Constituents - Biological treatment processes, Chemical Oxidation processes, Advanced Oxidation processes. | | | | | | |
| UNIT IV | WASTE WATER REUSE AND RESIDUAL MANAGEMENT | | | | 9 | |
| Individual and Common Effluent Treatment Plants - Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems; Quality requirements for waste water reuse in Industrial purposes; Disposal on water and land; Residuals of industrial wastewater treatment - Quantification and characteristics of Sludge - Thickening, digestion, conditioning, dewatering and disposal of sludge; Management of RO rejects. | | | | | | |
| UNIT V | CASE STUDIES | | | | 9 | |
| Industrial manufacturing process description; Waste water characteristics; Source reduction options and waste treatment flow sheet for Textiles, Tanneries, Pulp and paper, metal finishing and Sugar and Distilleries. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | identify various types and sources of industrial wastewater and their environmental implications. | | | | Remembering (K1) | |
| CO2 | recognize the cost-benefit aspects of prevention programs. | | | | Remembering (K1) | |
| CO3 | interpret and compare various advanced treatment options. | | | | Understanding (K2) | |
| CO4 | understand the various residual management techniques used for industrial residuals. | | | | Understanding (K2) | |
| CO5 | apply knowledge to design industry specific treatment schemes. | | | | Applying (K3) | |

TEXT BOOKS

1. Industrial wastewater management, Treatment and disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008.
2. Lawrance K. Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis "handbook of Industrial and Hazardous waste Treatment", Second Edition, 2004.

REFERENCES

1. Metcalf and Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017.
2. Nelson Leonard Nemerow, "Industrial waste Treatment", Elsevier, 2007.
3. Soli. J. Arceivala, Shyam. R. Asolekar, Waste water Treatment for pollution control and reuse by Tata McGraw Hill, 2007.
4. Wesley Eckenfelder W., " Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 2000.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO2 | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO3 | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO4 | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO5 | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 2 | 2 | - |



| | | | | | | |
|--|--|---|---|---|----------------------------------|-----------|
| CE23456 | AIR AND NOISE POLLUTION CONTROL ENGINEERING | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | identify and classify different types of air pollutants and noise pollution. | | | | | |
| 2 | understand the sources, classification, and effects of air pollutants. | | | | | |
| 3 | apply different methods of sampling and analysis of air pollutants and noise, including meteorological considerations. | | | | | |
| 4 | know the characteristics and types of gaseous pollutants | | | | | |
| 5 | understand the sources, impacts, and control measures for noise pollution and implement strategies for mitigation | | | | | |
| UNIT I | INTRODUCTION TO AIR POLLUTION | | | | 9 | |
| Atmosphere as a place of disposal of pollutants; Air Pollution - Definition, Air Pollution and Global Climate, Units of measurements of pollutants; Air quality criteria - emission standards, National ambient air quality standards; Air pollution indices - Air quality management in India | | | | | | |
| UNIT II | SOURCES, CLASSIFICATION AND EFFECTS | | | | 9 | |
| Sources and classification of air pollutants - Man made, Natural sources, Type of air pollutants, Pollution due to automobiles; Analysis of air pollutants - Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale. | | | | | | |
| UNIT III | SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING | | | | 9 | |
| Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors – Meteorology, temperature lapse rate and stability, Adiabatic lapse rate, Wind Rose, Inversion, Wind velocity and turbulence, Plume behavior, Dispersion of air pollutants, Air Quality Modeling. | | | | | | |
| UNIT IV | AIR POLLUTION CONTROL MEASURES | | | | 9 | |
| Control - Source correction methods - Control equipment, Particulate control methods, Bag house filter, Settling chamber, cyclone separators, inertial devices, Electrostatic precipitator, scrubber; Control of gaseous emissions - Absorption, Absorption equipment, adsorption and combustion devices (Theory and working of equipments only). | | | | | | |
| UNIT V | NOISE POLLUTION AND ITS CONTROL | | | | 9 | |
| Sources of noise - Units and Measurements of Noise, Characterization of Noise from Construction, Mining, Transportation and Industrial Activities; Airport Noise - General Control Measures, Effects of noise pollution on human beings, plants and animals, auditory effects, non-auditory effects; Noise Menace - Prevention and Control of Noise Pollution, Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent, Permissible limits of Noise. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | understand various types and sources of air pollution and its effects | | | | Understanding (K2) | |

| | | |
|-----|--|------------------|
| CO2 | classify various types of air pollutants and their sources | Remembering (K1) |
| CO3 | apply sampling and measurement techniques for air pollutants. | Applying (K3) |
| CO4 | evaluate control equipment for particulate and gaseous pollutants | Applying (K3) |
| CO5 | identify the sources, effects and control of vehicular, indoor air and noise pollution | Applying (K3) |

TEXT BOOKS

1. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017
2. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2006.

REFERENCES

1. Dr. Y. Anjaneyulu, "Air Pollution and Control Technologies", Allied publishers Pvt. Ltd., 2019.
2. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
3. "Air Prevention and Control of Pollution Act, 1981 As Amended by The Jan Vishwas Act 2023".
4. Principles of Environmental Science and Engineering, P. Venugopala Rao 2006.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | 2 | 3 | - | - | - | - | 2 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 1 | - | 2 | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | - | - | - | - | 2 | 2 | 2 |



| | | | | | | |
|---|--|--|---|---|--------------------------------------|-----------|
| CE23457 | ENVIRONMENTAL POLICY AND LEGISLATION | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the constitutional and international framework for environmental protection. | | | | | |
| 2 | study the legal framework for water pollution control and regulatory mechanisms. | | | | | |
| 3 | examine air pollution laws and enforcement through state and central agencies. | | | | | |
| 4 | learn the responsibilities of local bodies and pollution control boards in waste management. | | | | | |
| 5 | explore contemporary public interest litigation in environmental protection. | | | | | |
| UNIT I | INTRODUCTION TO ENVIRONMENT PROTECTION | | | | | 9 |
| Indian Constitution and Environmental Protection; National Environmental policies; Precautionary Principle and Polluter Pays Principle; Concept of absolute liability; Multilateral Environmental agreements and Protocols - Montreal Protocol, Kyoto agreement, Rio declaration. | | | | | | |
| UNIT II | WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974 | | | | | 9 |
| Power and Functions of regulatory agencies; Responsibilities of occupier provision relating to prevention and control scheme of consent to establish; consent to operate - Conditions of the consents, Outlet; Legal sampling procedures - State Water Laboratory; Appellate Authority - Penalties for violation of consent conditions; Provisions for closure/directions in apprehended pollution situation. | | | | | | |
| UNIT III | AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981 | | | | | 9 |
| Power and Functions of regulatory agencies; Responsibilities of occupier provision relating to prevention and control scheme of consent to establish; consent to operate - Conditions of the consents, Outlet; Legal sampling procedures - State Air Laboratory; Appellate Authority - Penalties for violation of consent conditions; Provisions for closure/directions in apprehended pollution situation. | | | | | | |
| UNIT IV | ENVIRONMENT (PROTECTION) ACT, 1986 | | | | | 9 |
| Genesis of the Act - delegation of powers; Role of Central Government; EIA Notification - Sitting of Industries - Coastal Zone Regulation; Responsibilities of local bodies mitigation scheme for Municipal Solid Waste Management; Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorisation – Biomedical waste rules; Responsibilities of generators and role of Pollution Control Boards. | | | | | | |
| UNIT V | RECENT RULES AND NOTIFICATIONS | | | | | 9 |
| Relevant Provisions of Indian Forest Act; Public Liability Insurance Act; Public Interest Litigation - Writ petitions, Supreme Court Judgments in Landmark cases; National Green tribunals; Recent environmental rules and notifications. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | identify key principles in national and international environmental law. | | | | Remembering (K1) | |
| CO2 | list out the roles, responsibilities and penalties under the water act. | | | | Remembering (K1) | |
| CO3 | understand enforcement procedures and legal responsibilities under the air act. | | | | Understanding (K2) | |

| | | |
|-----|--|--------------------|
| CO4 | interpret the significance of environmental impact assessments and waste rules. | Understanding (K2) |
| CO5 | apply legal knowledge to interpret current environmental policies and court interventions. | Applying (K3) |

TEXT BOOKS

1. Greger I. Megregor, "Environmental law and enforcement", Lewis Publishers, London.2021.
2. Shyam Divan and Armin Roseneranz "Environmental law and policy in India "Oxford University Press, New Delhi, 2001.

REFERENCES

1. Environmental Law Case Book, Lexis Nexis, Butterworths, Mohanty", S. K.,Leelakrishnan. P, Environment and Pollution Law, Universal Law Publishing Co.Pvt. Ltd., 2011.
2. Environmental Law and Policy in India", Shyam Divan and Armin Rosencranz, Oxford University Press, New Delhi, 2005.
3. CPCB, "Pollution Control acts, Rules and Notifications issued there under "Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.
4. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi Bombay.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO3 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO4 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 3 | - |
| CO5 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 3 |



| | | | | | | | |
|--|--|--|--|---|---|--------------------------------------|-----------|
| CE23551 | HARBOUR AND DOCK ENGINEERING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand the importance of Docks and Harbour Engineering for the water transportation. | | | | | | |
| 2 | gain knowledge on techniques of planning and designing the infrastructures. | | | | | | |
| 3 | analyze impact of various natural phenomena and harbor infrastructure. | | | | | | |
| 4 | understand cargo and passenger demand and cargo handling capacity of ports. | | | | | | |
| 5 | know an impact of water transportation and port activities. | | | | | | |
| UNIT I | WATER TRANSPORTATION | | | | | | 9 |
| Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, Canal; Inland water transportation - Development of ports and Harbours, Harbour classification, Site selection and Harbour dimensioning. | | | | | | | |
| UNIT II | NATURAL PHENOMENON | | | | | | 9 |
| Wind, Tides, Water waves - Wave decay and port, wave diffraction, breaking, reflection; Wave action on vertical walls and piles; Littoral drift; sediment transport; Effects on Harbour and structure design. | | | | | | | |
| UNIT III | HARBOUR INFRASTRUCTURES | | | | | | 9 |
| Types of breakwaters - jetty, dock fenders, piers, wharves, dolphin, mooring accessories; Repair facilities, wet docks - lift docks, dry docks, gates for graving docks, floating docks, slipways, locks and gates. | | | | | | | |
| UNIT IV | PORT FACILITY | | | | | | 9 |
| Transit shed, warehouses - cargo handling, container handling; Service for shipping terminals; Inland port facility; Navigational aids - types, requirements of signals, lighthouses, beacon light, buoys; Dredging and coastal protection; Types of dredgers - choices, usage of dredged material, Trends in development of dredging equipment; sea wall protection - sea wall revetment; bulkhead. | | | | | | | |
| UNIT V | PLANNING OF PORTS | | | | | | 9 |
| Regional and intercontinental transportation development; forecasting cargo and passenger demand - regional connectivity - cargo handling capacity of port - economic evaluation of port project; impacts of port activities. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | create an awareness about Docks and Harbour Engineering for the water transportation in the context of regional and intercontinental transportation. | | | | | Remembering (K1) | |
| CO2 | know techniques of planning and designing the infrastructures required for Harbour and Port area. | | | | | Understanding (K2) | |
| CO3 | understand an impact of various natural phenomena on design of port structure and components of harbour infrastructure. | | | | | Understanding (K2) | |
| CO4 | forecast cargo and passenger demand, cargo handling capacity of ports and economic evaluation of port project. | | | | | Applying (K3) | |
| CO5 | determine an impact of water transportation and port activities on environment. | | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|--|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Bindra S.P., Docks & Harbour Engineering, Dhanpat Rai Publications, 2012. | | | | | | | | | | | | | | |
| 2. Srinivasan R., Harbours, Docks and Tunnel Engineering, Charotar Publishing House, Anand, 2016. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Alonzo Def. Quinn, Design and Construction of Ports and Marine Structure, McGraw Hill Book Company, New York. | | | | | | | | | | | | | | |
| 2. Oza H.P and Oza G.H., Dock and Harbour Engineering, Charotar Publishing House, Anand, 2017. | | | | | | | | | | | | | | |
| 3. Gregory Tsinker, Hand book of "Port and Harbour Engineering" Geotechnical and structural aspects, 1997. | | | | | | | | | | | | | | |
| 4. Adrian Jarvis, "Port and Harbour Engineering" Ashgate Publishing Limited, 1998. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | 2 | 3 | 2 | - | - | - | 2 | 3 | 2 |
| CO2 | 3 | - | - | - | - | 2 | 3 | 2 | - | - | - | 2 | 2 | 3 |
| CO3 | 3 | - | - | - | - | 2 | 3 | 2 | - | - | - | 2 | - | 2 |
| CO4 | 3 | 3 | - | - | - | 2 | 3 | 2 | - | - | - | 2 | 2 | 2 |
| CO5 | 3 | - | - | - | - | 2 | 3 | 2 | - | - | - | 2 | 1 | 2 |



| | | | | | | |
|---|--|---|---|---|----------------------------------|-----------|
| CE23552 | MASS RAPID TRANSPORTATION SYSTEMS | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the types and functions of various urban mass transportation systems. | | | | | |
| 2 | learn the characteristics and demand patterns of urban transportation and methods of planning. | | | | | |
| 3 | know the design and evaluation of mass transportation systems using planning techniques. | | | | | |
| 4 | understand transit planning concepts and apply them to real-world transport systems. | | | | | |
| 5 | explore scheduling, operational issues, and route planning in public transit systems. | | | | | |
| UNIT I | INTRODUCTION TO TRANSPORTATION SYSTEM | | | | 9 | |
| Urban transportation systems- Mass rapid transit system, Light rail transit, Personal rapid transit, guided way systems, cabin taxi, dual mode bus, Para transit systems, Demand responsive system; Intermediate public transport - Case studies for the development done in metros, rail transit operation (Metro rail, Mono rail, urban rails) at global and Indian level Similar technology development in TRAM. | | | | | | |
| UNIT II | DEMAND AND PLANNING OF MRTS | | | | 9 | |
| History and role of Transit - Recent Trends Mass Transportation Characteristics, Demand Characteristics, Spatial, Temporal and Behavioral, Characteristics of Transportation Demand, Urban Mass Transportation Planning; Demand Surveys - Transit oriented land use development. | | | | | | |
| UNIT III | DESIGN AND EVALUATION OF MASS TRANSPORT | | | | 9 | |
| Four Stages of Planning - Performance Evaluation of Mass Transport System, Structure of Decision Making; Evaluation and Selection Methods - Selection Procedures, Economic Evaluation Methods. Terminals and their functions - Design, Typical Characteristics, Scheduling, Service Analysis, Vehicle Dispatch Policy, Vehicle Requirements; Spacing of Bus Tropos, - Route Spacing and Performance, Operational and Management Issues, Reserved Bus Lanes - Signal Preemption, Dial- a-Bus | | | | | | |
| UNIT IV | TRANSIT PLANNING | | | | 9 | |
| Planning – Definition, Shuttle systems, Corridors, Two-dimensional system, Realistic cases only - Flexible transit, Individual public transportation system, Collective transportation | | | | | | |
| UNIT V | PUBLIC TRANSIT | | | | 9 | |
| Introduction to public transit - History, Personal public transit experiences, Public transportation system characteristics, Mass transit definitions and classifications, Route development, stop location and stopping policy, Schedule development. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the different types of urban transportation systems and their functional features | | | | Understanding (K2) | |
| CO2 | recall characteristics of mass transportation demand and perform demand surveys | | | | Understanding (K2) | |
| CO3 | Identify economic and performance criteria used in the design and evaluation of mass transportation systems. | | | | Applying (K3) | |

| | | |
|-----|---|---------------|
| CO4 | apply transit planning techniques to solve real-world problems involving flexible and corridor-based systems. | Applying (K3) |
| CO5 | implement schedules and operational plans with efficient route and stop policies. | Applying (K3) |

TEXT BOOKS

1. M. J. Bruton, Introduction to Transportation Planning, Hutchinson, 2023 published by Routledge
2. John Khisty C, Kent Lall B, "Transportation Engineering – An Introduction, 3rd Edition, Prentice Hall of India, New Delhi, 2002

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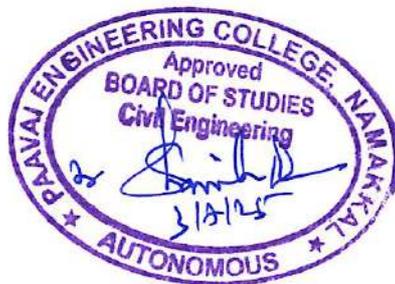
1. Khisty C J., Lall B.Kent, Transportation Engineering – An Introduction, Prentice- Hall, NJ, 2005
2. Chennai Metropolitan Development authority (CMDA) (2006), Chennai Metropolitan Area – Second Master Plan, Chennai.
3. John D.Edwards (Edr.), "Transportation Planning Hand Book", 2nd Edition, Institute of Transportation Engineers, Prentice Hall Inc., Washington DC, USA, 1999
4. O'Flaherty C.A, "Transport Planning and Traffic Engineering", Elsevier Publications, New Delhi, 1997.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | - | 2 | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | - | - | 1 | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 2 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | - | 1 | 2 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | - | 2 | 2 | 2 | 3 | 3 | 3 |



| | | | | | |
|--|--|----------|----------|----------|-----------|
| CE23553 | RIGID PAVEMENT ANALYSIS AND DESIGN | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | |
| To enable the students to | | | | | |
| 1 | know about the various factors affecting pavement analysis and design | | | | |
| 2 | gain knowledge in engineering analysis of stresses and strains in typical highway pavement structures due to loading from traffic and climate. | | | | |
| 3 | understand the material characteristics used in pavement. | | | | |
| 4 | familiarize with the design of pavements. | | | | |
| 5 | learn about pavement distress and evaluation techniques. | | | | |
| UNIT I | FACTORS AFFECTING PAVEMENT DESIGN | | | | 9 |
| Variables considered in pavement design - Types of pavements, Functions of individual layers, Classification of axle types of rigid chassis and articulated commercial vehicles, Legal axle and gross weights on single and multiple units, Tire pressure, Contact pressure, EAL and ESWL Concepts; Traffic Analysis - ADT, AADT, Truck factor, Growth factor, Lane, Directional distributions and Vehicle damage factors, Effect of transient and Moving loads. | | | | | |
| UNIT II | STRESSES IN PAVEMENTS | | | | 9 |
| Vehicle-Pavement interaction - Transient, Random and Damping vibrations, Steady state of vibration, Experiments on vibration, Stress inducing factors in rigid pavements; Stresses in rigid pavements - Westergaard's theory and assumptions, Stresses due to curling, Stresses and deflections due to loading, Frictional stresses, Stresses in dowel bars and tie bars. | | | | | |
| UNIT III | MATERIAL CHARACTERISTICS | | | | 9 |
| CBR and modulus of subgrade reaction of soil; Mineral aggregates - Blending of aggregates, Binders, Polymer and rubber modified bitumen, Resilient, Diametral resilient and complex (Dynamic) moduli of bituminous mixes, Permanent deformation parameters and other properties, Effects and methods of stabilization and use of geo synthetics. | | | | | |
| UNIT IV | DESIGN OF RIGID PAVEMENT | | | | 9 |
| Design of rigid pavements - Calibrated mechanistic design process, PCA, AASHTO and IRC Specifications; Introduction to prestressed and continuously reinforced cement concrete pavement design. | | | | | |
| UNIT V | PAVEMENT DISTRESS, EVALUATION AND REHABILITATION INCLUDING STABILIZATION | | | | 9 |
| Distresses in rigid pavements - condition surveys, Types of roughness, Present serviceability index, Skid resistance; Structural evaluation - Benkelman deflection method; Design of overlays both for highway and airport pavements - Flexible overlay over flexible pavement, Rigid overlay over rigid pavement, Flexible overlay over rigid pavements, Methods suggested by IRC - FAA and Asphalt Institute, Stabilization with special reference to highway pavements chemical and mechanical stabilization, Use of Geosynthetics (geotextiles and geogrids) in roads. | | | | | |
| TOTAL PERIODS | | | | | 45 |

| COURSE OUTCOMES | | | | | | | | | | | | | | |
|--|--|--------------------------------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| At the end of this course, students will be able to | | BT Mapped (Highest Level) | | | | | | | | | | | | |
| CO1 | recognize the factors and concepts involved in pavement analysis and design. | Understanding (K2) | | | | | | | | | | | | |
| CO2 | describe about the various stress factors involved in design. | Understanding (K2) | | | | | | | | | | | | |
| CO3 | acquire knowledge about the different material characteristics used in pavement. | Applying (K3) | | | | | | | | | | | | |
| CO4 | design of rigid pavements as per IRC specifications. | Applying (K3) | | | | | | | | | | | | |
| CO5 | explain evaluation techniques and stabilization of pavement. | Applying (K3) | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Kadiyali, Lal, "Principles and Practice of Highway Engineering", Khanna Tech Publications, New Delhi (7 th Reprint), 2023. | | | | | | | | | | | | | | |
| 2. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc, 2008. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Yoder E. J. and Witezak M. W., "Principles of Pavement Design", John Wiley and Sons Inc., New York, 2011. | | | | | | | | | | | | | | |
| 2. Khanna, S. K., Justo, C. E. G and Veeraragavan, A, 'Highway Engineering', Revised 10 th Edition, Khanna Publishers, Roorkee, 2021. | | | | | | | | | | | | | | |
| 3. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010. | | | | | | | | | | | | | | |
| 4. Rangwala., "Highway Engineering", 12 th Revised and Enlarged Edition, Charotar Publishing House, Anand, 2022. | | | | | | | | | | | | | | |
| 5. IRC: 58-2015, "Guidelines for the Design of Rigid Pavements for Highways", Indian Road Congress, New Delhi, 2015. | | | | | | | | | | | | | | |
| 6. IRC SP: 20-2002, "Rural Roads Manual", Indian Road Congress, New Delhi, 2002. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | 1 | 1 | - | - | - | 2 | - | - | 3 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 | - | - | 2 | 2 | - | - | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | 2 | - | 2 | - | - | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 3 | - | 1 | 2 | 2 | - | 2 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | - | 2 | - | 2 | 3 | 2 | 2 |



| | | | | | | |
|---|--|---|---|---|--------------------------------------|-----------|
| CE23554 | SMART CITIES | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | identify key concepts of urbanisation, smart cities, and infrastructure. | | | | | |
| 2 | learn the core components of physical infrastructure in smart cities. | | | | | |
| 3 | understand the core concepts of sustainability and smart urban planning. | | | | | |
| 4 | gain the knowledge on application of technologies in smart cities. | | | | | |
| 5 | know the project organizational structure and cost analysis . | | | | | |
| UNIT I | INTRODUCTION TO SMART CITIES | | | | 9 | |
| Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission | | | | | | |
| UNIT II | SMART PHYSICAL INFRASTRUCTURE | | | | 9 | |
| Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects. | | | | | | |
| UNIT III | SUSTAINABILITY AND SMART PLANNING | | | | 9 | |
| Relationship Between Sustainability and Smart planning - Place making project guidelines Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services; | | | | | | |
| UNIT IV | APPLICATION OF TECHNOLOGIES IN SMART CITIES | | | | 9 | |
| Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities | | | | | | |
| UNIT V | SMART CITIES PROJECT MANAGEMENT | | | | 9 | |
| Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the basics of Urbanisation and the role of smart cities | | | | Understanding (K2) | |
| CO2 | apply the knowledge on implementation of smart physical infrastructure. | | | | Applying (K3) | |
| CO3 | identify the role of smart planning for sustainable development. | | | | Applying (K3) | |

| | | |
|-----|--|---------------|
| CO4 | comprehend the knowledge of Technologies in Smart City planning. | Applying (K3) |
| CO5 | reviewing the case studies of smart city projects. | Applying (K3) |

TEXT BOOKS

1. P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer Link, 2017.
2. Sameer Sharma, “Smart Cities Unbounded- Ideas and Practice of Smart Cities in India”, Bloomsbury India, 2018.

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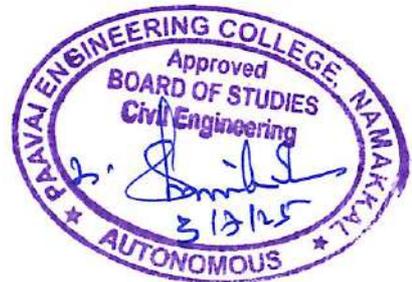
1. Binti Singh, Manoj Parmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory Routledge India, 2019
2. Jo Beall (1997); “A city for all: valuing differences and working with diversity”; Zed books limited, London (ISBN: 1-85649-477-2).
3. <https://smartcities.gov.in/guidelines#block-habikon-content>
4. UN-Habitat; “Inclusive and sustainable urban planning: a guide for municipalities”; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | 3 | 3 | 3 | 2 | - | - | - | 1 | 2 | 3 | 1 |
| CO2 | 3 | 2 | - | 3 | 3 | 3 | 2 | - | - | - | 1 | 2 | 3 | 1 |
| CO3 | 3 | 2 | - | 3 | 3 | 3 | 1 | - | - | - | 1 | 1 | 2 | 1 |
| CO4 | 3 | 2 | - | 3 | 3 | 3 | 1 | - | - | - | 1 | 1 | 3 | 1 |
| CO5 | 3 | 2 | - | 3 | 3 | 3 | 1 | - | - | - | 1 | 1 | 1 | 3 |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23555 | TRAFFIC ENGINEERING AND MANAGEMENT | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | know the fundamentals of road and vehicle characteristics. | | | | | |
| 2 | impart knowledge on various types of traffic surveys. | | | | | |
| 3 | understand the traffic design and its principle. | | | | | |
| 4 | gain knowledge about various types of traffic signs with regulations. | | | | | |
| 5 | know about traffic management and its regulatory measures. | | | | | |
| UNIT I | FUNDAMENTALS OF TRAFFIC ENGINEERING | | | | 9 | |
| Scope - Elements, Road characteristics, Road user characteristics, PIEV theory, Vehicle characteristics, IRC standards - Design speed, volume, Performance characteristics, Fundamentals of traffic Flow - Urban traffic problems in India. | | | | | | |
| UNIT II | TRAFFIC SURVEYS AND LEVEL OF SERVICE | | | | 9 | |
| Speed, journey time and delay surveys - Vehicle volume survey including non-motorized transports, Origin destination survey, Parking survey; Accident analyses - Statistical applications and traffic forecasting, Level of service; Highway capacity - Capacity of urban and rural roads, PCU concept, Traffic flow theory. | | | | | | |
| UNIT III | TRAFFIC DESIGN AND VISUAL AIDS | | | | 9 | |
| Design of at-grade intersections - Principles of design, Channelization; Design of rotaries; Traffic signals - Design of signal setting, Signal co-ordination; Roundabouts - Grade separated intersections, Geometric elements for divided and access-controlled highways and expressways. | | | | | | |
| UNIT IV | TRAFFIC SAFETY AND ENVIRONMENT | | | | 9 | |
| Road furniture - Street lighting, Traffic signs & markings; Networking pedestrian facilities & cycle tracks; Traffic regulation and control - Traffic Safety, Principles and practices, Road safety audit; Traffic and environment hazards - Air and noise pollution, causes, abatement measures. | | | | | | |
| UNIT V | TRAFFIC MANAGEMENT | | | | 9 | |
| Traffic system management (TSM) with IRC standards - Traffic regulatory measures; Travel demand management (TDM) - Direct and indirect methods, Congestion and parking pricing, All segregation methods, Coordination among different agencies; Intelligent transport System for traffic management - enforcement and education; Carpooling. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | infer the fundamental concepts of road user characteristics | | | | Understanding (K2) | |
| CO2 | select a suitable survey for traffic parameters and highway capacity | | | | Applying (K3) | |
| CO3 | develop channels, intersections, signals, roundabouts and parking arrangements | | | | Applying (K3) | |
| CO4 | explain traffic signs, markings for road safety and environmental impacts. | | | | Applying (K3) | |

| CO5 | Implement the traffic planning and management systems | Applying (K3) | | | | | | | | | | | | |
|--|---|---------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 9 th Edition, 2019. | | | | | | | | | | | | | | |
| 2. Subhash C Saxena., "Highway and Traffic Engineering", CBS Publishers and Distributors Pvt., Ltd., NewDelhi,2020 | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2 nd Edition, 2011. | | | | | | | | | | | | | | |
| 2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 3 rd Edition, 2010. | | | | | | | | | | | | | | |
| 3. Wolfgang S.Homburger at.al. "Fundamentals of Traffic Engineering", 15 th Edition, Institute of Transportation studies, University of California, 2012. | | | | | | | | | | | | | | |
| 4. Nicholas T.Garber, Lester A Hoel, "Traffic and Highway Engineering", Revised 2 nd Edition, IPT California, USA 1999. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | - | - | 2 | 2 |
| CO3 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | 2 | 3 |
| CO4 | 2 | 2 | - | 2 | - | 3 | 3 | - | 2 | 2 | - | - | 2 | |
| CO5 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 3 |



| | | | | | | |
|--|--|----------|---|---|--------------------------------------|-----------|
| CE23556 | SUSTAINABLE URBAN AND TRANSPORTATION DEVELOPMENT | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the types and functions of various Urban Sustainable Development | | | | | |
| 2 | learn the characteristics and assessment of Urban Sustainable Development and planning. | | | | | |
| 3 | know the design of Transport Integrated Urban systems and urban land use planning techniques. | | | | | |
| 4 | apply planning principles and tools for sustainable pedestrian, cycling, and transit infrastructure in urban mobility systems. | | | | | |
| 5 | explore the Sustainable policies and technology in Intelligent Transport Systems. | | | | | |
| UNIT I | SUSTAINABLE URBAN AND TRANSPORT PRINCIPLES | 9 | | | | |
| Concept of Urban Environmental Sustainability and Urban Development - Urban Sustainable Development, Methods and Tools for Sustainable Appraisal; Sustainable Transportation - Principles, indicators and its implications. | | | | | | |
| UNIT II | URBAN PLANNING AND ENVIRONMENT | 9 | | | | |
| Environment and Resources - Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development. | | | | | | |
| UNIT III | THE URBAN BUILT-IN ENVIRONMENT | 9 | | | | |
| Urban Form- Land Use, Compact Development, Principles of street design, complete streets, Transport Integrated Urban land use Planning; Guidelines for Environmentally sound Transportation. | | | | | | |
| UNIT IV | SUSTAINABLE TRANSPORTATION MODES PLANNING | 9 | | | | |
| Pedestrian - Planning Principles, Tools, Designs, Methods to measure success; Cycles - Planning Principles, Cycle Track Network, Crossings and intersections and junctions; Transit Planning - Road Side Infrastructure Planning. | | | | | | |
| UNIT V | SUSTAINABLE POLICIES AND TECHNOLOGY | 9 | | | | |
| Continuum of Policies, speed and speed limit policies, national policies, sustainable travel demand management; public awareness; pricing transportation - full cost of transportation, pricing and taxation, Telecommuting, Information and Communication technologies, E-commerce, Alternative Cleaner Fuels, vehicle technologies, fuel cells, Intelligent Transport Systems. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the different types of Urban Sustainable Development and their functional features. | | | | Understanding (K2) | |
| CO2 | identify characteristics and assessment of Urban Sustainable Development and methods of planning. | | | | Understanding (K2) | |
| CO3 | recall the design of Transport Integrated Urban systems and urban land use planning techniques. | | | | Understanding (K2) | |

| | | |
|-----|--|---------------|
| CO4 | apply planning principles and tools to develop sustainable pedestrian, cycling, and transit infrastructure within urban mobility systems | Applying (K3) |
| CO5 | apply green technologies such as EV integration, adaptive traffic control, and renewable energy in intelligent transport systems. | Applying (K3) |

TEXT BOOKS

1. Thomas A. Domenici and Daniel Mc Fadden, "Urban Travel Demand A Behavioral Analysis", American Elsevier Publishing Company Inc., 5th Edition, 2019.
2. Preston L. Schiller, Eric C. Brunn and Jeffrey R. Kenworthy. An Introduction to Sustainable Transportation: Policy, Planning and Implementation, 2017.

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1. Juan de Dios Orituzar and Luis G. Willum son, "Modelling Transport", A John Wiley and Sons, Inc., 4th edition 2017.
2. Mehrdad Ehsani, Fei-Yue Wang and Gary L. Brösch (Eds.) Transportation technologies for sustainability, 2013.
3. Sustainable Transportation and TDM – Planning the balances, Economic, Social and Ecological objectives; Victoria Transport Policy Institute, 2007.
4. Norbert Oppenheim, "Urban Travel Demand Modelling" A John Wiley and Sons, Inc., 3rd Edition, 2010.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | 3 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 3 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - | 2 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 2 |



| | | | | | | | |
|--|---|--|--|---|---|----------------------------------|-----------|
| CE23557 | TRANSPORTATION PLANNING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | gain knowledge on different types of transport and travel surveys. | | | | | | |
| 2 | explore various trip assignment and modal split techniques used in transportation planning. | | | | | | |
| 3 | familiarize with various evaluation techniques in transportation planning. | | | | | | |
| 4 | understand the characteristics of bus transportation systems in urban environments. | | | | | | |
| 5 | evaluate the effectiveness of different rail transport policies and planning strategies. | | | | | | |
| UNIT I | TRANSPORTATION PLANNING PROCESS | | | | | | 9 |
| Importance of transportation planning - Integration of Land Use and Transport; Systems Approach to Transport Planning - Four Steps in the Transport Planning Process, Travel Demand Modelling Approach; Traffic Analyses Zones - internal and external; Various Transportation Surveys for the collection of data - methodology, analyses of data and presentation of results. | | | | | | | |
| UNIT II | TRIP GENERATION STAGE | | | | | | 9 |
| Definition and importance; Trip Production and Attraction - Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model. | | | | | | | |
| UNIT III | TRIP DISTRIBUTION STAGE | | | | | | 9 |
| Definition and objective; Data collection- analyses and presentation of trip matrix table, Desire Line Diagram- Development of Gravity, growth factor methods for Trip Distribution - Calibration of gravity model and its validation. | | | | | | | |
| UNIT IV | MODAL SPLIT STAGE | | | | | | 9 |
| Factors influencing modal choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model. | | | | | | | |
| UNIT V | TRAFFIC ASSIGNMENT STAGE | | | | | | 9 |
| Assignment stage - General principles; Assignment Techniques - all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | identify various transport and travel survey methods | | | | | Understanding (K1) | |
| CO2 | apply appropriate trip assignment techniques and user-equilibrium models. | | | | | Applying (K3) | |

| | | |
|-----|---|---------------|
| CO3 | describe evaluation techniques such as cost-benefit analysis, multi-criteria analysis, and environmental impact assessment. | Applying (K3) |
| CO4 | performance indicators such as headway, passenger load, and fleet utilization. | Applying (K3) |
| CO5 | propose integrated planning strategies for efficient rail systems based on case studies and data analysis. | Applying (K3) |

TEXT BOOKS

1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2024 (9th edition),
2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2009, 3rd Edition (International version)

REFERENCES

1. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
2. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 3rd edition 2016.
3. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley and Sons 2001
4. Michael J. Bruton, Introduction to Transportation Planning, Hutchinson, London, 2023.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | - | 2 |
| CO2 | 2 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | 1 | 3 | 1 |
| CO3 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 |
| CO4 | 2 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | - |
| CO5 | 2 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | 1 | - | 2 |



| | | | | | | | |
|--|---|--|--|---|---|----------------------------------|-----------|
| CE23651 | REMOTE SENSING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand the basic physics behind remote sensing and electromagnetic radiation interactions. | | | | | | |
| 2 | learn about various platforms and sensors used in remote sensing. | | | | | | |
| 3 | gain knowledge on data acquisition systems and their engineering and scientific applications. | | | | | | |
| 4 | understand image preprocessing techniques and classification methods. | | | | | | |
| 5 | explore remote sensing applications in agriculture, forestry, urban planning, and disaster management. | | | | | | |
| UNIT I | PHYSICS OF REMOTE SENSING | | | | | | 9 |
| Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation - Reflectance, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, Atmospheric windows, Spectral reflectance of Earth's surface features, and Multi concept of Remote Sensing. | | | | | | | |
| UNIT II | PLATFORMS AND SENSORS | | | | | | 9 |
| Various types of platforms, different types of aircraft, manned and unmanned spacecrafts used for data acquisition - characteristics of different types of platforms - airborne and spaceborne, IRS Satellite Sensors, LANDSAT, SPOT, IKONOS, Quickbird, Geoeye, Kompsat, Worldview II & III, Microwave, ALOS, Planet Data, Sentinel, SMAP, MODIS etc. | | | | | | | |
| UNIT III | DATA ACQUISITION SYSTEMS AND APPLICATIONS | | | | | | 9 |
| Optical, Thermal and Microwave; Resolutions - spatial, spectral, radiometric and temporal, signal to noise ratio, LiDAR data acquisition and processing. Applications of Remote sensing in various Engineering and Science domains such as Agriculture, Forest, Soil, Geology, LU/LC, Water Resources, Urban, Disaster Management, etc. | | | | | | | |
| UNIT IV | DATA PRODUCTS AND IMAGE PREPROCESSING | | | | | | 9 |
| Data Products and their characteristics, Digital image formation, digital image display mechanism, image histograms, look up table data, Pre-processing - Atmospheric, Radiometric, Geometric Corrections - Basic Principles of Visual Interpretation, Ground Truth, Orthorectification, Applications. Supervised and Unsupervised Image Classification. | | | | | | | |
| UNIT V | APPLICATIONS OF REMOTE SENSING | | | | | | 9 |
| Applications – Plant Science, Land Use/Land Cover and Agriculture Applications, Disaster Management and Environmental Monitoring, Water Resources and Urban Applications, Earth Sciences, Forestry. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | explain the principles of electromagnetic radiation and its interaction with the atmosphere and Earth's surface. | | | | | Understanding (K2) | |
| CO2 | identify and compare various remote sensing platforms and sensors used for data acquisition. | | | | | Understanding (K2) | |
| CO3 | describe different data acquisition systems and analyze their applications in engineering and scientific domains. | | | | | Applying (K3) | |

| | | |
|-----|---|---------------|
| CO4 | apply preprocessing and interpret remote sensing images using classification and visual methods. | Applying (K3) |
| CO5 | demonstrate remote sensing applications in agriculture, water, forestry, urban planning, and disaster management. | Applying (K3) |

TEXT BOOKS

1. James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 6th Edition, 2022.
2. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, 6th edition of John Wiley and Sons, 2015.

REFERENCES

1. Chritian Matzler., Thermal microwave radiation: Applications for remote sensing, The institution of Engineering and Technology, London, 2007
2. Schowengerdt, R. A., Remote Sensing: Models and Methods for Image Processing, Academic Press,2007.
3. Cracknell, A.P., Introduction to Remote Sensing, Tylor and Francis, Second Edition, London, 2007.
4. Freek D. van der Meer, Remote Sensing and Digital Image Processing, 2004

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
 (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | - | 2 | - | - | - | - | 1 | 3 | 2 |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 2 | 3 | - | 2 | - | - | - | - | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | - | - | - | - | 2 | 2 | 1 |



| | | | | | | | |
|--|---|--|--|---|---|----------------------|-----------|
| CE23652 | LASER AND LIDAR SURVEYING IN AIRBORNE AND TERRESTRIAL APPLICATIONS | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand the basic principles of laser ranging, profiling, and scanning used in geospatial data acquisition. | | | | | | |
| 2 | explain classification and functions of static and dynamic terrestrial laser scanners and point cloud processing. | | | | | | |
| 3 | apply knowledge of airborne laser scanner components and scanning mechanisms for data acquisition. | | | | | | |
| 4 | understand Lidar system types, data filtering, and flight planning concepts. | | | | | | |
| 5 | apply Lidar data formats and tools to extract features for mapping and modeling applications | | | | | | |
| UNIT I | INTRODUCTION TO LASER SCANNER | | | | | | 9 |
| Laser-Basic principles of laser ranging, Profiling, scanning, components, working of solid-state and semiconductor lasers; Terrestrial, Airborne and Space borne applications - Laser ranging methods - Time-pulse method, Phase-comparison method and Heterodyne method; Power output-safety considerations-Laser hazard classifications. | | | | | | | |
| UNIT II | TERRESTRIAL LASER SCANNER | | | | | | 9 |
| Static Terrestrial laser-Classification, short range, medium range, long range using pulse ranging-Total stations with scanning capabilities; Dynamic Terrestrial laser scanner-specification, 2D and 3D point clouds and processing software - Applications of terrestrial laser scanning. | | | | | | | |
| UNIT III | AIR BORNE LASER SCANNERS | | | | | | 9 |
| Components of Airborne Laser Scanning System-GPS, IMU, LASER Scanner, Position and Orientation System (PoS) - Types of Scanning Mechanism and Ground Measuring Pattern, UAV based Topographic Laser Scanner - Synchronization of Laser Scanner and PoS - LASER Scanners Specification and Salient Features - Concept of Multi return, 3D Cloud Points-Reflectivity of Ground features-Range Correction Factor. | | | | | | | |
| UNIT IV | TERRESTRIAL AND AIR BORNE LIDAR | | | | | | 9 |
| Terrestrial Lidar - Static and mobile (vehicle mounted) Lidar, Types of Lidar, Range Finder, Dial and Doppler Lidar; platforms-terrestrial, airborne and space borne Lidar - Space borne Lidar missions, Digital Surface Model to Digital Elevation Model-Filtering, Ground Point Filtering, Flight Planning, Quality Control Parameters, Preparation of flight plan. | | | | | | | |
| UNIT V | LIDAR DATA MANAGEMENT AND APPLICATIONS | | | | | | 9 |
| Airborne Laser Scanner Error Sources - LIDAR data format: ASCII vs Binary, LAS Format Software used for LIDAR data processing and management - Merits of Airborne Laser Terrain Mapping - Overview of LIDAR Applications, 3D city model, Road and Building Extraction, Forestry Applications, Power Line Mapping. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |

| COURSE OUTCOMES | | BT Mapped (Highest Level) |
|---|---|------------------------------|
| At the end of this course, students will be able to | | |
| CO1 | understand laser principles, components, and applications across platforms. | Understanding (K2) |
| CO2 | explain types and uses of static and dynamic terrestrial lasers scanners. | Understanding (K2) |
| CO3 | understand airborne laser scanning system knowledge for data collection. | Understanding (K2) |
| CO4 | understand Lidar types, filtering, and flight planning techniques. | Understanding(K2) |
| CO5 | apply Lidar tools and formats for mapping and modeling applications | Applying (K3) |

TEXT BOOKS

1. Jie Shan, Charles K. Toth, "Topographic Laser Ranging and Scanning – Principles and Processing", 2 nd Edition, CRC Press Publication, March 2018. ISBN: 9781498772273.
2. George Vosselman and Hans-Gerd Maas, Airborne and Terrestrial Laser Scanning, Whittles Publishing, 2014.

REFERENCES

1. Michael Renslow, Manual of Airborne Topographic LiDAR, The American Society for Photogrammetry and Remote Sensing, 2022.
2. Matti Maltamo, Erik Næsset, Jari Vauhkonen, Forestry Applications of Airborne Laser Scanning Concepts and Case Studies, Springer, Dordrecht, 2016, Reprint Edition.
3. Pinliang Dong and Qi Chen & LiDAR Remote Sensing and Applications & CRC Press, 2017
4. Edward M. Mikhail, James S. Bethel, J. Chris McGlone & Introduction to Modern Photogrammetry & quot; Wiley, 2001

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 3 | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO5 | 3 | - | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | - |



| | | | | | | | |
|---|---|--|--|---|---|----------------------------------|-----------|
| CE23653 | SATELLITE IMAGE PROCESSING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand the fundamental concepts and systems involved in satellite image processing. | | | | | | |
| 2 | understand various sensor models and pre-processing techniques for image correction and enhancement. | | | | | | |
| 3 | apply spatial and frequency domain techniques for image enhancement and feature extraction. | | | | | | |
| 4 | explore different image classification techniques including supervised, unsupervised, and advanced classifiers. | | | | | | |
| 5 | gain knowledge on the use of machine learning, neural networks, and expert systems in satellite image interpretation. | | | | | | |
| UNIT I | FUNDAMENTALS OF IMAGE PROCESSING | | | | | | 9 |
| Information Systems - Encoding and decoding, acquisition, storage and retrieval, data products, satellite data formats; Digital Image Processing Systems-Hardware and software design consideration Scanner, digitizer; photo write systems. | | | | | | | |
| UNIT II | SENSORS MODEL AND PRE PROCESSING | | | | | | 9 |
| Image Fundamentals-Sensor models - spectral response-Spatial response-IFOV, GIFOV and GSI - Simplified Sensor Models, Sampling and quantization concepts, Image Representation and geometry and Radiometry, Colour concepts, Sources of Image degradation and Correction procedures - Atmospheric, Radiometric, Geometric Corrections, Image Geometry Restoration, Interpolation methods and resampling techniques. | | | | | | | |
| UNIT III | IMAGE ENHANCEMENT | | | | | | 9 |
| Image Characteristics - Histograms, Scatter grams Univariate and multi variate statistics, enhancement in spatial domain, global, local and colour Transformations, PC analysis, edge detections, merging; filters - convolutional, HPF, HB, directional box, cascade, Morphological and adaptive filters, Zero crossing filters; scale space transforms, power spectrum, texture analysis, frequency transformations, Fourier, wavelet and curvelet transformations. | | | | | | | |
| UNIT IV | IMAGE CLASSIFICATION | | | | | | 9 |
| Spectral discrimination - pattern recognition concepts, Baye's approach, Signature and training sets, Separability test, Supervised Classification-Minimum distance to mean, Parallelepiped, MLC Unsupervised classifiers, ISODATA, K-means Support Vector Machine, Segmentation (Spatial, Spectral), Tree classifiers, Accuracy assessment, Error matrix, Kappa statistics, ERGAS, RMS | | | | | | | |
| UNIT V | ADVANCED CLASSIFIERS | | | | | | 9 |
| Fuzzy set classification - sub pixel classifier, hybrid classifiers, Texture based classification, Object based classifiers, Artificial Neural nets, Hebbian leaning, Expert system, types and examples, Knowledge systems. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the essential workings and foundational concepts of satellite image processing systems. | | | | | Understanding (K2) | |

| | | |
|-----|--|--------------------|
| CO2 | identify the concept of image histograms and their significance in identifying image quality issues. | Understanding (K2) |
| CO3 | implement essential steps required to prepare images for extracting features in spatial and frequency domains. | Understanding (K2) |
| CO4 | identify the core ideas behind image classification techniques used in image processing. | Applying (K3) |
| CO5 | apply the impact of data normalization and pre-processing on machine learning outcomes. | Applying (K3) |

TEXT BOOKS

1. John, R. Jensen, Introductory Digital Image Processing, Prentice Hall, New Jersey, 4th Edition, 2015.
2. Robert, A. Schowengerdt, Techniques for Image Processing and classification in Remote Sensing, Academic Press, 2012.

REFERENCES

1. Robert, G. Reeves, - Manual of Remote Sensing Vol. I and II - American Society of Photogrammetry, Falls, Church, USA, 1983.
2. Richards, Remote sensing digital Image Analysis - An Introduction 5th Edition, 2012, Springer - Verlag 1993.
3. Digital Image Processing by Rafael C. Gonzalez, Richard Eugene Woods- Pearson/Prentice Hall, 2008.
4. Digital Image Processing: PIKS Scientific Inside by William K. Pratt 4th Edition, Wiley Interscience, 2007.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | 3 | - | - | - | - | - | - | - | 2 | 1 | 3 |
| CO2 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | - | - | 2 | | 2 | 2 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | 3 | 2 | 2 | - |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | 3 | - | 3 | 1 |



| | | | | | | | |
|---|---|--|--|---|---|--------------------------------------|-----------|
| CE23654 | URBAN GEOINFORMATICS | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | obtain knowledge on fundamentals of geoinformatics. | | | | | | |
| 2 | gain knowledge on urban mapping and administrative agencies. | | | | | | |
| 3 | know the application of GIS and remote sensing in plan preparation. | | | | | | |
| 4 | introduce geo demographic analysis and land suitability analysis. | | | | | | |
| 5 | expose the commercial FEA Software. | | | | | | |
| UNIT I | FUNDAMENTALS | | | | | | 9 |
| Relevance of Geoinformatics for Urban Planning - Scope and Limitations, Resolution, Characteristics of Settlements, Interpretation from Aerial and Satellite images, Digital Image Processing Techniques, Texture based analysis, Automated Feature extraction. | | | | | | | |
| UNIT II | URBAN MAPPING | | | | | | 9 |
| Urban Area - planning and administrative agencies, Physical Structure and Composition, Delimitation of Urban Agglomeration, Urban Pattern Characterization, Urban Morphology, Land Cover Classification, Urban Heat Island, Housing Typology, Use of High-resolution, Hyperspectral Remote Sensing, Radar Remote Sensing for Urban Areas. | | | | | | | |
| UNIT III | URBAN PLANNING | | | | | | 9 |
| Classification of Plans - Master and Detailed Development, Objectives and Contents, Census Estimation, Water Demand Analysis, Use of remote sensing and GIS in plan preparation, Urban Information System, and data base management, Urban Solid Waste Management Planning, Utility Planning, transportation planning. | | | | | | | |
| UNIT IV | URBAN ANALYSIS | | | | | | 9 |
| Urban Growth and Sprawl - Physical Patterns and Forms, Causes and Consequences, Monitoring Urban Growth through Remote Sensing, Analysis of Urban Growth, Geodemographic Analysis, Property Market Analysis Urban Renewal, Land Suitability Analysis, traffic and parking analysis, case studies. | | | | | | | |
| UNIT V | URBAN MODELLING | | | | | | 9 |
| Urban Growth Modelling - Planning Support Systems, Urban Environmental Monitoring and Modelling, 3D city Modelling, Intelligent transportation systems, Case Studies. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the basics of Urban mapping and Plan preparation. | | | | | Understanding (K2) | |
| CO2 | identify application of remote sensing in urban mapping. | | | | | Applying (K3) | |
| CO3 | explain role of remote sensing in preparation of urban plans. | | | | | Applying (K3) | |
| CO4 | apply the modeling techniques for modeling and prediction of future land use scenarios. | | | | | Applying (K3) | |
| CO5 | apply the concept of spatial data inputs. | | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Rashed, Tarek; Jürgens, Carsten (Eds.), Remote Sensing of Urban and Suburban Areas, Springer, 1 st Edition. 2010. | | | | | | | | | | | | | | |
| 2. Netzband, Maik; Stefanov, William L.; Redman, Charles (Eds.), Applied Remote Sensing for Urban Planning, Governance and Sustainability, Springer, 1 st Edition, 2007. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Soergel, Uwe (Eds.), Radar Remote Sensing of Urban Areas, Remote Sensing and Digital Image Processing, Vol. 15, 1 st Edition, Springer, 2010. | | | | | | | | | | | | | | |
| 2. Basudeb Bhatta, Analysis of Urban Growth and Sprawl from Remote Sensing Data, 1 st Edition, Springer-Verlag, 2010. | | | | | | | | | | | | | | |
| 3. Qihao Weng, Dale A. Quattrochi (Eds), Urban Remote Sensing, 1 st edition, CRC Press, 2006. | | | | | | | | | | | | | | |
| 4. Jean-Paul Donnay, Michael John Barnsley, Remote sensing and urban analysis, 1 st Edition, Taylor and Francis e-Library, 2005. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | 2 | 3 | 2 | 3 | - | - | - | 2 | 2 | 2 |
| CO2 | 3 | - | - | - | 2 | 2 | 3 | 2 | - | - | - | 2 | 2 | 3 |
| CO3 | 3 | - | - | - | 3 | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 |
| CO4 | 3 | - | - | - | 2 | 2 | 2 | 2 | - | - | - | 2 | 1 | 3 |
| CO5 | 2 | - | - | - | 2 | 2 | 2 | 2 | - | - | - | 3 | 3 | 3 |



| | | | | | | | |
|--|---|--|--|---|---|--------------------------------------|-----------|
| CE23655 | GEOGRAPHICAL INFORMATION SYSTEMS | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | learn the Fundamental Knowledge of Map | | | | | | |
| 2 | understanding the Geospatial datas and storage | | | | | | |
| 3 | learn the database structures and topology | | | | | | |
| 4 | gain the knowledge in network analysis | | | | | | |
| 5 | know the application of GIS | | | | | | |
| UNIT I | MAP | | | | | | 9 |
| Map - Mapping concepts, analysis with paper, based maps, limitations, Computer Automated Cartography, History and Developments; GIS- Definition, components, advantages of digital maps, projections and coordinate systems. | | | | | | | |
| UNIT II | FUNDAMENTALS OF GIS | | | | | | 9 |
| Overview of geospatial data sources - Data formats, Open data principles and policies, Data acquisition and Storage, Overview of key open land data sources, Land use and land cover datasets, Digital elevation models (DEMs). | | | | | | | |
| UNIT III | DATABASE MANAGEMENT AND TOPOLOGY | | | | | | 9 |
| Database Management - Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware and Software, Introduction to popular GIS software like ArcGIS, QGIS; Topology - Types of Errors, Editing and Error Rectification, Types of Topology, Modelling topological Relationships, Tolerances. | | | | | | | |
| UNIT IV | SPATIAL ANALYSIS | | | | | | 9 |
| Spatial analysis - Proximity Analysis, Overlay Analysis, Buffer Analysis; Network Analysis - Route alignment, Canal alignment; Digital Elevation Models, Map composition, Preparation of qualitative and quantitative maps, levels of maps, map elements and map scales, 3D Analyst, Interpolation Methods. | | | | | | | |
| UNIT V | GIS PROJECT PLANNING AND IMPLEMENTATION | | | | | | 9 |
| GIS Project Planning - Requirements, Phases of Planning, Specifications, and Procedure for analysis projects and design projects. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | identify the basic components of GIS. | | | | | Applying (K3) | |
| CO2 | classify the maps, coordinate systems and projections. | | | | | Applying (K3) | |
| CO3 | process spatial and attribute data and prepare thematic maps using GIS Softwares. | | | | | Applying (K3) | |
| CO4 | identify and rectify mapping inaccuracies and preparation of qualities and quantities maps. | | | | | Applying (K3) | |
| CO5 | explain the Conceptualize a GIS project. | | | | | Applying (K3) | |

TEXT BOOKS

1. Kang Tsung Chang., Introduction to Geographic Information Systems, 9th Edition Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2018.
2. C.P.Lo & Albert K. W.Yeung, Concepts and Techniques of Geographic Information Systems, second Edition, Prentice Hall India Pvt.Ltd, 2016

REFERENCES

1. Burrough, P.A., Principles of GIS for Land Resource Assessment, Oxford Publications, 2005.
2. Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, XanEdu Publishing Inc, 6th Edition, 2019.
3. Paul Longley., Geographic Information systems and Science, John Wiley & Sons, 4th Edition,2015.
4. . Michael J De Smith (Author), Michael F Goodchild (Author), Paul a Longley, Geospatial Analysis: A Comprehensive Guide, Winchelsea Press, 6th Edition, 2018.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
 (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | 3 | - | 2 | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 2 | - | - | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO4 | 2 | 2 | 3 | 2 | 3 | - | 2 | - | - | - | - | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | - | - | - | - | 2 | 2 | 1 |



| | | | | | | | |
|---|--|--|--|---|---|---|----------|
| CE23656 | TOTAL STATION AND GPS SURVEYING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | learn the fundamentals of Total Station and Electromagnetic wave propagation used in distance measurement. | | | | | | |
| 2 | understand the measuring principles of electro-optical and microwave systems in Total Station instruments. | | | | | | |
| 3 | gain knowledge on GPS concepts, components, and satellite signal structures. | | | | | | |
| 4 | acquire skills in processing GPS data and use related software tools for high accuracy applications. | | | | | | |
| 5 | apply Total Station and GNSS techniques to real-world surveying and mapping problems. | | | | | | |
| UNIT I | FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES | | | | | | 9 |
| Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying - Applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies, Refractive index (RI), factors affecting RI, Computation of group for light and near infrared waves at standard and ambient conditions, Computation of RI for microwaves at ambient condition, Reference refractive index, Real-time application of first velocity correction. Measurement of atmospheric parameters, Mean refractive index, Second velocity correction, Total atmospheric correction, Use of temperature -pressure, transducers. | | | | | | | |
| UNIT II | ELECTRO-OPTICAL AND MICROWAVE | | | | | | 9 |
| Electro optical system - Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments; Microwave system Measuring principle, working principle, Sources of Error, Microwave Total Station instruments; Comparison between Electro-optical and Microwave system, Care and maintenance of Total Station instruments, COGO functions - Area, Inverse / MLM, REM, Resection, offsets and stakeout, Land survey applications. | | | | | | | |
| UNIT III | SATELLITE SYSTEM | | | | | | 9 |
| Basic concepts of GPS - Historical perspective and development, applications, Geoid and Ellipsoid, satellite orbital motion, Keplerian motion, Kepler's Law, Perturbing forces, Geodetic satellite, Doppler effect, Positioning concept, GNSS and IRNSS, SBAS, GAGAN and WAAS Different segments - space, control and user segments, satellite configuration, GPS signal structure, Orbit determination and representation, Anti Spoofing and Selective Availability, Task of control segment, GPS receivers. | | | | | | | |
| UNIT IV | GPS DATA PROCESSING | | | | | | 9 |
| GPS observables - code and carrier phase observation, linear combination and derived observables, concept of parameter estimation, downloading the data, RINEX Format, Differential data processing; software modules - solutions of cycle slips, ambiguities - Multi path and other observational errors, satellite geometry and accuracy measures, Continuously Operating Reference System (CORS), long base line processing, use of different processing softwares - Open Source, Scientific and Commercial. | | | | | | | |
| UNIT V | SURVEYING METHODS AND APPLICATIONS | | | | | | 9 |
| Total Station - Traversing and Trilateration measurement and adjustment, Planimetric map and Contour map and Topography Mapping; GNSS - Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. | | | | | | | |

| | | | | | | | | | | | | | | |
|--|--|---|---|---|---|---|---|---|---|----|----|----|--------------------------------------|----|
| Observation by Radiation, Lee frog and Trilateration measurement and processing; Topography mapping using PPK and RTK methods Total Station and GNSS applications. | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | | | | | | | | |
| At the end of this course, students will be able to | | | | | | | | | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the fundamental concepts and working principles of Total Station | | | | | | | | | | | | Understanding (K2) | |
| CO2 | apply knowledge of electromagnetic waves in Total Station and GNSS systems | | | | | | | | | | | | Applying (K3) | |
| CO3 | apply GPS and GNSS fundamentals in geospatial positioning and satellite-based surveying | | | | | | | | | | | | Applying (K3) | |
| CO4 | explain the working principles of electro-optical, microwave, and GPS instruments | | | | | | | | | | | | Applying (K3) | |
| CO5 | apply techniques of Total Station and GNSS data processing in mapping and surveying applications | | | | | | | | | | | | Applying (K3) | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Satheesh Gopi, R.Sathishkumar, N.Madhu, "Advanced Surveying- Total Station, GPS, GIS and Remote sensing", Pearson education, 2 nd Edition, 2018. | | | | | | | | | | | | | | |
| 2. Rueger, J.M. Electronic Distance Measurement, Springer -Verlag, Berlin, 4 th Edition, 1996. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 3 rd Edition, 2016 | | | | | | | | | | | | | | |
| 2. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4 th Edition, 2015. | | | | | | | | | | | | | | |
| 3. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983 | | | | | | | | | | | | | | |
| 4. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | - | 1 | - | - | 2 | - | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | 1 | - | 2 | - | - | 3 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | 2 | - | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | - | 2 | 2 | 2 | 3 | 3 | 2 |



| | | | | | | | |
|---|---|--|--|---|---|----------------------|-----------|
| CE23657 | GEOINFORMATICS FOR NATURAL DISASTERS | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand the causes and progress of climate change | | | | | | |
| 2 | examine the current scenario and its impact on climate. | | | | | | |
| 3 | lean the climate dynamics knowledge for mitigation strategies | | | | | | |
| 4 | analyze causes and prepare for future climate anomalies | | | | | | |
| 5 | develop climate resilience plans using geospatial tools. | | | | | | |
| UNIT I | OVERVIEW OF CLIMATE CHANGE AND DISASTER MANAGEMENT | | | | | | 9 |
| Climate Change - Hazards and Disasters, Overview of international agreements, Climate model, GCM, Regional Models, Sectoral models, CMIP, Performance Indicators for Evaluating GCMs, Policy Frameworks and Instruments for Climate Change Mitigation and adaptations, Policy Frameworks for Disaster Management, Disaster Risk Reduction for SDG Achievement, IPCC and Sendai Framework for Disaster Risk Reduction. | | | | | | | |
| UNIT II | FLOOD, DROUGHT AND COASTAL RISK ASSESSMENT | | | | | | 9 |
| Changes in precipitation patterns and hydrological cycles - Flood and Drought Risk assessment, Remote Sensing Applications in Agricultural Drought Monitoring and Forecasting, Satellite sensors and imagery for Water Resources, Spectral Indices (NDWI, MNDWI), Hydrological parameter estimation using RS and GIS; Digital Elevation Model (DEM), hydro-processing, drainage network and pattern, watershed delineation, Application of hydrologic models in present and future resources assessment - GIS application in hydrological models, Coastal Hazards, Coastal erosion and Inundation mapping, Storm Surge Hazard Mapping, Vulnerability Analysis, Landslide Hazard Mapping | | | | | | | |
| UNIT III | AGRICULTURE RISK AND FOREST HABITAT SUITABILITY ASSESSMENT | | | | | | 9 |
| Interaction between climate systems and agricultural/forest ecosystem, Role of forests in the global carbon cycle, Carbon Dynamics and Forest Management, Application of remote sensing in precision agriculture and forest management, Satellite sensors and imagery for Forest and Agriculture, Spectral Indices (NDBI, NDVI, SAVI, SMI) Mapping - Cropping Pattern Change Analysis, Layer classification, Modeling and decision support systems, Adaptation and mitigation strategies in agriculture and forest, Carbon credits and markets | | | | | | | |
| UNIT IV | GIS FOR DISASTER PLANNING AND PREPAREDNESS | | | | | | 9 |
| Geoinformatics models in managing forest fires, floods, landslides, cyclone and earthquake mapping - Essential Disaster Management Map Layers, Common GIS Tasks for Disaster Planning and Preparation Activities, Evacuation Route Planning, Evacuation Zone Planning, Scenario Modeling to Answer What-If Questions, Public Outreach and Citizen Participation- Disaster Response GIS Products, Future of GIS for Disaster Management. | | | | | | | |
| UNIT V | CASE STUDIES | | | | | | 9 |
| Feature Extraction using Google Earth - Geo-referencing Raster Map Images, Field Survey using GPS, Land Use Mapping using ArcGIS, Extraction of Exposure Data from Land Use Map using ArcGIS, Computation of Area Exposed to Hazard using ArcGIS, Generation of Vulnerability Maps using ArcGIS, Generation of Risk Maps and Damage to Properties | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |

| COURSE OUTCOMES | | | | | | | | | | | | | | |
|--|---|--------------------------------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| At the end of this course, students will be able to | | BT Mapped (Highest Level) | | | | | | | | | | | | |
| CO1 | understand the causes and progress of climate change. | Understanding (K2) | | | | | | | | | | | | |
| CO2 | understand the present scenario and its effect on changing climate | Understanding (K2) | | | | | | | | | | | | |
| CO3 | apply the knowledge gained in terms of climate dynamics to prepare and mitigate extreme climate | Applying (K3) | | | | | | | | | | | | |
| CO4 | analyze the probable causes and plan for the preparedness for future climate anomalies. | Analysing (K4) | | | | | | | | | | | | |
| CO5 | develop a climate resilience resource planning mode using geospatial tools and data. | Analysing (K4) | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Brian Tomaszewki Geographic Information Systems (GIS) for Disaster Management, Routledge, Taylor and Francis, 2021 | | | | | | | | | | | | | | |
| 2. C.P. Nair, Sreeja S. Geoinformatics Applications in Disaster Management, Trainer's Module, National Institute of Disaster Management, New Delhi, 2012. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Geographic information system for climate and disaster risk assessment Training Manual, Climate Change Commission, Manila 2016. | | | | | | | | | | | | | | |
| 2. Remote Sensing of the Environment - An Earth Resource Perspective. Jensen, J.R., .Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2001. | | | | | | | | | | | | | | |
| 3. Remote Sensing and Image Interpretation, T.M. Lillesand and R.W. Kiefer, John Wiley & Sons, 2000. | | | | | | | | | | | | | | |
| 4. Paul Longley., Geographic Information systems and Science, John Wiley & Sons, 4 th Edition, 2015. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | 3 | - | 3 | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 2 | - | - | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO4 | 1 | 2 | 3 | 2 | 3 | - | 2 | - | - | - | - | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | - | - | - | - | 2 | 2 | 1 |



| | | | | | | | |
|--|---|--|--|---|---|----------------------------------|-----------|
| CE23851 | CONSTRUCTION TECHNOLOGY | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | know the properties and applications of different construction materials. | | | | | | |
| 2 | understand the production, processing and testing of concrete. | | | | | | |
| 3 | learn the construction principles, formwork and other construction methods. | | | | | | |
| 4 | study the types of building finishes and building services. | | | | | | |
| 5 | learn the different repair techniques in construction. | | | | | | |
| UNIT I | BUILDING MATERIALS | | | | | | 9 |
| Introduction to building materials - Classification and requirements of good stone and brick, Brick manufacturing, Harmful ingredients, testing, Constituent of a good brick earth; Lime - manufacturing, Field-testing, Artificial hydraulic lime; Timber - classification, structure, seasoning, defects; Paints - Constituents, types and characteristics of varnishes. | | | | | | | |
| UNIT II | CONCRETE TECHNOLOGY | | | | | | 9 |
| Introduction to cement - High grade cements, Advances in manufacture of cement; Concrete Mix Design; Process of manufacture of concrete - Batching, mixing, transporting, placing, compaction, curing and finishing; Testing of fresh and hardened concrete; Non-destructive testing. | | | | | | | |
| UNIT III | PRINCIPLES OF BUILDING CONSTRUCTION | | | | | | 9 |
| Introduction - Bonding, Reinforced brick work, Stone masonry, Hollow block masonry, Composite masonry, Cavity walls; Flooring, Formwork, Shoring and Scaffolding, Slip and moving forms; Roofs and roof coverings; Under pinning, Submerge structures. | | | | | | | |
| UNIT IV | BUILDING ITEMS | | | | | | 9 |
| Plastering and pointing; Painting, Distempering and white washing; Damp proof course (DPC) - Anti-termite measures and treatments; Construction joints; Plumbing and electrification - various types of fittings and laying procedure. | | | | | | | |
| UNIT V | CONSTRUCTION DAMAGES AND REPAIR TECHNIQUES | | | | | | 9 |
| Causes of damage and deterioration in masonry and concrete structures - Symptoms and Diagnosis; Types of repair and rehabilitation techniques; Case studies. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | distinguish the different construction materials and select appropriate materials for construction. | | | | | Remembering (K1) | |
| CO2 | design suitable concrete mixes and test the concrete. | | | | | Understanding (K2) | |
| CO3 | execute construction jobs with the knowledge of the different construction techniques. | | | | | Understanding (K2) | |
| CO4 | comprehend the different types of building finishes and gain the ability to supervise the execution of different building services. | | | | | Applying (K3) | |
| CO5 | identify the building defects and apply suitable repair techniques to rectify them. | | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| 1. Shetty, M.S., Concrete Technology, S.Chand and Company, 2011. | | | | | | | | | | | | | | |
| 2. Rangwala.S.C., Engineering Materials, Charotar Publishing House Pvt. Ltd, 2017. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
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| 2. Neville A.M., Properties of Concrete, Fourth edition, Pearson Education Ltd. 2004. | | | | | | | | | | | | | | |
| 3. Arora, S.P. and Bindra, S.P., Building Construction, Dhanpat Rai and Sons, 1997. | | | | | | | | | | | | | | |
| 4. Punmia, B.C., Building Construction, Laxmi Publications (P) Ltd., 1993. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | - | 2 | 3 | 2 | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | - | - | - | - | 3 | 3 | 2 | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | - | - | - | 2 | 2 | 3 | 2 | - | - | - | 2 | - | 2 |
| CO4 | 3 | - | - | - | 2 | 2 | 3 | 2 | - | - | - | 2 | 2 | 2 |
| CO5 | 3 | - | - | - | 3 | 2 | 3 | 2 | - | - | - | 3 | 3 | 1 |



| | | | | | | | |
|--|---|--|--|---|---|----------------------------------|-----------|
| CE23852 | BASICS SURVEYING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | learn the basic principles of Surveying. | | | | | | |
| 2 | gain the knowledge on chain surveying. | | | | | | |
| 3 | understand the operations in chain surveying. | | | | | | |
| 4 | gain the knowledge on instrumentation in compass surveying. | | | | | | |
| 5 | learn the fundamentals of compass traversing. | | | | | | |
| UNIT I | INTRODUCTION TO SURVEYING | | | | | | 9 |
| Concept of Surveying - purpose of Surveying, Divisions of surveying, Classification of Surveying based on different criteria, Fundamental principles of Surveying, Measurements Units and conversions, Instruments used for taking linear and angular measurements. | | | | | | | |
| UNIT II | PRINCIPLES OF CHAIN SURVEYING | | | | | | 9 |
| Purpose and Principle of Chain Surveying - Suitability of Chain Surveying, Survey stations and their selection, Survey lines and offsets, Purpose, Perpendicular and oblique, Instruments used in Chain survey and their function; Ranging a survey line - Direct ranging and Indirect ranging, Chaining a line, Duties of leader and follower, Chaining on a sloping ground | | | | | | | |
| UNIT III | OPERATIONS IN CHAIN SURVEYING | | | | | | 9 |
| Errors in ordinary chaining - Correction due to incorrect length of Chain, problems; Different operations in Chain Surveying - Setting out right angles with cross staff, Cross staff survey, Recording field notes in Field book. | | | | | | | |
| UNIT IV | PRINCIPLES AND INSTRUMENTS IN COMPASS SURVEYING | | | | | | 9 |
| Compass surveying - Purpose, principle and uses of compass Survey, Description working and use of Prismatic compass, Operations in using Compass before taking readings; Concept of Meridian -Types of meridians, Bearing and angle, Designation of bearings, Whole Circle Bearing, Quadrantal Bearing, Conversion. | | | | | | | |
| UNIT V | COMPASS TRAVERSING | | | | | | 9 |
| Field work in Compass Survey - field notes; Traverse - Open and Closed Traverse using Prismatic Compass, Determination of included angles from the given bearings and vice versa in compass traverse. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | understand the concept of chain surveying. | | | | | Understanding (K2)) | |
| CO2 | apply the principles of chain surveying. | | | | | Applying (K3) | |
| CO3 | describe the standard operations in chain surveying. | | | | | Applying (K3) | |
| CO4 | explain the principles and procedures of Compass Surveying. | | | | | Applying (K3) | |

| CO5 | plot the closed traverse for the given data. | | | | | | | | | | | | Applying (K3) | |
|---|--|---|---|---|---|---|---|---|---|----|----|----|---------------|---|
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I and II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2023.. | | | | | | | | | | | | | | |
| 2. N.N.Basak, Surveying, Tata McGrow Hill Pvt Ltd, New Delhi, Second Edition, 2017 | | | | | | | | | | | | | | |
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| 2. C. Venkatramiah, Textbook of Surveying, Universities Press, Second Edition, 2011 | | | | | | | | | | | | | | |
| 3. K. R. Arora, Surveying Vol I and II, Standard Book house, Twelfth Edition 2013. | | | | | | | | | | | | | | |
| 4. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012 | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | 3 | - | 3 | 2 | - | - | - | 1 | 2 | 2 | 3 |
| CO2 | 3 | 2 | - | 3 | - | 3 | 2 | - | - | - | 1 | 2 | 1 | 3 |
| CO3 | 3 | 2 | - | 3 | - | 3 | 1 | - | - | - | 1 | 1 | 3 | 2 |
| CO4 | 3 | 2 | - | 3 | - | 3 | 1 | - | - | - | 1 | 1 | 1 | 2 |
| CO5 | 3 | 2 | - | 3 | - | 3 | 1 | - | - | - | 1 | 1 | 2 | 1 |



| | | | | | | | |
|---|---|--|--|---|---|----------------------------------|-----------|
| CE23853 | CONTRACT AND LABOUR LAWS | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | learn about various construction contracts. | | | | | | |
| 2 | know about tender and bidding process. | | | | | | |
| 3 | understand about arbitration and appointment of arbitrators | | | | | | |
| 4 | gain knowledge on labour regulations | | | | | | |
| 5 | define about the legal requirements. | | | | | | |
| UNIT I | CONSTRUCTION CONTRACTS | | | | | | 9 |
| Elements of Contracts - Types of Contracts, Features, Suitability; Design of Contract Documents - International Contract Document, Standard Contract Document, Law of Torts; Indian Contracts Act | | | | | | | |
| UNIT II | TENDERS | | | | | | 9 |
| Prequalification - Bidding, Accepting, Evaluation of Tender from Technical, Contractual and Commercial Points of View; Contract Formation and Interpretation - Potential Contractual Problems, World Bank Procedures and Guidelines; Tamilnadu Transparency in Tenders Act. | | | | | | | |
| UNIT III | ARBITRATION | | | | | | 9 |
| Comparison of Actions and Laws - Agreements, Subject Matter, Violations, Appointment of Arbitrators, Conditions of Arbitration, Powers and Duties of Arbitrator; Rules of Evidence - Enforcement of Award, Costs. | | | | | | | |
| UNIT IV | LABOUR REGULATIONS | | | | | | 9 |
| Social Security - Welfare Legislation, Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration; Insurance and Safety Regulations - Workmen's Compensation Act; Indian Factory Act, Tamilnadu Factory Act, Child Labour Act, Other Labour Laws. | | | | | | | |
| UNIT V | LEGAL REQUIREMENTS | | | | | | 9 |
| Insurance and Bonding - Laws Governing Sale, Purchase and Use of Urban and Rural Land, Land Revenue Codes; Tax Laws - Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs; Legal Requirements for Planning - Property Law, Agency Law, Local Government Laws for Approval, Statutory Regulations. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | explain the types of contract and contract document | | | | | Understanding (K2) | |
| CO2 | summarize the bidding and accepting of tenders | | | | | Understanding (K2) | |
| CO3 | examine the powers and duties of arbitrators | | | | | Applying (K3) | |
| CO4 | identify the various laws and regulations | | | | | Applying (K3) | |
| CO5 | assess the laws related to land and tax | | | | | Applying (K3) | |

| TEXT BOOKS | | | | | | | | | | | | | | |
|--|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
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| 2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2021. | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2018. | | | | | | | | | | | | | | |
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| 3. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2019. | | | | | | | | | | | | | | |
| 4. C.S. Venkata Ratnam, Globalisation and labour management relations, Response Books 2015 | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's | | | | | | | | | | | | | | |
| (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 1 | 1 | - | - | - | 2 | 3 | 3 | - | 3 | - | 1 | 2 | 1 |
| CO2 | 3 | - | - | - | - | 2 | 2 | 3 | - | 3 | - | - | 1 | 1 |
| CO3 | 3 | 1 | - | - | - | 3 | 2 | 3 | - | 3 | - | 1 | 3 | 1 |
| CO4 | 1 | - | - | - | - | 2 | 3 | 3 | - | 3 | - | - | 1 | 2 |
| CO5 | 1 | 2 | - | - | - | 3 | 3 | 3 | - | 3 | - | 1 | 3 | 3 |



| | | | | | | | |
|--|--|--|--|---|---|----------------------------------|-----------|
| CE23854 | BASICS OF TRANSPORTATION ENGINEERING | | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | | | |
| To enable the students to | | | | | | | |
| 1 | understand types and cross-sectional elements of highways. | | | | | | |
| 2 | learn the geometric design of roads and hill roads. | | | | | | |
| 3 | know construction and maintenance of pavements. | | | | | | |
| 4 | understand railway track components and layout. | | | | | | |
| 5 | learn about railway construction, signalling, and station layout. | | | | | | |
| UNIT I | CROSS SECTIONAL ELEMENTS OF HIGHWAYS | | | | | | 9 |
| Classification of Highways - Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements, Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths (IRC Standards); Sight Distances - Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance - Cross Sections of Different Class of Roads. | | | | | | | |
| UNIT II | GEOMETRIC DESIGN OF HIGHWAYS | | | | | | 9 |
| Horizontal Alignments - Superelevation, Widening of Pavements on Horizontal Curves; Vertical Alignments - Rolling, Limiting, Exceptional and Minimum Gradients; Summit and Valley Curves - Geometric Design of Hill Roads (IRC Standards Only) | | | | | | | |
| UNIT III | CONSTRUCTION AND MAINTENANCE OF HIGHWAY | | | | | | 9 |
| Construction of Flexible and Rigid Pavements - Defects in Flexible and Rigid Pavements; Highway Drainage; Evaluation and Maintenance of Pavements. | | | | | | | |
| UNIT IV | RAILWAY PLANNING AND DESIGN | | | | | | 9 |
| Permanent Way - Components and Functions of Each Component; Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels; Creeps Sleepers - Functions, Materials, Density; Ballasts - Functions, Materials, Ballast less Tracks Geometric Design of Railway Tracks Gradients and Grade Compensation, Superelevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves. | | | | | | | |
| UNIT V | RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION | | | | | | 9 |
| Points and Crossings - Turnouts, Track circuiting, Signaling, Interlocking, Lay Outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, Level Crossings. | | | | | | | |
| | | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | | |
| At the end of this course, students will be able to | | | | | | BT Mapped (Highest Level) | |
| CO1 | understand IRC road classification, elements, and sight distances. | | | | | Understanding (K2) | |
| CO2 | recall geometric design elements for highways and hill roads. | | | | | Understanding (K2) | |
| CO3 | identify types, construction, and defects of pavements. | | | | | Applying (Applying) | |

| CO4 | describe components and functions of railway track. | Applying (Applying) | | | | | | | | | | | | |
|--|--|---------------------|---|---|---|---|---|---|---|----|----|----|-------|---|
| CO5 | apply knowledge in railway track construction and signaling. | Applying (Applying) | | | | | | | | | | | | |
| TEXT BOOKS | | | | | | | | | | | | | | |
| 1. Kadiyalil. R, Engineering Traffic and Transport Planning, Khanna Publishers, New Delhi, 2019. | | | | | | | | | | | | | | |
| 2. Khanna K., Justo C.E.G., Highway Engineering Revised 10th Edition Khanna Publishers, Roorkee, 2014 | | | | | | | | | | | | | | |
| REFERENCES | | | | | | | | | | | | | | |
| 1. Sharma S.K., Principles Practice and Design of Highway Engineering, S. Chand and Co Ltd. New Delhi, 2006 | | | | | | | | | | | | | | |
| 2. Chandola S.P. Transportation Engineering-2019 | | | | | | | | | | | | | | |
| 3. Agarwal M.M., Indian Railway Track, 14 th Edition, Prabha and Co., New Delhi, 2002. | | | | | | | | | | | | | | |
| 4. Saxena S.C. Highway and Traffic Engineering, 2014. | | | | | | | | | | | | | | |
| CO-PO MAPPING : | | | | | | | | | | | | | | |
| Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | | | | | | | | | | |
| CO's | PO's | | | | | | | | | | | | PSO's | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 |



| | | | | | |
|--|--|---|---|---|----------|
| CE23855 | GREEN BUILDING TECHNOLOGY | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES | | | | | |
| To enable the students to | | | | | |
| 1 | know various aspects of green buildings. | | | | |
| 2 | use different steps involved in measuring environmental impact assessment. | | | | |
| 3 | relate the construction of green buildings with prevailing energy conservation policy and regulations. | | | | |
| 4 | know and identify different green building construction materials. | | | | |
| 5 | learn different rating systems and their criteria. | | | | |
| UNIT I | INTRODUCTION TO GREEN BUILDING AND DESIGN FEATURES | | | | 9 |
| Definition of Green Building, Benefits of Green Building, Components, features of Green Building, Site selection, Energy Efficiency, Water efficiency, Material Efficiency, Indoor Air Quality, Site selection strategies, Landscaping, building form, orientation, building envelope and fenestration, material and construction techniques, roofs, walls, fenestration and shaded finishes, advanced passive heating and cooling techniques, waste reduction during construction. | | | | | |
| UNIT II | ENERGY AUDIT AND ENVIRONMENTAL IMPACT ASSESSMENT | | | | 9 |
| Energy audit - Meaning, Necessity, Procedures, Types, Energy Management Programs, EIA regulations, Steps in environmental impact assessment process, Benefits of EIA, Limitations of EIA, Environmental clearance for civil engineering projects. | | | | | |
| UNIT III | ENERGY AND ENERGY CONSERVATION | | | | 9 |
| Renewable Energy Resources - Solar Energy, Wind Energy, Ocean Energy, Hydro Energy, Biomass Energy; Non-renewable Energy Resources - Coal, Petroleum, Natural Gas, Nuclear Energy, Chemical Sources of Energy, Fuel Cells, Hydrogen, Biofuel; Introduction, Specific objectives, present scenario, Need of energy conservation, LEED India Rating System and Energy Efficiency; Energy saving houses - Green House, Passive house, Passive house construction, Low-energy house, Zero-energy house, Energy consulting, Energy efficiency. | | | | | |
| UNIT IV | PRINCIPLES AND PLANNING OF GREEN BUILDING | | | | 9 |
| Features - Salient features of Green Building, Environmental design (ED) strategies for building construction; Process - Improvement in environmental quality in civil structure Materials, Green building materials and products, Bamboo, Rice husk ash concrete, plastic bricks, Bagasse particle board, Insulated concrete forms, reuse of waste material, Plastic, rubber, Newspaper wood, Non Toxic paint, green roofing. Housing modernization and management (building and construction safety, energy efficiency in housing, Property Refurbishment, Upgrade, Modernization , Renovation - Modular kitchens, bathrooms | | | | | |
| UNIT V | RATING SYSTEM | | | | 9 |
| Introduction to (LEED) criteria, Indian Green Building council (IGBC) Green rating, Green Rating for Integrated Habitat Assessment. (GRIHA) criteria Heating Ventilation Air Conditioning (HVAC) unit | | | | | |

in green Building Functions of Government organization working for Energy conservation and Audit(ECA) - National Productivity council (NPC) Ministry of New and Renewable Energy (MNRE) Bureau of Energy efficiency (BEE) - BER (Building Energy Rating), Certificates, Plumbing and Electrical to heating efficiency

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

**BT Mapped
(Highest Level)**

| | | |
|-----|--|--------------------|
| CO1 | understand the concepts of Green Building and its Design Features. | Understanding (K2) |
| CO2 | explain the Environmental Impacts. | Understanding (K2) |
| CO3 | explain the concept of Energy and Energy Conservation. | Understanding (K2) |
| CO4 | discuss the Principles and Planning of Green Building. | Understanding (K2) |
| CO5 | summarize the green Building Functions in various organizations. | Understanding (K2) |

TEXT BOOKS

1. Kibert, C.J., Sustainable construction: Green Building design and Delivery, John Wiley Hobouken, New Jersey, 3rd Edition, 2012
2. Chauhan, D S Sreevasthava, S K., Non-conventional Energy Resources, New Age International Publishers, New Delhi, 4th Edition, 2021

REFERENCES

1. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi.
2. Jagadeesh, K S, Reddy Venkatta Rama and Nanjunda Rao, K S., Alternative Building Materials and Technologies, New Age International Publishers, Delhi.
3. Sam Kubba., Handbook of Green Building Design and Construction, Butterworth- Heinemann.
4. Sharma K V, Venkateshaiah P., Energy Management and Conservation, IK International.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 1 | 1 | - | - | - | 2 | 3 | 3 | - | 3 | - | 1 | 2 | 3 |
| CO2 | 3 | - | - | - | - | 2 | 2 | 3 | - | 3 | - | - | 1 | 3 |
| CO3 | 3 | 2 | - | - | - | 3 | 2 | 3 | - | 3 | - | 1 | 3 | 1 |
| CO4 | 1 | - | - | - | - | 2 | 3 | 3 | - | 3 | - | - | 1 | 2 |
| CO5 | 1 | 2 | - | - | - | 3 | 3 | 3 | - | 3 | - | 1 | 3 | 3 |



| | | | | | | |
|--|--|---|---|---|--------------------------------------|-----------|
| CE23856 | ENVIRONMENTAL POLICY AND LEGISLATION | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES | | | | | | |
| To enable the students to | | | | | | |
| 1 | understand the constitutional and international framework for environmental protection. | | | | | |
| 2 | study the legal framework for water pollution control and regulatory mechanisms. | | | | | |
| 3 | examine air pollution laws and enforcement through state and central agencies. | | | | | |
| 4 | learn the responsibilities of local bodies and pollution control boards in waste management. | | | | | |
| 5 | explore contemporary public interest litigation in environmental protection. | | | | | |
| UNIT I | INTRODUCTION TO ENVIRONMENT PROTECTION | | | | 9 | |
| Indian Constitution and Environmental Protection; National Environmental policies; Precautionary Principle and Polluter Pays Principle; Concept of absolute liability; Multilateral Environmental agreements and Protocols - Montreal Protocol, Kyoto agreement, Rio declaration. | | | | | | |
| UNIT II | WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974 | | | | 9 | |
| Power and Functions of regulatory agencies; Responsibilities of occupier provision relating to prevention and control scheme of consent to establish; consent to operate - Conditions of the consents, Outlet; Legal sampling procedures - State Water Laboratory; Appellate Authority - Penalties for violation of consent conditions; Provisions for closure/directions in apprehended pollution situation. | | | | | | |
| UNIT III | AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981 | | | | 9 | |
| Power and Functions of regulatory agencies; Responsibilities of occupier provision relating to prevention and control scheme of consent to establish; consent to operate - Conditions of the consents, Outlet; Legal sampling procedures - State Air Laboratory; Appellate Authority - Penalties for violation of consent conditions; Provisions for closure/directions in apprehended pollution situation. | | | | | | |
| UNIT IV | ENVIRONMENT (PROTECTION) ACT, 1986 | | | | 9 | |
| Genesis of the Act - delegation of powers; Role of Central Government; EIA Notification - Siting of Industries - Coastal Zone Regulation; Responsibilities of local bodies mitigation scheme for Municipal Solid Waste Management; Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorisation – Biomedical waste rules; Responsibilities of generators and role of Pollution Control Boards. | | | | | | |
| UNIT V | RECENT RULES AND NOTIFICATIONS | | | | 9 | |
| Relevant Provisions of Indian Forest Act; Public Liability Insurance Act; Public Interest Litigation - Writ petitions, Supreme Court Judgments in Landmark cases; National Green tribunals; Recent environmental rules and notifications. | | | | | | |
| | | | | | TOTAL PERIODS | 45 |
| COURSE OUTCOMES | | | | | | |
| At the end of this course, students will be able to | | | | | BT Mapped (Highest Level) | |
| CO1 | identify key principles in national and international environmental law. | | | | Remembering (K1) | |
| CO2 | list out the roles, responsibilities and penalties under the water act. | | | | Remembering (K1) | |
| CO3 | understand enforcement procedures and legal responsibilities under the air act. | | | | Understanding (K2) | |

| | | |
|-----|--|--------------------|
| CO4 | interpret the significance of environmental impact assessments and waste rules. | Understanding (K2) |
| CO5 | apply legal knowledge to interpret current environmental policies and court interventions. | Applying (K3) |

TEXT BOOKS

1. Greger I. Megregor, "Environmental law and enforcement", Lewis Publishers, London.2021.
2. Shyam Divan and Armin Roseneranz "Environmental law and policy in India "Oxford University Press, New Delhi, 2001.

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1. Environmental Law Case Book, Lexis Nexis, Butterworths, Mohanty", S. K.,Leelakrishnan. P, Environment and Pollution Law, Universal Law Publishing Co.Pvt. Ltd., 2011.
2. Environmental Law and Policy in India", Shyam Divan and Armin Rosencranz, Oxford University Press, New Delhi, 2005.
3. CPCB, "Pollution Control acts, Rules and Notifications issued there under "Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.
4. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi Bombay.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| CO's | PO's | | | | | | | | | | | | PSO's | |
|------|------|---|---|---|---|---|---|---|---|----|----|----|-------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | - |
| CO3 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO4 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 3 | - |
| CO5 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 3 |

