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| **Course Code** | **14CE2002** | **Duration** | **3hrs** |
| **Course Name** | **MECHANICS OF SOLIDS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Describe different types of beams based on the support condition. | | CO2 | R | 1 |
| 2. | Define the term torsion. | | CO2 | R | 1 |
| 3. | Define the term pure bending. | | CO2 | R | 1 |
| 4. | Define the term principal planes. | | CO1 | R | 1 |
| 5. | Define resilience. | | CO1 | R | 1 |
| 6. | Describe the meaning of strength of a section. | | CO2 | R | 1 |
| 7. | Infer bending moment diagram. | | CO2 | U | 1 |
| 8. | State Hooke’s law. | | CO1 | R | 1 |
| 9. | Define stress. | | CO1 | R | 1 |
| 10. | Express the relation between young’s modulus and bulk modulus. | | CO1 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the types of loads with neat sketch. | | CO1 | U | 3 |
| 12. | List the different types of loads acting on the beam. Differentiate the point load and uniformly distributed load. | | CO2 | R | 3 |
| 13. | A solid shaft of 20 cm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced in the shaft is 50 N/mm2. | | CO3 | A | 3 |
| 14. | Construct the shear force and bending moment diagram for a cantilever of length L carrying a point load W at free end. | | CO2 | A | 3 |
| 15. | Determine the diameter of a circular bar which is subjected to an axial pull of 160 kN, if the maximum allowable shear stress on any section is 65 N/mm2. | | CO1 | A | 3 |
| 16. | Write the torsion equation of a shaft with expressions. | | CO3 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | A bar of 50 mm diameter is subjected to a pull of 100kN. The measured extension on gauge length of 200 mm is 0.2 mm and change in diameter is 0.004mm. Calculate  a. Young’s modulus b. Poisons ratio c. Bulk modulus. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | The principal stress at a point across two planes are 120 N/mm2 (tensile) and 60 N/mm2(Compressive). Determine the normal, tangential stress and the resultant stress on a plane inclined at 45oto the axis of minor stresses. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | A simply supported beam 8 m long carries a point load of 4kN and 4kN at distances of 4m and 4m from the left end. Draw Shear Force and Bending Moment diagrams for the beam. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | A timber beam is 120mm wide and 300mm deep and is used on a span of 4metres. The beam carries a UDL of 3 kN/m run over the entire length. Find the maximum bending stress induced. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | A hollow shaft of external diameter 100 mm transmits 200 kW power at 150 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 70 N/mm2. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain in detail the theories of failure   1. The maximum principal stress theory 2. The maximum strain theory 3. The maximum shear stress theory | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | The following data refer to a tensile test conducted on a mild steel bar.   1. Diameter of the steel bar = 30mm 2. Gauge length = 200mm 3. Extension at the load of 150kN = 0.15mm 4. Load at elastic limit = 250kN 5. Maximum load = 380kN 6. Total extension = 60mm 7. Diameter of the rod at failure = 23mm   Calculate  a. The Young’s modulus b. The stress at elastic limit  c. The percentage elongation d. The percentage decrease in area | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A simply supported beam of length 8m rests on supports 6m apart, the right hand end is overhanging by 2m. The beam carries a UDL of 1500N/m over the entire length. Draw the shear force and bending moment diagrams and find the point of contra flexure. | CO2 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the fundamental concepts of mechanics. |
| CO2 | Analyse the behavior of structural members under different loading conditions. |
| CO3 | Categorise suitable method for analysis of structures. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 3 | 27 |  |  |  | 35 |
| CO2 | 7 | 1 | 51 |  |  |  | 59 |
| CO3 | 0 | 3 | 27 |  |  |  | 30 |
|  | | | | | | | **124** |



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| **Course Code** | **18CE3038** | **Duration** | **3Hrs** |
| **Course Name** | **WATER RESOURCES PLANNING AND SYSTEMS ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Define Systems and classify systems with examples. | CO1 | U | 8 |
|  | b. | Infer design and analysis of a system. Explain with an example. | CO1 | R | 8 |
|  |  |  |  |  |  |
| 2. | a. | An irrigation project is to be developed. There is 20 Mm3 of water available annually. Two high-value specialty crops, A and B, are considered for which water consumption requirements are 9000 m3 and 6000 m3, respectively. It has also been determined that the planting of more than 1600 hectares to crop A or 2400 hectares to crop B would cause an adverse effect on the market for these special crops. It has been estimated that each acre devoted to crop A will result in Rs. 28800 profit, while an acre of crop B will give a net profit of Rs. 48,000. Structure the LP model for this problem stating the logics involved. | CO3 | An | 8 |
|  | b. | Enumerate the process of Inflow as a stochastic process. | CO2 | Ap | 8 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the procedures for optimization of functions with single variable and multi-variables | CO4 | An | 8 |
|  | b. | State the significance of Sensitivity Analysis with reference to optimality and feasibility. | CO5 | Ap | 8 |
|  |  |  |  |  |  |
| 4. | a. | Consider that funds are allocated to three water resources development project namely, A, B and C in order to maximize the total expected revenue. Each water resources development project consists of different alternative configurations that require different funding levels and yield different revenues. Due to budget limitations, the total available funds for the entire development are fixed. Describe the general philosophy of the dynamic programming technique in deriving the optimal allocation of funds to the three projects with the objective of maximizing the total revenues. | CO3 | Ap | 10 |
|  | b. | Explain the concept of suboptimization and principle of optimality. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 5. | a. | Elaborate objective function in both canonical and standard form Minimize Z = 2 x1 + 3 x2 + 5x3  Sub to -3x1 + 4x2 ≤ 5  x1 + 3x2 + x3 ≥ 4  x1 + x3 ≤ 3  x1, x2, x3 ≥ 0 | CO4 | Ap | 6 |
|  | b. | Elaborate the master plan approach for reservoir allocation strategies | CO6 | U | 10 |
|  |  |  |  |  |  |
| 6. | a. | Summarize the implementation and planning strategies of water resources projects. | CO6 | U | 8 |
|  | b. | Enumerate in detail: Dynamic programming and Bellman’s principle of optimality and its characteristics. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 7. | a. | Associate curse of dimensionality with water resources projects. | CO4 | U | 8 |
|  | b. | Categorize the application of dynamic programming for resource allocation in a reservoir. | CO6 | Ap | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Illustrate the various levels of water resource planning and development. | CO1 | U | 10 |
|  | b. | Elaborate the term sensitivity analysis with three steps and also list out the applications of linear programming in water resources. | CO2 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the steps involved in planning a water resources project in an integrated way |
| CO2 | Gain knowledge about different components of National Water Policy |
| CO3 | Understand the economic policy to carryout cost-benefit analysis |
| CO4 | Formulate the objective function and constraints |
| CO5 | Apply few optimization tools and techniques |
| CO6 | Develop reservoir operation policy |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 8 | 18 |  |  |  |  | 26 |
| CO2 |  | 18 | 8 |  |  |  | 26 |
| CO3 |  |  | 10 | 8 |  |  | 18 |
| CO4 |  | 8 | 6 | 8 |  |  | 22 |
| CO5 |  | 6 | 8 |  |  |  | 14 |
| CO6 |  | 18 | 8 |  |  |  | 26 |
|  | | | | | | | **132** |



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| **Course Code** | **18CE3049** | **Duration** | **3hrs** |
| **Course Name** | **ELECTROCHEMICAL WATER PROCESSING AND WATER TREATMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss the working principle of electrochemical cell with a schematic diagram. Explain how the current is conducted in the cell. | CO1 | U | 10 |
|  | b. | Explain how the mass transfer occurs in the electrochemical cells with the passage of current. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Differentiate between   1. Galvanic cell and Electrolytic cell 2. Anodes and cathodes 3. Faradaic and Non-Faradaic currents 4. Electrical double layer | CO1 | U | 10 |
|  | b. | What are the mechanics of electrodes? Discuss in detail any one of the standard electrodes applied in water treatment. | CO6 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Discuss in detail the different factors and operational parameters to be considered in the design of electrochemical reactor. | CO3 | Ap | 10 |
|  | b. | What is electrolysis and discuss in detail the working principle of any one of the electrochemical reactors in water treatment. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Classify different designs of electrochemical reactor with an example. | CO3 | An | 10 |
|  | b. | Enumerate the advantages, limitations and applications of monopolar and bipolar electrode configuration in water treatment. | CO2 | Ap | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the working principle of flow through cell and mixed tank cell with a neat sketch. Mention their specific applications. | CO3 | Ap | 10 |
|  | b. | Distinguish between electrode passivation and activation. How passivation can be avoided in electrocoagulation? | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain how electrocoagulation is different from chemical coagulation. Compare and contrast both methods. | CO4 | U | 12 |
|  | b. | Describe the working principle of electrodialysis in desalination. Enumerate the components involved in electrodialysis design. | CO4 | Ap | 8 |
|  |  |  |  |  |  |
| 7. | a. | Explain in detail the process of electrocoagulation in removal of suspended solids with a neat sketch. | CO6 | U | 14 |
|  | b. | Discuss in detail the six operational parameters that influence the performance of electrocoagulation. | CO2 | An | 6 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the principal involved in any four electrochemical methods of recovering heavy metals with a neat sketch. | CO5 | Ap | 10 |
|  | b. | Discuss how iron can be removed in acid baths. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain how the Bio-ciding technology is useful in water treatment with a case study. | CO5 | U | 10 |
|  | b. | Discuss in detail the principles, process and applications of Electrolytic chlorination. | CO5 | Ap | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts of electrochemistry |
| CO2 | Anlayse the characteristics of the effluent and sludge produced |
| CO3 | Design electrochemical reactor |
| CO4 | Understand the mechanism of electro dialysis for desalination |
| CO5 | Apply electrochemical methods for heavy metal removal |
| CO6 | Develop new electrodes for electrocoagulation and capacitive deionization |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 20 | - | 10 | - | - | 30 |
| CO2 | - |  | 10 | 20 | - | - | 30 |
| CO3 | - | 10 | 20 | 10 | - | - | 40 |
| CO4 | - | - | 10 | 10 | - | - | 20 |
| CO5 | - | - | 20 | 20 | - | - | 40 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18CE3053** | **Duration** | **3hrs** |
| **Course Name** | **DESIGN OF HYDRAULIC AND CONVEYANCE STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Summarize the need of reservoir and mention the types. | CO1 | U | 10 |
|  | b. | Illustrate the types of hydraulic structures. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Interpret the types of Canals system and mention the uses. | CO1 | U | 10 |
|  | b. | Explain the criteria considered in selecting the site for dam. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the environmental and social impact considered in the preliminary and final investigations in the context of dam site selection. | CO2 | A | 10 |
|  | b. | Determine the measure to control and mitigate seepage. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Illustrate the components in the open channel spillway. | CO3 | A | 10 |
|  | b. | Articulate the causes and consequences of cavitation in spillway. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the different types of energy dissipation devices in hydraulic structures. | CO3 | U | 10 |
|  | b. | Summarize the design and principles for Canal Sections in Alluvial Soil and Hard Rock Zones. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Infer the solutions in gate maintenance of canal Inlets and Sluices. | CO4 | A | 10 |
|  | b. | Examine the types of regulators and canal falls constructed in canals. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Estimate saddle siphon spillway has a rectangular throat section 2.2m wide and the radius of crown and crest are 3m and 1.6m, respectively. With the normally adopted valves of atmospheric pressure and the net operating head of 7.5 m at the crest, compute the discharge through the siphon. | CO5 | U | 10 |
|  | b. | Infer the measures to control Reservoir sedimentation. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Summarize the EPANET, WaterGEMS and Infowater software usage in water network modelling. | CO5 | U | 10 |
|  | b. | Describe any two components of hydropower structures. | CO6 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Identify the hydropower structures components and mention the use of it. | CO6 | U | 10 |
|  | b. | Describe the various structures used in the production of hydropower. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the design criteria for various types of dams |
| CO2 | Analyze and design various hydraulic structures |
| CO3 | Design a water supply distribution network |
| CO4 | Design irrigation channels and cross drainage works |
| CO5 | Estimate the hydropower potential |
| CO6 | Design penstocks and surge tanks |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A4** | **An** | **E** | **C** | **Total** |
| CO1 |  | 30 |  |  |  |  | 30 |
| CO2 |  | 10 | 20 |  |  |  | 30 |
| CO3 |  | 10 | 20 |  |  |  | 30 |
| CO4 |  | 10 | 20 |  |  |  | 30 |
| CO5 |  | 30 |  |  |  |  | 30 |
| CO6 |  | 30 |  |  |  |  | 30 |
|  | | | | | | | **180** |



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| **Course Code** | **18CE3054** | **Duration** | **3hrs** |
| **Course Name** | **PRINCIPLES OF INTEGRATED WATER RESOURCES**  **MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain ‘Green Water’ and its influence on agriculture and ecological ecosystem. | CO1 | U | 8 |
|  | b. | Discuss the key principles from Earth Summit (UNCED) and Dublin Conference. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 2. | a. | Explain the key elements and principles of River Basin Management. | CO3 | Ap | 8 |
|  | b. | Discuss in detail the impacts of population growth and human activities on water resources and water scarcity. | CO4 | An | 8 |
|  |  |  |  |  |  |
| 3. | a. | Explore the significant and wide-ranging effects of global climate change on water resources. | CO2 | An | 8 |
|  | b. | Discuss in detail the important features of National Water Policy 2002. | CO3 | U | 8 |
|  |  |  |  |  |  |
| 4. | a. | Explain the importance of environmental flows in the context of ecosystem health and sustainable development. | CO6 | Ap | 8 |
|  | b. | Define ecosystem services, provide examples and explain how adaptive management supports ecosystem services. | CO6 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | Explore the detrimental effects of saltwater intrusion on groundwater quality and availability in coastal areas. | CO6 | E | 8 |
|  | b. | Define Integrated Water Resources Management and explain the principles of Integrated Water Resources Management (IWRM). | CO1 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | Explain how the inter basin transfer may be useful in the context of IWRM with an example. List out the limitations. | CO2 | An | 8 |
|  | b. | Discuss in detail the model of the conjunctive use of groundwater and surface water in the context of irrigation. | CO4 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | Explain the principles and functions of the primary, secondary and tertiary unit operations in grey water treatment with a neat layout. | CO4 | Ap | 8 |
|  | b. | Discuss the surface and subsurface recharge structures in detail with sketch. | CO4 | Ap | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Explore the principles, applications, advantages and limitations of any two desalination techniques in detail. | CO4 | U | 10 |
|  | b. | Discuss the objectives, process and limitations of PPP in the context of IWRM. | CO5 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the concepts of IWRM principles |
| CO2 | Plan integrated water resources development projects considering sustainability aspects |
| CO3 | Involve in water management projects from a multi-objective and multi-purpose perspective |
| CO4 | Develop various water conservation techniques |
| CO5 | Understand Private Public Partnership (PPP) |
| CO6 | Analyze the environmental and health issues due to different water issues |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 16 |  |  |  |  | 16 |
| CO2 |  | 8 |  | 16 |  |  | 24 |
| CO3 |  | 8 | 8 |  |  |  | 16 |
| CO4 |  | 10 | 16 | 8 | 8 |  | 42 |
| CO5 |  | 10 |  |  |  |  | 10 |
| CO6 |  |  | 8 | 8 | 8 |  | 24 |
|  | | | | | | | **132** |



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| **Course Code** | **18CE3057** | **Duration** | **3hrs** |
| **Course Name** | **FOREST, URBAN AND AGRICULTURAL WATERSHED MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Summarize the key factors that are considered by the civil engineers in watershed planning. | CO1 | U | 10 |
|  | b. | Describe watershed development, objectives, and mention its significance in environmental management. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | List the key assessment indicators for monitoring and evaluating sustainability of watershed development projects. | CO2 | R | 10 |
|  | b. | Analyze global agricultural trends and their impact on watershed management. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain watershed delineation and its importance in managing water and the environment. | CO3 | U | 10 |
|  | b. | Identify the role of forest in snow-influenced watersheds and effective watershed management for sustainable water resources. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Distinguish the effects of deforestation on erosion in forested watersheds and its impact on watershed management. | CO5 | U | 10 |
|  | b. | Articulate the impact of the forest hydrology system in the Western Ghats on water resources and biodiversity. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Express the significance of agricultural practices in managing cultivated watersheds. | CO5 | U | 10 |
|  | b. | Classify the impact of green buildings on urban watershed management, specifically in terms of water conservation and sustainability. | CO6 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Recognize the significance of land use planning in watershed development and its relationship with conservation efforts. | CO6 | R | 10 |
|  | b. | Compare floodplain management strategies for mitigating urban flooding in urban watershed management. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Summarize in-depth explanations for both peak flow and low flow. | CO2 | U | 10 |
|  | b. | Interpret the influence of urban watershed management on urban water supply sustainability. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the concept of nutrient budgeting within agricultural practices, highlighting its significance and components. | CO4 | U | 10 |
|  | b. | Describe the following terms in detail, providing comprehensive explanations:  • Erosion  • Storage and irrigation | CO1 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write the impact of changes in a urban watershed based on a specific case study. | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the hydrologic principles in forest, urban and agricultural management |
| CO2 | Apply the techniques for soil erosion control, flood management and storm management |
| CO3 | Develop an integrated watershed management plan |
| CO4 | Determine nutrient budget for a watershed |
| CO5 | Develop storm water management strategy for a watershed |
| CO6 | Apply water conservation techniques in green buildings |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 20 | 10 | - | - | - | 40 |
| CO2 | 10 | 30 | - | 10 | - | - | 50 |
| CO3 | - | 20 | - | - | - | - | 20 |
| CO4 | - | 10 | - | - | - | - | 10 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | 10 | - | 20 | 10 | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **18CE3059** | Duration | 3hrs |
| **Course Name** | **IMPACT OF CLIMATE CHANGE ON WATER RESOURCES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | Illustrate carbon cycle and mention its importance pertaining to human influence. | CO1 | U | 16 |
|  |  |  |  |  |  |
| 2. |  | Describe El Niño and La Niño events federated by trade winds. | CO2 | U | 16 |
|  |  |  |  |  |  |
| 3. |  | Interpret Higher Dimensional models and GCMs with relevant equations. | CO3 | A | 16 |
|  |  |  |  |  |  |
| 4. |  | Discuss UNICEF response for water-related adaptation to climate change in the field of water, sanitation and hygiene. | CO4 | U | 16 |
|  |  |  |  |  |  |
| 5. |  | Employ CCS as contributor to climate change and bring out its role influencing mitigation. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 6. |  | Interpret the findings of Ganga Damodar Project (case study). | CO6 | A | 16 |
|  |  |  |  |  |  |
| 7. | a. | Explain the four stages of Cyclone and mention past five years tropical cyclones occurred in India (any 3). | CO2 | R | 8 |
|  | b. | Generalize the Special Report on Emission Scenarios (SRES) designed to limit greenhouse gas emissions. | CO3 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. |  | Describe the various strategies incorporated for flood and coastal zone management. | CO6 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Enumerate the characteristics of climate change |
| CO2 | Assess the impact of climate change |
| CO3 | Utilize the tools for vulnerability assessment |
| CO4 | Incorporate the adaptation techniques |
| CO5 | Plan the mitigation activities |
| CO6 | Implement the mitigation activities as per the policies |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 16 | - | - | - | - | 16 |
| CO2 | 8 | 16 |  | - | - | - | 24 |
| CO3 | - | 8 | 16 | - | - | - | 24 |
| CO4 | - | 16 | - | - | - | - | 16 |
| CO5 | - | - | 16 | - | - | - | 16 |
| CO6 | - | 20 | 16 | - | - | - | 36 |
|  | | | | | | | **132** |



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| **Course Code** | **18CE3059** | **Duration** | **3hrs** |
| **Course Name** | **IMPACT OF CLIMATE CHANGE ON WATER RESOURCES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Visualize the effects of various SRES scenarios on temperature. | CO1 | U | 10 |
|  | b. | Identify the characteristics of climate system components. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the climate drivers and the major components of climate systems. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Relate the Hadley cell circulation and radiative forcing pattern around the earth surface. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain relative vulnerability of water resources systems with reference to climate change. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Discuss in detail about carbon dioxide capture and storage. | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Elaborate the conflicts that arise between adaptation and mitigation in water resources project. | CO5 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Determine the various issues related to transboundary waters along with conflicts raised by economics and trade. | CO6 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Evaluate the feature of Earth-system models of intermediate complexity. | CO3 | An | 10 |
|  | b. | Elaborate Himalayan glacier studies. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Examine the features of the Ganga Damodar Project. | CO6 | An | 10 |
|  | b. | Explain the procedures for temporal and spatial assessment of water resources. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Enumerate the characteristics of climate change |
| CO2 | Assess the impact of climate change |
| CO3 | Utilize the tools for vulnerability assessment |
| CO4 | Incorporate the adaptation techniques |
| CO5 | Plan the mitigation activities |
| CO6 | Implement the mitigation activities as per the policies |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 40 |  |  |  |  | 40 |
| CO2 |  | 20 |  |  |  |  | 20 |
| CO3 |  | 20 |  | 10 |  |  | 30 |
| CO4 |  |  | 20 |  |  |  | 20 |
| CO5 |  | 10 | 20 |  |  |  | 30 |
| CO6 |  |  | 30 | 10 |  |  | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **18CE3061** | **Duration** | **3hrs** |
| **Course Name** | **REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Examine the spectral signature and spectral curve. Interpret its usage in identifying the features. | CO1 | U | 10 |
|  | b. | List and explain orbits followed by remote sensing satellites. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain in detail with neat sketches the Atmospheric interactions with Electro Magnetic Radiation. | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | Combine a short note on the features and applications of Remote Sensing Satellites. | CO2 | U | 10 |
|  | b. | Enumerate the different types of platform and explain in detail with give examples. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Elaborate active sensor and passive sensor and explain in detail that are designed for satellites. | CO3 | A | 10 |
|  | b. | Discuss in detail about editing raster dataset. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Compare data products and relate the data products with applications | CO3 | U | 10 |
|  | b. | Differentiate Supervised and Unsupervised image classification techniques. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss image enhancement techniques and explain image classification procedure with flow chart. | CO5 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Describe in detail, Components of GIS and Theoretical models of GIS operation. | CO3 | U | 10 |
|  | b. | Classify map based on scale and purpose. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | List the important functions of Data base management system. | CO3 | R | 10 |
|  | b. | Elaborate the advantages and disadvantages of raster and vector data structures. | CO3 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain in briefly Spectral Reflectance of Water bodies. | CO6 | A | 10 |
|  | b. | Demonstrate the principle of RS. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the principles and components of Remote Sensing and GIS. |
| CO2 | Analyze and interpret satellite images using digital image processing. |
| CO3 | Create thematic maps for various applications. |
| CO4 | Implement overlay analysis for various environmental and water resources application. |
| CO5 | Create spatial and temporal variation maps. |
| CO6 | Apply GIS and RS tool in environmental and water resources projects. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 10 |  | 20 |  |  | 40 |
| CO2 |  | 30 |  |  |  |  | 30 |
| CO3 | 10 | 30 | 10 |  |  |  | 50 |
| CO4 |  | 10 | 10 |  |  |  | 20 |
| CO5 |  |  |  | 20 |  |  | 20 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **20CE1001** | **Duration** | **3hrs** |
| **Course Name** | **BUILDING SCIENCE AND ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define sun path diagram. | | CO1 | R | 1 |
| 2. | Infer the two essential skills required for an engineer while designing a building. | | CO1 | U | 1 |
| 3. | Illustrate the importance of providing HVAC system in a building. | | CO2 | A | 1 |
| 4. | Discuss the relationship between metabolism and different human activities. | | CO2 | R | 1 |
| 5. | Illustrate green building. | | CO3 | An | 1 |
| 6. | State the cultural value in the context of engineering. | | CO6 | R | 1 |
| 7. | Classify the components of built environment. | | CO4 | An | 1 |
| 8. | Express the formula to calculate reverberation time. | | CO4 | U | 1 |
| 9. | Define daylighting. | | CO5 | R | 1 |
| 10. | State the demerits of daylighting and solar shading. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate heliocentric view and geocentric view. | | CO1 | U | 3 |
| 12. | List out the ways to achieve thermal comfort in building. | | CO2 | U | 3 |
| 13. | Categorize various methods to improve indoor comfort in building. | | CO3 | An | 3 |
| 14. | State the fundamental requirements in designing rooms for better audio effects. | | CO4 | A | 3 |
| 15. | Describe the significance of day lighting. | | CO5 | U | 3 |
| 16. | Illustrate the requirements of providing insulation in a building. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain microclimate and macroclimate concepts. | CO1 | U | 6 |
|  | b. | Illustrate the types of sun shading devices. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the heat transfer mechanism in human body with appropriate equations and diagram. | CO2 | U | 8 |
|  | b. | Explain different types of thermal indices. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. | a. | Summarize the energy use indicators in building design. | CO2 | U | 8 |
|  | b. | Write a note on energy neutral and energy positive building. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. |  | Explain various acoustic materials used in buildings. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the integrated design approach in day lighting. | CO5 | U | 7 |
|  | b. | Explain the context of LEED with reference to rating. | CO4 | A | 5 |
|  |  |  |  |  |  |
| 22. |  | Develop a study for an auditorium related to acoustic design. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Describe room acoustic parameters and sound absorption strategies in buildings. | CO4 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the thermal balance to be maintained in buildings. | CO2 | U | 6 |
|  | b. | Develop a design strategy for buildings in different climatic conditions. | CO1 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the climate responsive design of buildings |
| CO2 | Illustrate the thermal comfort and energy efficiency requirements |
| CO3 | Illustrate acoustics, in the design of buildings |
| CO4 | Demonstrate the principles of noise control |
| CO5 | Design for visual quality and day lighting |
| CO6 | Appraise the design principles in real time environment |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | 6 | - |  |  | 23 |
| CO2 | 5 | 25 | 1 | - |  |  | 31 |
| CO3 | - | 12 | 4 | 4 |  |  | 20 |
| CO4 | - | 13 | 8 | 1 |  |  | 22 |
| CO5 | 2 | 10 | - | - |  |  | 12 |
| CO6 | 1 | - | 15 | - |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE1002** | **Duration** | **3hrs** |
| **Course Name** | **ENGINEERING MECHANICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | What is the expression for the mass moment of inertia of a cone? | | CO1 | R | 1 |
| 2. | Explain about the parallel axis theorem. | | CO1 | U | 1 |
| 3. | An object is projected at an angle of 50° with respect to the horizontal axis with a velocity of 10 m/s. Determine the horizontal component of the velocity. | | CO2 | E | 1 |
| 4. | Demonstrate curvilinear motion with an example. | | CO2 | U | 1 |
| 5. | An object rotates at a speed of 120 rpm. Estimate the value of angular velocity. | | CO3 | E | 1 |
| 6. | Define bulk modulus. | | CO3 | R | 1 |
| 7. | Explain about Poission’s ratio. | | CO4 | U | 1 |
| 8. | What is modulus of rigidity? | | CO4 | R | 1 |
| 9. | Classify the truss. | | CO5 | An | 1 |
| 10. | What is the relationship between Young’s modulus and bulk modulus? | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the moment of Inertia of the figure given below about the  X-X axis.  X  X  120 mm  40mm  100mm | | CO6 | E | 3 |
| 12. | Discover the Cartesian coordinates for (10, 60°). | | CO2 | An | 3 |
| 13. | A person lifts a block of weight 500 N vertically by 500 mm in 5 seconds. Determine the energy spent and the power. | | CO2 | E | 3 |
| 14. | The Young’s modulus and the Poisson’s ratio are 2 x 105 N/mm2 and 0.3 for a material. Estimate the value of rigidity modulus. | | CO4 | E | 3 |
| 15. | Determine the force in the member GC.  H G F E  60°  A  A1 B C D  100 kN  100 kN | | CO5 | E | 3 |
| 16. | The strain along the length and diameter of a cylinder subjected to a tensile force are 0.0032 and 0.0.001 respectively. Discover the value of volumetric strain. | | CO4 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine the moment of Inertia of the figure given below about the  centroidal axis parallel to the XX axis.  100 mm  10 mm  10mm  80 mm  10 mm  150 mm | CO6 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | A ball is dropped on a floor from a height of 10m. If the coefficient of restitution is 0.85, determine the height upto which the ball will raise after the second impact. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | A body of mass 20 kg rests on a horizontal platform. The mass is connected by a string passing over a smooth pulley as shown in figure to another body of mass 3 kg. Initially, the friction between the 20 kg block and the table is just sufficient to prevent motion. If an additional body of mass 1 kg is added to the 3 kg mass, discover the acceleration of the two bodies.  3 kg  20 kg | CO2 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | A bar of size 75mm x 25mm and length 500mm is subjected to a tensile force of 100 kN. Determine the change in the volume.  The value of modulus of rigidity of a material is 0.8 x 105 N/mm2 and the value of Poisson’s ratio is 0.33. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Determine the support reactions for the beam shown below:  7 kN  10 kN  20 kN/m  1m 2m 1.5m 2m 1.5m  8 m | CO5 | E | 8 |
|  | b. | Illustrate a perfect truss and deficient truss with neat diagram. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Analyse the forces in the various members of the truss shown below.  20 kN  40 kN  E  D  B  60° 60° 60° 60°  C  A    6 m | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | A bullet loses 1/25th of its velocity while passing through a plank. Estimate how many such planks are needed to bring the bullet to rest. | CO2 | C | 10 |
|  | b. | Define power and the recall the unit for power. | CO2 | R | 2 |

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| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A compound tube consists of steel tube of 150mm internal diameter and 170mm external diameter. The steel tube is surrounded by a outer brass tube of 170mm internal diameter and 190mm external diameter. The tube is subjected to a load of 1200 kN. Determine the stresses in the tubes and the change in length. Length of the tube is 600 mm.  Es = 2 x 105 N/mm2 and Eb = 1 x 105 N/mm2. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the concepts of mechanics |
| CO2 | Identify the principles of dynamics |
| CO3 | Examine the concepts of kinetics |
| CO4 | Analyse the stresses in the members |
| CO5 | Apply the equilibrium concepts in analysis of members |
| CO6 | Apply the basic principles to solve problems in mechanics |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 |  |  |  |  | 2 |
| CO2 | 3 |  |  | 15 | 16 | 10 | 44 |
| CO3 | 1 |  |  |  | 1 |  | 2 |
| CO4 | 2 | 1 |  | 3 | 15 |  | 21 |
| CO5 |  | 4 |  | 13 | 11 |  | 28 |
| CO6 |  |  |  |  | 27 |  | 27 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE1003** | **Duration** | **3hrs** |
| **Course Name** | **GREEN DESIGN AND LIFE CYCLE ASSESSMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State the concept of green energy. | | CO1 | R | 1 |
| 2. | List out the stages involved in LCA. | | CO1 | R | 1 |
| 3. | Illustrate the corporate image benefits of energy. | | CO2 | U | 1 |
| 4. | Discuss the embodied energy in green design. | | CO2 | U | 1 |
| 5. | Employ the strategies involved in carbon management. | | CO3 | A | 1 |
| 6. | List out the ways to reduce carbon footprint. | | CO3 | R | 1 |
| 7. | Define Life Cycle Assessment. | | CO5 | R | 1 |
| 8. | Extend the significance of EIA. | | CO4 | U | 1 |
| 9. | Illustrate the advantages of green design technology. | | CO6 | A | 1 |
| 10. | Define green transport. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe the impacts of global warming. | | CO1 | U | 3 |
| 12. | List out the economic benefits of energy. | | CO2 | U | 3 |
| 13. | Enumerate the rating systems in green analysis. | | CO6 | R | 3 |
| 14. | Determine the measurement for customer satisfaction. | | CO4 | A | 3 |
| 15. | Explain the cost-benefit analysis of LCA. | | CO3 | An | 3 |
| 16. | Mention some environmental impacts that occurs during construction. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a note on global warming and climate change. | CO1 | A | 6 |
|  | b. | Discuss about energy consumption during building construction. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe energy efficiency principles followed in building design. | CO2 | R | 6 |
|  | b. | Explain the mitigation of GHG in buildings. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Enumerate the product standards adapted green analysis. | CO3 | R | 6 |
|  | b. | Explain low carbon refurbishment process. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Describe the methods followed for the measurement of greenhouse gas emission. | CO1 | A | 6 |
|  | b. | Develop the strategy to analyze energy in buildings. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Elaborate the stages involved in Life cycle Inventory Analysis. | CO3 | A | 6 |
|  | b. | Illustrate Environmental Impact Assessment of a project. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the carbon footprint analysis procedures in detail. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the personal and social benefits of energy. | CO5 | U | 6 |
|  | b. | Explain sustainability assessment of LCA. | CO4 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe carbon footprint analysis. | CO4 | U | 6 |
|  | b. | Explain the lighting and ventilation techniques involved in green design. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the carbon emission from the buildings |
| CO2 | Illustrate the energy efficiency principles |
| CO3 | Apply the energy analysis models |
| CO4 | Analyze the sustainability of buildings |
| CO5 | Apply the social and economic aspects in green buildings |
| CO6 | Formulate techniques for green design in buildings |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 9 | 12 | - |  |  | 23 |
| CO2 | 6 | 11 | - | - |  |  | 17 |
| CO3 | 7 | - | 13 | 9 |  |  | 29 |
| CO4 | 1 | 13 | 3 | - |  |  | 17 |
| CO5 | 1 | 15 | 12 | - |  |  | 28 |
| CO6 | 3 | - | 1 | 6 |  |  | 10 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2001** | **Duration** | **3hrs** |
| **Course Name** | **SURVEYING AND GEOMATICS ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define surveying. | | CO3 | R | 1 |
| 2. | Compare plan and map. | | CO1 | U | 1 |
| 3. | Define departure. | | CO2 | R | 1 |
| 4. | Define the term Reduced bearing. | | CO2 | R | 1 |
| 5. | List the two methods of tachometric surveying. | | CO3 | R | 1 |
| 6. | Define tacheometer. | | CO1 | R | 1 |
| 7. | List the components of simple curve. | | CO4 | R | 1 |
| 8. | Calculate the degree of the circular curve if the radius of curve is 393m. | | CO4 | A | 1 |
| 9. | What is EDM in survey? | | CO1 | U | 1 |
| 10. | List the applications of total station. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare plane and geodetic surveying. | | CO6 | U | 3 |
| 12. | List out the different types of errors in leveling. | | CO3 | R | 3 |
| 13. | Compare latitude and departure. | | CO2 | U | 3 |
| 14. | Discuss the essential points of difference between a tacheometer and theodolite. | | CO1 | U | 3 |
| 15. | Indicate the capability of total station. | | CO5 | U | 3 |
| 16. | Explain drone surveying. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | The following consecutive readings were taken with a leveling instrument at intervals of 15 m.  2.375, 1.730, 0.615, 3.450, 2.835, 2.070, 1.835, 0.985, 0.435, 1.630, 2.255 and 3.630 m.  The instrument was shifted after the fourth and eighth readings. The first reading was taken on a BM of RL 100 m. Calculate the RLs of all the points using height of instrument method and Rise and fall method. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain single plane method with neat sketch. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | The following observations were taken with a tachometer fitted with an anallactic lens, the staff being held vertically. The constant of the tachometer is 100 and 0.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Int.  Station | Height of instrument | Staff station | Vertical angle | Staff readings (m) | Remark | | A | 1.255 | BM | -4°20’ | 1.325, 1.825,2.325 | RL of BM = 250.750m | | A | 1.255 | B | +6°30’ | 0.850, 1.600, 2.350 | | C | 1.450 | B | -7°24’ | 1.715, 2.315,2.915 |   Calculate the RL of C and the distance between A and B. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the precautions to be taken while using total station. | CO5 | U | 3 |
|  | b. | Discuss the important operations of total station with example. | CO1 | U | 9 |
|  |  |  |  |  |  |
| 21. | a. | A simple circular curve of radius 150m is to be laid between the straights AB and BC at an intersection angle of 132o 50’ the length of the long chord being 120m. Calculate the necessary offsets from long chord at an interval of 15m. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain different characteristics of contouring. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the various components of a simple curve with a neat sketch. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the benefits of drone surveying. | CO6 | U | 6 |
|  | b. | Explain the drone flight plan. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Recall the principles of surveying equipment’s | | | | | | | |
| CO2 | Select methods to measure angles and distances | | | | | | | |
| CO3 | Schedule field surveying operations | | | | | | | |
| CO4 | Examine the implementation of surveying procedures for setting out curves | | | | | | | |
| CO5 | Appraise the usage of equipment’s and methods in triangulation survey | | | | | | | |
| CO6 | Formulate the surveying methods and executions | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** | |
| CO1 | | 1 | 14 | - | - | - | - | 15 | |
| CO2 | | 2 | 3 | 24 | - | - | - | 29 | |
| CO3 | | 5 | 12 | 12 | - | - | - | 29 | |
| CO4 | | 1 | - | 13 | - | - | - | 14 | |
| CO5 | | 1 | 9 | - | - | - | - | 10 | |
| CO6 | | - | 27 | - | - | - | - | 27 | |
|  | | | | | | | | **124** | |



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| **Course Code** | **20CE2002** | **Duration** | **3hrs** |
| **Course Name** | **MECHANICS OF SOLIDS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State Hooke’s law. | | CO1 | R | 1 |
| 2. | Define Factor of safety. | | CO1 | R | 1 |
| 3. | Define Bending moment. | | CO1 | R | 1 |
| 4. | Define Hogging moment. | | CO1 | R | 1 |
| 5. | Name the two types of springs. | | CO1 | R | 1 |
| 6. | List the stresses developed in the material, when a thin cylindrical shell is subjected to an internal fluid pressure. | | CO2 | U | 1 |
| 7. | Define thIck cylinder. | | CO1 | R | 1 |
| 8. | Specify the nature of failure of the long column. | | CO2 | U | 1 |
| 9. | Define slenderness ratio. | | CO1 | U | 1 |
| 10. | What is bending equation? | | CO1 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Define Strain and list the different type of strain. | | CO1 | R | 3 |
| 12. | List the important types of loads. | | CO1 | R | 3 |
| 13. | Derive the expression for circumferential stress of a thin cylinder | | CO2 | U | 3 |
| 14. | A beam 6m long, simply supported at its ends, is carrying a point load of 50kN at its center. The moment of inertia of the beam is given as 78x106mm4. If E is given as 2.1x105 N/mm2, calculate the slope at the supports. | | CO3 | U | 3 |
| 15. | List the types of end conditions of the columns. | | CO2 | U | 3 |
| 16. | Define polar modulus and recall the equation for a solid shaft. | | CO2 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | A brass bar having cross sectional area of 1000 mm2 is subjected to axial forces as shown in Fig. Find the net deformation in the bar. Take E = 1.05×105 N/mm2  enter image description here | CO3 | A | 6 |
|  | b. | At a point in a strained material the principal stresses are 100 N/mm2 (tensile) and 60 N/mm2 (Compressive). Determine the normal, shear and resultant stress on a plane inclined at 50o to the axis of major principal stress. Also determine the maximum shear stress at the point. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | A cantilever of length 2 m carries a UDL of 10 kN/m over the entire length from the free end. Draw the shear force and bending moment diagram for the cantilever. | CO5 | A | 6 |
|  | b. | A simply supported beam of length 8m carries a point load of 3 kN at a distance of 2 m from the left end and a UDL of 5 kN/m over a length of 4m from the right end. Draw the shear force and bending moment diagram for the beam. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Derive the deflection equation of a simply supported beam carrying uniformly distribution load. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | A compound cylinder is made by shrinking a cylinder of external diameter 300mm and internal diameter of 250 mm over another cylinder of external diameter 250 mm and internal diameter of 200 mm. The radial pressure at the junction after shrinking is 8 N/mm2. Find the final stresses set up across the section, when the compound cylinder is subjected to an internal pressure of 84.5 N/mm2. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | A simply supported beam of length 4m is subjected to a uniformly distributed load of 30 kN/m over the whole span and deflects 15 mm at the center. Determine the crippling loads when the beam is used as a column with the following conditions: i) one end is fixed and other end hinged ii) both ends are hinged. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Determine the diameter of the solid steel shaft which will transmit 90 kW at 160 r.p.m. Also determine the length of the shaft if the twist should not be more than 1o in a shaft length. The maximum shear stress is limited to 60N/mm2. Take modulus of rigidity is 8x104 N/mm2. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | A solid steel shaft is to transmit 75 kW power at 200 r.p.m. Taking allowable shear stress as 70 N/mm2. Find suitable diameter if the maximum m torque transmitted at each revolution exceeds the mean by 30%. | CO3 | A | 8 |
|  | b. | A solid shaft of 150 mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is 45 N/mm2. | CO3 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A thin cylinder of internal diameter 1.25 m contains a fluid at an internal pressure of 2 N/mm2. Determine the maximum thickness of the cylinder if: i) the longitudinal stress is not to exceed 30 N/mm2 and ii) circumferential stress is not to exceed 45 N/mm2. | CO3 | A | 4 |
|  | b. | Calculate the i) change in diameter ii)change in length and iii) change in volume of a thin cylindrical shell 200 cm diameter, 2 cm thick and 10 m long when subjected to a internal pressure of 3N/mm2. Take E = 2x105N/mm2 and poisons ratio is 0.3. | CO3 | A | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the concepts and principles |
| CO2 | Explain the behaviour of structural elements |
| CO3 | Analyze the structural members for various forces |
| CO4 | Estimate the response of the elements |
| CO5 | Develop suitable response intricacies |
| CO6 | Adapt suitable analysis procedure |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 12 | 2 | - | - | - | - | 14 |
| CO2 | 3 | 8 | - | - | - | - | 11 |
| CO3 | - | 3 | 60 | - | - | - | 63 |
| CO4 | - | - | - | - | - | - | - |
| CO5 | - | - | 24 | - | - | - | 24 |
| CO6 | - | - | - | 12 | - | - | 12 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2003** | **Duration** | **3hrs** |
| **Course Name** | **FLUID MECHANICS AND MACHINERY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Classify fluids as per Newton’s Law of Viscosity. | | CO1 | U | 1 |
| 2. | Explain the principle of venturimeter. | | CO2 | R | 1 |
| 3. | Define Total Energy line. | | CO2 | U | 1 |
| 4. | State Darcy Weisbach equation. | | CO3 | R | 1 |
| 5. | Compare major and minor losses. | | CO3 | U | 1 |
| 6. | Define Sequent depths. | | CO4 | R | 1 |
| 7. | Elaborate Conveyance of a channel. | | CO4 | R | 1 |
| 8. | State Impulse momentum equation. | | CO5 | R | 1 |
| 9. | List the types of Rotodynamic pumps. | | CO6 | R | 1 |
| 10. | State at what condition suction stroke will take place in a reciprocating pump. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain the working principle of single column manometer. | | CO1 | U | 3 |
| 12. | Calculate the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/mm2 above atmospheric pressure. | | CO1 | A | 3 |
| 13. | Explain the head loss in a contraction section. | | CO2 | U | 3 |
| 14. | List the conditions for the most economical trapezoidal section of a channel. | | CO3 | R | 3 |
| 15. | Determine the specific energy of flowing water through a rectangular channel of width 5m when the discharge is 10m3 /s and depth of water is 3m. | | CO4 | A | 3 |
| 16. | List three applications of Submersible pump. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | A rectangular plane surface 2m wide and 3m deep lies in water in such a way that its plane of angle of 300 with the free surface of water. Determine the total pressure and the position of center of pressure when the upper edge is 1.5m below the free water surface. | CO1 | A | 6 |
|  | b. | A 30cm diameter pipe conveying water branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s. Estimate the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm pipe is 2 m/s. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Estimate the head lost due to friction in a pipe of diameter 300 mm and length 50 m., through which water is flowing at a velocity of 3 m/s using Darcy weisbach formula. Take Kinematic viscosity of water as 0.01 stokes | CO2 | A | 6 |
|  | b. | An oil of sp.gr. 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take Cd = 0.98. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | The difference in water surface levels in two tanks, which are connected by three pipes in series of length 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm and 400 mm respectively. Determine the rate of flow of water if co-efficient of friction are .005, .0052 and .0048 respectively, considering minor losses. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Calculate the discharge through the trapezoidal channel of width 8m and side slope of 1 horizontal to 3 vertical. The depth of flow of water is 2.4m and value of Chezy’s constant, C = 50. The slope of the bed of the channel is given in 1 in 4000. | CO4 | A | 6 |
|  | b. | In a rectangular channel of 0.5 m width, a hydraulic jump occurs at a point where depth of water flow is 0.15 m and Froude number is 2.5. Determine:   1. Specific Energy 2.Critical and subsequent depths 3.Head loss   4. Energy dissipated | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Determine the rate of change of depth of water in a rectangular channel of 10m wide and 1.5m deep, when the water is flowing with a velocity of 1 m/s. The flow of water through the channel of bed slope is 1 in 4000, is regulated in such a way that energy line is having a slope of 0.00004. | CO5 | A | 6 |
|  | b. | A rectangular channel is to be dug in the rocky portion of a soil. Calculate its most economical cross-section, if it is to convey 12 m3/s water with an average velocity of 3m/s. Take Chezy’s constant C = 50 | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | A sluice gate discharges water into a horizontal rectangular channel with a velocity of 10m/s and depth of flow of 1m. Determine the depth of flow after the jump and consequent loss in total head. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | A single jet pelton wheel runs at 300 r.p.m under a head of 510m. The jet diameter is 200 mm. its deflection inside the bucket is 165° and its relative velocity is reduced by 15% due to friction. Determine.  a. Water power.  b. Resultant force on the bucket.  c. Overall efficiency.  Take coefficient of velocity = 0.98 and  Speed ratio = 0.46 | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | The diameter and stroke length of a reciprocating pump are 12cm and 20cm respectively. The lengths of suction and delivery pipes are 8m and 25m respectively and their diameters are 7.5 cm. If the pump is running at 40 rpm and the suction and delivery heads are 4 and 14m, determine the pressure head in the cylinder:   1. At the beginning of the suction and delivery stroke 2. At the middle of the suction and delivery stroke 3. At the end of the suction and delivery stroke   Take atmospheric pressure head = 10.3m. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recall the behaviour of fluids under static condition, measure pressure changes and estimate total pressure on plane surfaces |
| CO2 | Demonstrate flow measurement methods |
| CO3 | Identify the flow pattern and estimate total energy |
| CO4 | Measure flow in open channels |
| CO5 | Demonstrate various types of flows in open channels |
| CO6 | Investigate the selection and operation turbines and pumps |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 4 | 9 |  |  |  | 13 |
| CO2 | 1 | 4 | 18 |  |  |  | 23 |
| CO3 | 4 | 1 | 12 |  |  |  | 17 |
| CO4 | 2 |  | 15 |  |  |  | 17 |
| CO5 | 2 |  | 24 |  |  |  | 26 |
| CO6 | 3 |  | 13 | 12 |  |  | 28 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2004** | **Duration** | **3hrs** |
| **Course Name** | **SOIL MECHANICS AND FOUNDATION ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the IS soil classification. | | CO1 | R | 1 |
| 2. | Express the geological cycle of the formation of soil. | | CO1 | U | 1 |
| 3. | Quote the concept of flow net. | | CO2 | R | 1 |
| 4. | Identify the equation of Darcy’s law. | | CO2 | U | 1 |
| 5. | State the principle involved in consolidation. | | CO3 | R | 1 |
| 6. | Differentiate the mechanism of compaction and consolidation. | | CO3 | U | 1 |
| 7. | Define soil investigation. | | CO4 | R | 1 |
| 8. | Identify the methods involved in the SPT of soil. | | CO4 | U | 1 |
| 9. | List the use of Boussinesq theory. | | CO5 | R | 1 |
| 10. | Differentiate Mohr’s strength theory and Modified Mohr coulomb’s theory. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the techniques used for SPT in soil. | | CO1 | R | 3 |
| 12. | Express the factors affecting the compaction of the soil. | | CO2 | U | 3 |
| 13. | Describe the soil nomenclature. | | CO3 | R | 3 |
| 14. | Discuss shear parameters in soil. | | CO4 | U | 3 |
| 15. | Identify the factors affecting the consolidation of the soil. | | CO5 | R | 3 |
| 16. | Distinguish between strip and strap footing. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Choose the type of sieve analysis of sandy soil and brief it in detail the procedure of sieve analysis of the soil and its types. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Deduce the mechanism of permeability and brief out the tests conducted to determine the permeability of soil. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Employ the mechanism of compaction and consolidation and brief the equipment used for the above parameters in detail. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Deduce the concept of Modified Mohr Coulomb’s strength theory and Mohr Coulomb’s strength theory used in determining soil stress distribution. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Choose the methods of sampling and SPT used to investigate the soil semi-direct methods. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | An undisturbed soil sample has a volume of 100cm3 and a mass of 190g. on oven drying, for 24 hours the mass is reduced to 150g. The specific gravity of soil solids is 2.7. Determine the water content, void ratio and degree of saturation of the soil. Also, find the unit weight of soil if the soil is in dry, partially (50%) and fully saturated (100%) | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Demonstrate SCPT used in soil investigation of soil. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Choose the types of shallow foundations and brief them in detail. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | List the basic equations of elasticity |
| CO2 | Distinguish between the applications of different types of finite elements. |
| CO3 | Develop the finite element discrimination for seepage, consolidation soil structure interaction problems. |
| CO4 | Identify the suitable foundation construction |
| CO5 | Design the foundation system for shallow depth |
| CO6 | Analyse the earth retaining structures for different soil medium |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 1 | 12 | 12 | - | - | 29 |
| CO2 | 1 | 4 | - | 12 | - | - | 17 |
| CO3 | 4 | 1 | 12 |  | - | - | 17 |
| CO4 | 1 | 4 | - | 12 | - | - | 17 |
| CO5 | 4 | - | 24 | - | - | - | 28 |
| CO6 | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2005** | **Duration** | **3hrs** |
| **Course Name** | **WATER SUPPLY AND SANITATION** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define electrical conductivity. | | CO1 | R | 1 |
| 2. | Define pH and total hardness standards for drinking water. | | CO5 | R | 1 |
| 3. | Explain screening process operates in primary treatment. | | CO2 | R | 1 |
| 4. | Describe the dewatering process in sludge treatment. | | CO2 | U | 1 |
| 5. | Give examples of any two meters used in water supply. | | CO6 | U | 1 |
| 6. | Define Sewer joints. | | CO4 | U | 1 |
| 7. | Explain water recycling. | | CO3 | U | 1 |
| 8. | State membrane filtration process in advanced recycling technology. | | CO6 | R | 1 |
| 9. | Give examples any two of waterborne diseases. | | CO1 | U | 1 |
| 10. | Define ponds. | | CO1 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Interpret the various factors that influence population growth. | | CO6 | U | 3 |
| 12. | Identify the key steps involved in the process of secondary treatment. | | CO1 | U | 3 |
| 13. | List the requirements of good pipes. | | CO2 | R | 3 |
| 14. | Compare physical losses and non-physical losses that occur in pipes. | | CO6 | U | 3 |
| 15. | Summarize the benefits of drainage systems in buildings. | | CO3 | U | 3 |
| 16. | Describe the incentive factors for wastewater recycling. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Classify the chemical properties of water in a detailed manner. | CO1 | U | 6 |
|  | b. | Interpret the methods used for population forecasting. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the process of wastewater that undergoes in tertiary treatment | CO3 | A | 6 |
|  | b. | Infer the characteristics of sludge and mention its types. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the process for laying the water supply pipes. | CO3 | A | 6 |
|  | b. | Write the design specifications for a working chamber of a manhole. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Classify the types of meters used in water supply systems. | CO4 | A | 8 |
|  | b. | Summarize the safety measures for sewer maintenance. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Interpret types of sanitary fittings with the help of diagrams. | CO4 | U | 8 |
|  | b. | Identify the types of pipes used in plumbing. | CO6 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the objectives and collection methods in sanitary system. | CO1 | A | 6 |
|  | b. | Explain the safety measures for sewerman. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Interpret visual inspection and sounding rod method for detecting leaks in pipelines. | CO5 | A | 6 |
|  | b. | Explain the various types of sewerage systems used in wastewater management. | CO2 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Infer the significance and importance of water recycling | CO4 | U | 6 |
|  | b. | Explain three advanced recycling methods and provide a well-structured diagram for the concept of diversity in advanced recycling. | CO4 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Select appropriate treatment to raw water |
| CO2 | Design the pipe-network for water supply and sewage disposal effectively. |
| CO3 | Calculate and Estimate the quantity and quality of water used for domestic as well as construction. |
| CO4 | Design the water distribution and sewer networks. |
| CO5 | Make use of available standards. |
| CO6 | Prepare the plan and implement house plumbing work effectively. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 10 | 12 | - | - | - | 24 |
| CO2 | 4 | 13 | - | - | - | - | 17 |
| CO3 | - | 10 | 18 | - | - | - | 28 |
| CO4 | - | 19 | 14 | - | - | - | 33 |
| CO5 | 1 | 3 | 6 | - | - | - | 10 |
| CO6 | 1 | 11 | - | - | - | - | 12 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2006** | **Duration** | **3hrs** |
| **Course Name** | **SOLID WASTE MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Discuss waste segregation. | | CO1 | U | 1 |
| 2. | Illustrate the sources of solid waste. | | CO1 | U | 1 |
| 3. | Define autoclaving. | | CO3 | R | 1 |
| 4. | State E-waste. | | CO1 | R | 1 |
| 5. | Describe the hospital waste. | | CO1 | R | 1 |
| 6. | List any one difference between processing and separation. | | CO3 | R | 1 |
| 7. | Define “Brown” waste. | | CO1 | R | 1 |
| 8. | Explain active composting. | | CO3 | U | 1 |
| 9. | Define the biogas. | | CO6 | R | 1 |
| 10. | List any two benefits of recycling. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | State classification of waste. | | CO2 | R | 3 |
| 12. | Discuss the benefits of biomedical waste management. | | CO3 | U | 3 |
| 13. | Explain the steps in the management of biomedical waste by using a neat and clean diagram. | | CO3 | U | 3 |
| 14. | Identify the color coding for the segregation of biomedical waste. | | CO3 | U | 3 |
| 15. | Classify the influencing factors for solid waste. | | CO3 | U | 3 |
| 16. | Describe the recycling using examples. | | CO3 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Sketch the types of transfer station. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the following terms  1. Physical properties of solid waste  2. Chemical properties of solid waste | CO1 | U | 6 |
|  | b. | Discuss the handing and separation of solid waste at the source. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Prepare waste sampling and characterization plan. | CO2 | A | 6 |
|  | b. | Articulate the sanitary landfills using neat and clean diagram. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Describe any six important points for extended producer responsibility. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate environmental risk assessment framework by using a neat and clean diagram. | CO2 | U | 6 |
|  | b. | Explain the key functions of the waste exchange. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain any ten salient feature of solid waste management rules, 2016. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Describe Swatch Bharat Abhiyan using a case study. | CO5 | R | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the biogas plant using neat and clean diagram. | CO6 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Analyse the nature and characteristics of municipal solid wastes |
| CO2 | Sort out the functional elements for solid waste management |
| CO3 | Apply the techniques and methods used in transformation, conservation and recovery of materials from solid waste |
| CO4 | Identify and design waste containment systems |
| CO5 | Gain knowledge in regulatory requirements regarding municipal solid waste management |
| CO6 | Apply the basic scientific principles for solving practical waste management challenges |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 14 | - | - | - | - | 17 |
| CO2 | 3 | 6 | 6 | - | - | - | 15 |
| CO3 | 5 | 13 | 18 | - | - | - | 36 |
| CO4 | - | 18 | - | - | - | - | 18 |
| CO5 | 12 | 12 | - | - | - | - | 24 |
| CO6 | 14 | - | - | - | - | - | 14 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2007** | **Duration** | **3hrs** |
| **Course Name** | **TRANSPORTATION ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the classification of road system under Bombay road plan. | | CO1 | R | 1 |
| 2. | List the items included in inventory survey. | | CO1 | R | 1 |
| 3. | State French Road construction. | | CO2 | R | 1 |
| 4. | Describe the Jayankar committee. | | CO2 | R | 1 |
| 5. | State the types of Bitumen. | | CO3 | R | 1 |
| 6. | Label the types of pavement. | | CO3 | R | 1 |
| 7. | List various data to be collected for railway track alignment. | | CO4 | R | 1 |
| 8. | Define the term Guage. | | CO4 | R | 1 |
| 9. | Recognize the function of ballast in railway track. | | CO5 | R | 1 |
| 10. | Identify the use of creep. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Identify the items included in inventory survey. | | CO1 | U | 3 |
| 12. | Define inductive loop method. | | CO2 | U | 3 |
| 13. | Describe the Group Index Value. | | CO3 | U | 3 |
| 14. | Summarize the load transfer in flexible pavement. | | CO4 | U | 3 |
| 15. | Explain various types of crossings. | | CO5 | U | 3 |
| 16. | Describe semaphore signal. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain various obligatory points which effects the highway alignment. | CO1 | U | 6 |
|  | b | Discuss the salient features of Nagpur Road Plan. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the application of origin-destination survey. | CO2 | U | 6 |
|  | b. | Explain the parking studies and its methods. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the pavement material tests carried for Coarse aggregate. | CO3 | U | 6 |
|  | b. | Design the flexible pavement for a NH having the following data:  CBR of subgrade soil = 4%, CBR of soil aggregate mix = 20%,  CBR of soil kankar aggregate mix = 10%, CBR of WBM coarse = 85%.  The minimum thickness of bituminous macadam surfacing  may be taken as 5cm. The last traffic count is 1450 commercial  Vehicles/day. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Examine the two methods for conducting spot speed surveys. | CO3 | A | 6 |
|  | b. | Discover the importance of traffic volume studies. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Summarize the difference between Slip and Skid and the factors affecting the friction. | CO4 | U | 6 |
|  | b. | Explain the given terms:   1. Types of vertical curve 2. Types of Chambers | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain how the quality of the bitumen can be checked in the laboratory. Explain any two test procedure. | CO4 | U | 4 |
|  | b. | The speeds of overtaking and overtaken vehicles are 60 kmph and 50 kmph respectively on a two way traffic road. If the acceleration of overtaking vehicle is 0.9m/sec2, i) Calculate safe overtaking sight distance ii) Obtain the minimum length of overtaking zone and iii) with a neat sketch of overtaking zone show in the position of sign posts. Assume all other data as per IRC. | CO4 | An | 8 |
|  |  |  |  |  |  |
| 23. | a. | Show the sketch of a turnout and explain its working principle. | CO5 | U | 6 |
|  | b. | Explain the various components of Railway Track with help of a neat sketch. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the requirements for passenger amenities in railway station. | CO6 | U | 6 |
|  | b. | Explain the tunneling method for railway construction | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the concepts of development of highway and railway engineering |
| CO2 | Explain the components of highway and railway engineering |
| CO3 | Carryout the engineering surveys involved in planning of highway and railway engineering |
| CO4 | Design the geometric elements of highway and railway engineering |
| CO5 | Recognize the functions of structural elements of highway and railway engineering |
| CO6 | Identify the materials used for the construction of highway and railway engineering |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 |  |  |  |  | 17 |
| CO2 | 2 | 15 |  |  |  |  | 17 |
| CO3 | 2 | 9 | 12 | 6 |  |  | 29 |
| CO4 | 2 | 19 |  | 8 |  |  | 29 |
| CO5 | 1 | 15 |  |  |  |  | 16 |
| CO6 | 1 | 15 |  |  |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2008** | **Duration** | **3hrs** |
| **Course Name** | **TRAFFIC ENGINEERING AND MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | What does space mean speed? | | CO1 | R | 1 |
| 2. | What is the shape of a camber in cement concrete pavements? | | CO1 | R | 1 |
| 3. | When was the Border Roads Development Organisation (BRO) set up? | | CO2 | R | 1 |
| 4. | What is the velocity of Light waves? | | CO2 | R | 1 |
| 5. | What is the purpose of Broken Lines? | | CO3 | R | 1 |
| 6. | What are A Routes? | | CO3 | R | 1 |
| 7. | Stop sign comes under which type of sign | | CO4 | R | 1 |
| 8. | What test is performed for weathering of aggregates for road works? | | CO4 | R | 1 |
| 9. | What are the different types of traffic? | | CO5 | R | 1 |
| 10. | What is speed? | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain the specific objectives of the Origin-Destination Survey. | | CO1 | U | 3 |
| 12. | Classify the types of road safety signs. | | CO2 | U | 3 |
| 13. | Outline the advantages and disadvantages of traffic signals. | | CO3 | U | 3 |
| 14. | Explain the discernment by artificial lighting. | | CO4 | U | 3 |
| 15. | Discuss One Way Street. | | CO5 | U | 3 |
| 16. | Explain the characteristics to represent traffic flow. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Identify the Elements of Traffic Engineering. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the Origin Destination Survey and its methods. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Summarize the factors affecting the Capacity and level of service of highways. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain Intersection Channelization. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the Road Safety Audit. | CO5 | U | 6 |
|  | b. | Identify the general principles of Traffic Signing. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Explain Traffic Management. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the Statistical applications in traffic Studies. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the capacity of urban streets. | CO3 | U | 6 |
|  | b. | Explain the capacity of multi-lane rural highways. | CO3 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundamentals of traffic engineering |
| CO2 | Carryout different traffic studies |
| CO3 | Design channels, intersections, signals, roundabouts, and parking arrangements |
| CO4 | Express the application of traffic flow theory |
| CO5 | Enhance safety and environment in all design aspects |
| CO6 | Develop traffic management system |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 3 | 12 | - | - | - | 17 |
| CO2 | 2 | 15 | - | - | - | - | 17 |
| CO3 | 2 | 15 | - | - | - | - | 29 |
| CO4 | 2 | 27 | - | - | - | - | 17 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 1 | 27 | - | - | - | - | 28 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2009** | **Duration** | **3hrs** |
| **Course Name** | **SMART CITY PLANNING AND MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State the components of Smart city. | | CO1 | R | 1 |
| 2. | Define smart city. | | CO2 | R | 1 |
| 3. | List any two notable developments in transportation during the Automobile Era (1930s - 1950s). | | CO3 | R | 1 |
| 4. | Define urban mobility. | | CO3 | R | 1 |
| 5. | Describe the traditional electrical grid system. | | CO4 | U | 1 |
| 6. | Explain accent lighting. | | CO4 | R | 1 |
| 7. | Define vertical transportation systems. | | CO4 | U | 1 |
| 8. | List the importance of smart water management. | | CO5 | R | 1 |
| 9. | State the allocation of funding for the AMRUT mission. | | CO6 | R | 1 |
| 10. | Describe fire safety and early warning systems. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Illustrate a general framework for a smart city. | | CO2 | U | 3 |
| 12. | List the urban mobility needs in smart cities. | | CO3 | R | 3 |
| 13. | Identify the issues with the traditional electrical grid. | | CO4 | U | 3 |
| 14. | Interpret the policy challenges related to Smart Water Management (SWM). | | CO5 | U | 3 |
| 15. | List the regulatory requirements for fire safety. | | CO4 | R | 3 |
| 16. | State the objectives of the AMRUT mission. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a detailed note on evolution of smart city. | CO1 | U | 6 |
|  | b. | Infer the objectives and scope of the smart cities mission in India. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Interpret the role of technology in urban mobility. | CO3 | U | 6 |
|  | b. | List the key initiatives for enhancing smart urban mobility. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the smart grid technology implementation curve and provide a neat figure | CO4 | U | 6 |
|  | b. | Explain the key initiatives for smart energy management in the cities of Pune, India, and Quezon City, Philippines. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Write about the major advantages of lighting control. | CO4 | A | 6 |
|  | b. | Explain monitoring systems and consider any five factors to consider while choosing an access control system. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Write the steps involved in implementing smart water management based on sustainability. | CO5 | A | 6 |
|  | b. | Describe the categories and options related to sewage and sewage monitoring, as well as the monitoring of combined sewer overflows. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the implementation of citizen safety and environmental sustainability in Singapore as a smart city. | CO6 | A | 6 |
|  | b. | Describe the case study of Pune city as it pertains to smart city initiatives. | CO6 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the concept of Transit-Oriented Development (TOD) and its relevance in urban planning. | CO3 | U | 6 |
|  | b. | List the factors that support Transit-Oriented Development (TOD). | CO3 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write about the key aspects that make Vienna a successful smart city case study. | CO6 | A | 6 |
|  | b. | List the outcomes and achievements of Amritsar's smart city initiatives. | CO6 | R | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Identify the concepts of a smart city | | | | | | | |
| CO2 | Understand the components of a Smart City | | | | | | | |
| CO3 | Apply the concepts of urban mobility | | | | | | | |
| CO4 | Apply the smart energy and smart building concepts | | | | | | | |
| CO5 | Apply the smart water management concepts. | | | | | | | |
| CO6 | Analyse the smart cities across the countries | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** | |
| CO1 | | 1 | 6 |  |  |  |  | 7 | |
| CO2 | | 1 | 9 |  |  |  |  | 10 | |
| CO3 | | 17 | 12 |  |  |  |  | 29 | |
| CO4 | | 5 | 17 | 12 |  |  |  | 34 | |
| CO5 | | 1 | 9 | 6 |  |  |  | 16 | |
| CO6 | | 10 | 6 | 12 |  |  |  | 28 | |
|  | | | | | | | | **124** | |



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| **Course Code** | **20CE2010** | **Duration** | **3hrs** |
| **Course Name** | **ENGINEERING SUSTAINABILITY: ANALYSIS AND DESIGN** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State the concept of paradigm shift. | | CO1 | R | 1 |
| 2. | Enumerate the main parameters of sustainability. | | CO1 | R | 1 |
| 3. | Define the advantages of life cycle costing. | | CO2 | R | 1 |
| 4. | State the need of life cycle cost analysis (LCCA) at present scenario. | | CO2 | R | 1 |
| 5. | List the types of footprint. | | CO3 | R | 1 |
| 6. | Define the term carbon footprint. | | CO3 | R | 1 |
| 7. | Name the steps involved inventory analysis. | | CO4 | R | 1 |
| 8. | List the importance of GDP. | | CO4 | R | 1 |
| 9. | Name any one sustainable filler materials. | | CO5 | R | 1 |
| 10. | State the uses of bamboo in construction field. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Trace the purpose of sustainability and its key components. | | CO1 | U | 3 |
| 12. | Identify sustainability quotient formula. | | CO2 | U | 3 |
| 13. | Indicate the use of ecological footprint analysis. | | CO3 | U | 3 |
| 14. | Interpret the social impact assessment necessity. | | CO4 | U | 3 |
| 15. | Describe the human diseases caused due to air pollution. | | CO5 | U | 3 |
| 16. | Infer the principle of deconstruction techniques. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the triple bottom line theory with flowchart. | CO1 | U | 6 |
|  | b. | Summarize the life cycle cost analysis and its key aspects. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the merits and demerits of modern economy over the traditional economy. | CO2 | U | 6 |
|  | b. | Generalize the concept of benefit and cost ratio of a project. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Summarize the different environmental aspects by life cycle impact assessment. | CO3 | U | 6 |
|  | b. | Explain the different types of footprint in sustainability impact assessment. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Infer the human development index in the aspects of social sustainability. | CO4 | An | 6 |
|  | b. | Compare the conventional civil techniques with modern sustainable civil techniques. |  |  | 6 |
|  |  |  |  |  |  |
| 21. | a. | Relate a case study on improving the air quality in environment. | CO5 | U | 6 |
|  | b. | Write the sustainable water quality improvement techniques. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Articulate the various materials and methods of sustainable filler materials replacing the conventional materials. | CO5 | A | 6 |
|  | b. | Write the sustainable construction of geothermal energy foundation. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the intelligent transport system and its advantages. | CO6 | A | 6 |
|  | b. | Explain a case study on the intelligent transport system. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Summarize the concept of design for adaptability and deconstruction. | CO6 | E | 6 |
|  | b. | Recommend the safety measures to be taken for the workers in the site. | CO6 | E | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the concepts of sustainability |
| CO2 | Understand the Concepts of Economic Sustainability |
| CO3 | Analyse the Concepts of Environmental Sustainability |
| CO4 | Analyse the Social aspects of sustainability |
| CO5 | Apply the concepts of sustainability to environmental and geotechnical engineering |
| CO6 | Apply the concepts of sustainability to construction and transportation engineering |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 |  |  |  |  | 17 |
| CO2 | 2 | 15 |  |  |  |  | 17 |
| CO3 | 2 | 15 |  |  |  |  | 17 |
| CO4 | 2 | 3 |  | 12 |  |  | 17 |
| CO5 | 1 | 15 | 12 |  |  |  | 28 |
| CO6 | 1 | 3 | 12 |  | 12 |  | 28 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2011** | **Duration** | **3hrs** |
| **Course Name** | **ANALYSIS OF STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State and explain the principle of virtual work. | | CO1 | R | 1 |
| 2. | Give the equation that is used for the determination of deflection at a given point in truss. | | CO2 | R | 1 |
| 3. | Recall the numbers of slope deflection equation for three span continuous beam. | | CO2 | R | 1 |
| 4. | Define stiffness. | | CO1 | R | 1 |
| 5. | The moment required to rotate the near end of a prismatic beam through a unit angle without translation, the far end being hinged supported, is given by | | CO1 | U | 1 |
| 6. | Recall the moment at a hinged end of a simple beam | | CO1 | R | 1 |
| 7. | Draw the ILD for reaction at the left support of a simply supported beam. | | CO2 | R | 1 |
| 8. | Recall the location of maximum shear force in a simple beam with any kind of loading. | | CO5 | R | 1 |
| 9. | Define the term Horizontal thrust. | | CO5 | R | 1 |
| 10. | Recall the minimum tension in the cable when loaded uniformly throughout the span. | | CO2 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare statically determinate and indeterminate structures. | | CO1 | U | 3 |
| 12. | Explain the use of slope deflection method. | | CO1 | U | 3 |
| 13. | Discuss the types of arches according to the support conditions. | | CO3 | R | 3 |
| 14. | Expalin the uses of influence line diagrams? | | CO1 | U | 3 |
| 15. | Explain with the aid of a sketch, the normal thrust and radial shear in an arch rib | | CO6 | U | 3 |
| 16. | Develop the stiffness matrix for a given beam shown in fig. EI is constant. | | CO5 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine the horizontal displacement at joint C in the frame shown in figure using virtual work method. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Analyse the continuous beam loaded as shown in fig.by slope deflection method. Take E = 2 x 105 N/mm2 and I = 16 x 107 mm4. Sketch the bending moment diagram. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the portal frame loaded as shown in fig. by moment distribution method and sketch bending moment diagrams. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Two point loads of 100 kN and 200 kN spaced 3 m apart cross a girder of span 12 m from left to right with the 100 kN leading. Draw the ILD for shear force and bending moment and find the values of maximum shear force and bending moment at a section 4 m from the left hand support. Also evaluate the absolute maximum bending moment due to the given loading system. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | A three hinged parabolic arch hinged at the supports and at the crown has a span of 24 m and rise 4 m. It carries a concentrated load of 50 kN at 18 m from the left support and a uniformly distributed load of 30 kN/m over the left half portion. Determine the moment, thrust and radial shear at a section 6 m from the left support. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | A circular (three hinged) arch of span 25 m with a central rise of 5 m is hinged at the crown and the end supports. It carries a point load of 100 kN at 6 m from the left support. Calculate i) The reaction at the supports and ii) Moment at 5 m from the left support. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | A suspension cable is supported at 2 points 25m apart. The left support is 2.5 m above the right support. The cable is loaded with a uniformly distributed load of 10 kN/m throughout the span. The maximum dip in the cable from the left support is 4m. Find the maximum and minimum tensions in the cable. | CO3 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the continuous beam shown in fig. and draw the bending moment diagram using Stiffness martix method. Assume EI is constant | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the concepts and principles |
| CO2 | Explain the behaviour of structural elements |
| CO3 | Analyze the structural members for various forces |
| CO4 | Analyze the response of the Structural elements |
| CO5 | Develop suitable response intricacies |
| CO6 | Adapt suitable analysis procedure |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 10 | - | - | - | - | 13 |
| CO2 | 4 | - | - | - | - | - | 4 |
| CO3 | 3 | - | - | 12 | 12 | - | 27 |
| CO4 | - | - | - | 36 | 12 | - | 48 |
| CO5 | 2 | - | 3 | - | 12 | - | 17 |
| CO6 | - | 3 | - | 12 | - | - | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2012** | **Duration** | **3hrs** |
| **Course Name** | **MECHANICS AND DESIGN OF CONCRETE STRUCTURES** | **Max. Marks** | **100** |

IS 456, SP 16 codes are permitted, Assume the missing design data suitably

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define the term “Fe 500”. | | CO1 | R | 1 |
| 2. | Write the material safety factor of steel. | | CO2 | U | 1 |
| 3. | Write the load factor used for dead, live load and wind load. | | CO1 | R | 1 |
| 4. | List the types of grade of concrete used in construction. | | CO1 | R | 1 |
| 5. | Select the type of column used in corner of building. | | CO2 | U | 1 |
| 6. | Identify the appropriate cover thickness used for footing. | | CO1 | U | 1 |
| 7. | Classify different types of slabs used in construction | | CO2 | U | 1 |
| 8. | Sketch the bending moment diagram of continuous beam under UDL | | CO2 | A | 1 |
| 9. | Write the minimum reinforcement to be used for slab | | CO1 | A | 1 |
| 10. | Sketch typical details of R.C one way slab. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the influencing factors that control the deflection in bending members | | CO2 | A | 3 |
| 12. | Sketch the stress strain diagram of under, over and balanced reinforced section | | CO3 | A | 3 |
| 13. | Sketch the slab panel with the edge condition showing the following   * Two adjacent edges discontinuous * Interior panel * One short edge continuous | | CO2 | A | 3 |
| 14. | Differentiate one way slab and two way slab. | | CO1 | R | 3 |
| 15. | Classify the types of footing with examples. Explain the need for choosing combined footing. | | CO6 | U | 3 |
| 16. | What are the approximate methods available for analysis of multistory buildings? | | CO1 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Calculate the thickness and reinforcement details of the one way simply supported slab for the following data  Size of slab – 2.5x8m  Grade of concrete – M25  Grade of steel - Fe500  Live load - 3kN/m2  Floor finish – 0.5 kN/m2 | CO4 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Design a beam(doubly reinforced) for the following data  Beam of size 230x500mm  Span of the beam is 7.5m  M40 concrete and Fe 500 grade  Moment – 250kNm | CO4 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Design the RCC beam of size 230x600mm supported on column of 300mm thick. Span of the beam is 6m. The load from the slab to the beam is 18kN/m. M35 concrete and Fe 500 grade. Evaluate the depth and reinforcement details of section. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Analyse and Design the column for the following data  Axial load – 3600kN  Grade of concrete – M40  Grade of steel - Fe500  Bending in X direction – 150kNm (Uni axial bending)  Size of column – 300x600mm | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Determine the reinforcement to be provided for the biaxial bending column for the following data  Axial load – 4500kN  Grade of concrete – M30  Grade of steel - Fe500  Size of column – 230x450mm  Bending in X direction – 120kNm  Bending in Y direction – 200kNm | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Estimate the size required and the area of reinforcement for the Isolated footing with the following data  Grade of concrete – M50  Grade of steel - Fe500  Size of column –230x500mm  Axial load – 4500kN  Safe bearing capacity of soil – 250kN/m2 | CO5 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the preliminary analysis of multistoreyed RCC buildings. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design a reinforced concrete slab for a 6m x 4m size. Live load acting on the slab is 4Kn/m2. Assume the corners of the slab are held down. | CO5 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the design philosophies of RCC elements |
| CO2 | Analyse the behaviour of structural elements |
| CO3 | Illustrate the stress resultants of LSM and WSM |
| CO4 | Recommend the design section of the structural elements |
| CO5 | Develop suitable detailing diagrams of RC elements |
| CO6 | Prepare the design basis report for RC buildings |

|  |  |  |  |  |  |  |  |
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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 9 | 1 | 1 | - | - | - | 11 |
| CO2 | - | 3 | 7 | - | - | - | 10 |
| CO3 | 1 | - | 3 | - | - | - | 4 |
| CO4 | - | - | 12 | 24 | - | - | 36 |
| CO5 | - | - | 24 | - | 24 | - | 48 |
| CO6 | - | 15 | - | - | - | - | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2013** | **Duration** | **3hrs** |
| **Course Name** | **DESIGN OF STEEL STRUCTURES** | **Max. Marks** | **100** |

**IS 800-2007, IS 875 Part 1, 2 and 3, SP 6 & Steel Tables are permitted for the Exam**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Q. No. | Questions | | CO | BL | Marks |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1 | How would you select the minimum distance between the edge of a plate to the centre of the bolt hole for a bolt hole with the flame cut edge is | | CO4 | R | 1 |
| 2 | Can you determine the minimum yield strength in N/mm2 of the bolts belonging to property class 8.8? | | CO4 | E | 1 |
| 3 | Can you identify the nature of the tie member of a roof truss? | | CO1 | A | 1 |
| 4 | How would you determine the K value of the column fixed at both ends from IS 800-2007? | | CO3 | A | 1 |
| 5 | Classify the buckling class of a hot rolled I section about z axis when h/bf is greater than 1.2 and tf less than 40mm as per IS code. | | CO4 | U | 1 |
| 6 | How would you interpret the ISWB section? | | CO1 | U | 1 |
| 7 | Can you identify the Indian Standard Code for determining the wind loads? | | CO3 | A | 1 |
| 8 | How would you categorize deflection, vibration, Durability and Fire Resistance under the limit state method of design? | | CO4 | An | 1 |
| 9 | Can you specify the percentage of wall opening in the case of normal permeability? | | CO2 | A | 1 |
| 10 | Draw a sketch to illustrate windward slope and Leeward slope on a roof truss? | | CO2 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11 | How would you interpret the meaning of property class 4.6 bolts? | | CO1 | U | 3 |
| 12 | How would you illustrate block shear failure of a tension member with a neat sketch? | | CO1 | U | 3 |
| 13 | Can you specify the dominant factors affecting the ultimate strength of practical columns? | | CO4 | A | 3 |
| 14 | How would you demonstrate a semi-compact section with an appropriate stress strain diagram? | | CO2 | U | 3 |
| 15 | How would you apply curtailment of cover plates on a bolted plate girder? | | CO3 | A | 3 |
| 16 | Classify the Gantry girders in terms of frequency of use. | | CO3 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17 | a. | A lap joint is made with 12mm thick plates with 6 numbers of 16mm black bolts (G 4.6) as represented in figure. Appraise its joint capacity when fully threaded bolts are provided. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 18 | a. | Calculate the maximum tension allowed on a single angle ISA 75 x 75 x 6 if it is connected on one side of a gusset plate of 8mm thick with bolts of 20mm diameter. Bolt strength is 43kN per bolt. End distance is 35mm and pitch for bolts is 50mm | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19 | a. | Design a bridge compression member of 2 channels placed toe-to-toe. The length of two members is 7m. It carries a load of 1000kN. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20 | a. | Design a simply supported beam to carry an udl of 50 kN/m. The effective span of the beam is 8m. The beam is laterally supported. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21 | a. | How would you determine the maximum uniformly distributed load ‘w’ that can act on a ISMB 500 beam which is simply supported at its end of effective span 6m. The beam is laterally unsupported. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 22 | a. | How would you classify the types of plate girders, their components and application? | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23 | a. | How would you explain the calculation of the wind load on a roof truss applying the codal principles? | CO3 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24 | a. | Design a bridge compression member of 2 ISMC 350 placed back to back at 350mm. The length of two members is 6m. It carries a load of 2000kN. The most unfavourable slenderness ratio of the sections is 43.93. If the channels are connected by lacings, design the lacing system. . | CO3 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the behaviour of members |
| CO2 | Estimate the forces in members. |
| CO3 | Design the member for forces |
| CO4 | Choose suitable codal provisions |
| CO5 | Explain the design intricacies |
| CO6 | Formulate the design for steel structures |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| CO2 | 0 | 4 | 1 | 36 | 0 | 0 | 41 |
| CO3 | 0 | 0 | 41 | 3 | 12 | 0 | 56 |
| CO4 | 1 | 1 | 3 | 1 | 1 | 0 | 7 |
| CO5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2014** | **Duration** | **3hrs** |
| **Course Name** | **WATER RESOURCES SYSTEMS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the components of hydrologic cycle. | | CO1 | R | 1 |
| 2. | Enumerate excess rainfall. | | CO1 | U | 1 |
| 3. | State unit hydrograph. | | CO2 | R | 1 |
| 4. | Elaborate maximum flood discharge. | | CO2 | U | 1 |
| 5. | Mention the components of hydrograph. | | CO2 | R | 1 |
| 6. | Define an irrigation system. | | CO5 | R | 1 |
| 7. | Elucidate consumptive irrigation requirement [CIR]. | | CO3 | U | 1 |
| 8. | Mention the purpose of weirs. | | CO4 | Ap | 1 |
| 9. | Compare flood control reservoir with storage reservoir. | | CO4 | Ap | 1 |
| 10. | Differentiate specific yield with specific capacity. | | CO6 | Ap | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Elaborate different forms of precipitation. | | CO1 | U | 3 |
| 12. | Enumerate the components of runoff with a neat diagram. | | CO2 | U | 3 |
| 13. | State about reservoir planning and mention the objectives also. | | CO3 | Ap | 3 |
| 14. | Conceptualize mass inflow curve and demand curve. | | CO4 | An | 3 |
| 15. | Demonstrate the steady flow to a well in a confined aquifer. | | CO6 | U | 3 |
| 16. | Discuss the advantages of drip irrigation. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the hydrological cycle process and write the basic components of the hydrological cycle with a relevant diagram. | CO1 | U | 4 |
|  | b. | A catchment area has seven raingauge stations. In a year, the annual rainfall recorded by the gauges are as follows:    For a 5% error in the estimation of the mean rainfall, calculate the minimum number of additional raingauge stations to be established in the catchment. | CO1 | Ap | 8 |
|  |  |  |  |  |  |
| 18. | a. | Explain Recording Rain gauges with diagrams. | CO2 | U | 6 |
|  | b. | Recall the Empirical methods for Evapotranspiration (any three). | CO2 | R | 6 |
|  |  |  |  |  |  |
| 19. | a. | Appraise in detail about the base flow separation. | CO3 | U | 6 |
|  | b. | Elaborate the empirical equations used for estimation of evapotranspiration. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 20. | a. | Elucidate various types of Geologic formation and aquifers. | CO6 | U | 4 |
|  | b. | A 30 cm well fully penetrates an unconfined aquifer of 25 m saturated depth. When a discharge of 2100 lpm was being pumped for a long time, observation wells at radial distances of 30 and 90 m indicated drawdown of 5 and 4 m respectively. Estimate the coefficient of permeability and transmissibility of the aquifer. | CO6 | Ap | 8 |
|  |  |  |  |  |  |
| 21. | a. | What is river training works and write the objectives and purposes? | CO4 | U | 6 |
|  | b. | Discuss the purposes of cross regulators and factors of selecting a suitable type of cross drain works? | CO4 | Ap | 6 |
|  |  |  |  |  |  |
| 22. | a. | The ordinate of 2-h unit hydrograph of a basin is given: Compute a 4-h unit hydrograph ordinate and plot: (i) the 4-h Unit Hydrograph   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Time | (h) | 0 | 2 | 4 | 6 | 8 | 10 | 12 | | 2-h UH Ordinates | (m3/s) | 0 | 25 | 100 | 120 | 160 | 180 | 110 | | Time | (h) | 14 | 16 | 18 | 20 | 22 | 24 | 26 | | 2-h UH Ordinates | (m3/s) | 70 | 30 | 20 | 6 | 0 | 0 | 0 | | CO3 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Discuss about aqueducts, culverts and causeways with suitable diagrams. | CO4 | U | 6 |
|  | b. | Enumerate various methods applied for groundwater recharging. | CO6 | Ap | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Elaborate about canal regulation works: Head regulator, cross regulator, sluices and canal drops. | CO5 | U | 6 |
|  | b. | During the recuperation test of a 4.0 m open well a recuperation of the depression head from 2.5 m to 1.25 m was found to take place in 90 minutes. Determine the (i) specific capacity per unit well area, and (ii) yield of the well for a safe drawdown of 2.5 m (iii) What would be the yield from a well of 5.0 m diameter for a drawdown of 2.25 m. | CO6 | Ap | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognise the concepts to manage water resources and apply for hydrological modelling |
| CO2 | Decide and plan basic water resources projects |
| CO3 | Analyse the flow in streams |
| CO4 | Appreciate the importance of reservoirs and hydraulic structures |
| CO5 | Identify the irrigation methods |
| CO6 | Plan structures for recharging groundwater |

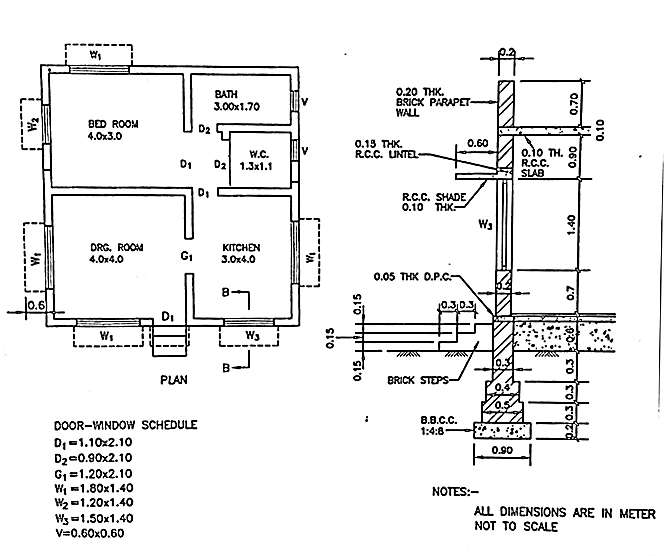
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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 8 | 8 |  |  |  | 17 |
| CO2 | 14 | 10 |  |  |  |  | 24 |
| CO3 |  | 7 | 3 | 12 |  |  | 22 |
| CO4 |  | 12 | 8 | 3 |  |  | 23 |
| CO5 | 1 | 6 | 6 |  |  |  | 13 |
| CO6 |  | 10 | 15 |  |  |  | 25 |
|  | | | | | | | **124** |



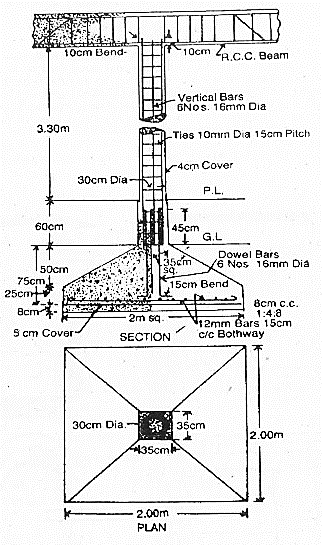
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| --- | --- | --- | --- |
| **Course Code** | **20CE2015** | **Duration** | **3hrs** |
| **Course Name** | **QUANTITY SURVEYING AND ESTIMATION** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define estimation. | | CO1 | R | 1 |
| 2. | List out the data required to prepare an estimate. | | CO1 | R | 1 |
| 3. | State the importance of rate analysis. | | CO2 | R | 1 |
| 4. | Define the nominal size of modular brick. | | CO2 | R | 1 |
| 5. | Define center line method. | | CO3 | R | 1 |
| 6. | List out the two main methods used in building estimate. | | CO3 | R | 1 |
| 7. | Describe the formula for finding No.of bars. | | CO4 | R | 1 |
| 8. | Name the important parts to be considered in the estimation of culvert. | | CO1 | R | 1 |
| 9. | Identify the purpose of valuation. | | CO5 | R | 1 |
| 10. | List out the different method of valuation. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List out the different types of estimate. | | CO1 | R | 3 |
| 12. | Differentiate lead and lift. | | CO2 | U | 3 |
| 13. | Determine the Length of the rod. Assume side cover is 40mm. | | CO3 | A | 3 |
| 14. | Calculate the number of standard modular bricks required for flat brick soling for one kilometer length of 4 m wide road. | | CO4 | A | 3 |
| 15. | Rewrite the types of outgoings. | | CO5 | U | 3 |
| 16. | List out the points needs to be considering in report preparation. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the various types of estimates. Also explain under what circumstances each one of them is prepared. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Prepare rate analysis and BOQ for a plastering work in CM 1:6. Thick of plastering is 12 mm and area of wall is 100 m2.  Assume other required data.  Labour required for 100 m2 plastering,   * Mason = 4 * Mazdoor = 6 * Beldar = 4 * Bhisti = 2   Rate of Labour   * Mason = 1050 * Mazdoor = 750 * Beldar = 618 * Bhisti = 400   Rate of material   * Cement – Rs.450 / Bag * P Sand – Rs. 1317 / m3 | CO2 | A | 6 |
|  | b. | Calculate the quantity material quantity (brick and dry mortar) required for an 1m3 Brick work. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Prepare the quantity estimation of the following items, using plan and section given in Skech A. Assume other relevent data.   1. Earthwork excavation in foundation. 2. Brick work in foundation and plinth. 3. Damp proof course. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Prepare a detailed estimate of a R.C.C column with foundation footing from the given Sketch B. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | A three storied building is standing on a plot of land measuring 1000 sq.m. the plinth area of each storey is 500 sq.m. the building is of R.C.C framed structure and the future life may be taken as 70 years. The building fetches a gross rent of Rs. 2500.00 per month. Calculate the capitalized value of the property on the basis of 6% net yield. For sinking fund 3% compound interest may be assumed. Cost of land may be taken Rs. 100.00 sq.m. Other data required may be assumed suitably. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Calculate the approximate cost of the residential building having a carpet area of 2000 sq.m. Plinth area rate is Rs. 1000/Sq.m | CO5 | A | 6 |
|  | b. | Explain the following terms:   1. Depreciation. 2. Obsolescence. 3. Gross income and net income | CO1 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the need of estimation. | CO1 | U | 6 |
|  | b. | Explain the need of valuation. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the report on estimation for construction of water supply and sanitary work. | CO6 | U | 12 |

**Skech A**



**Skech B**



**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | list the detailed specification for different types of structures |
| CO2 | Plan the rate analysis of civil engineering works. |
| CO3 | Determine the rates of various items of civil works |
| CO4 | Justify estimated cost of civil construction projects |
| CO5 | Evaluate the actual value of any property |
| CO6 | Explain specifications and tendering process for contracts |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 18 | 12 |  |  |  |  | 30 |
| CO2 | 2 | 15 | 12 |  |  |  | 29 |
| CO3 | 2 |  | 21 |  |  |  | 23 |
| CO4 | 1 |  | 15 |  |  |  | 16 |
| CO5 | 2 | 9 | 6 |  |  |  | 17 |
| CO6 | 3 | 6 |  |  |  |  | 9 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2016** | **Duration** | **3hrs** |
| **Course Name** | **CONSTRUCTION TECHNOLOGY AND AUTOMATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Live loads and dead loads act in a horizontal direction.  a) True b) False | | CO 1 | U | 1 |
| 2. | Which of the following is NOT a renewable energy source commonly used in green building design?  a) Solar power b) Wind power c) Natural gas d) Geothermal energy | | CO 1 | R | 1 |
| 3. | In Plastering, the first coat is called \_\_\_\_\_\_\_\_\_\_\_\_ | | CO 2 | U | 1 |
| 4. | Name any two types of Joints in concrete. | | CO 2 | R | 1 |
| 5. | DPC stands for \_\_\_\_\_\_\_\_\_\_\_\_ | | CO 3 | R | 1 |
| 6. | Name any two sound proofing materials. | | CO 4 | U | 1 |
| 7. | Operating cost = \_\_\_\_\_\_\_\_\_\_\_+\_\_\_\_\_\_\_\_\_\_\_  a) Job cost + Process cost b) Fixed cost + Variable cost  c) Job cost + Transporting cost d) Labor cost + Material cost | | CO 4 | U | 1 |
| 8. | Which of the following colors is used for radiation hazard?  a) Red b) Orange c) Purple d) Green | | CO 5 | R | 1 |
| 9. | Consider the following statements:  1. Mobile cranes are sophisticated machines that are designed for lifting  efficiently.  2. Mobile cranes are a versatile and reliable means of lifting on-site.  Which of the above statements is/are correct?  1) 1 only 2) 2 only 3) Both 1 and 2 4) Neither 1 nor 2 | | CO 5 | R | 1 |
| 10. | Enlist the benefits of contour crafting. | | CO 6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Why is it important to consider local building codes and regulations when creating a building layout? | | CO1 | R | 3 |
| 12. | Compare Shallow and Deep foundations. | | CO2 | U | 3 |
| 13. | Fix the term ‘Acoustics’. | | CO3 | U | 3 |
| 14. | List the factors to be considered in selecting the equipment for any work. | | CO4 | R | 3 |
| 15. | Draw a neat sketch of the forklift along with its components. | | CO5 | U | 3 |
| 16. | Write the advantages and disadvantages of Automation in construction. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Elaborate the considerations that should be considered during the site selection process for different building types. | CO1 | E | 6 |
| b. | Enlist the key principles that guide effective planning. | CO 1 | AN | 6 |
|  |  |  |  |  |  |
| 18. | a. | Enumerate the different types of bricks commonly used in brick masonry. | CO2 | E | 6 |
| b. | Discuss the key safety considerations for scaffolding. | CO2 | AN | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the role of fire protection engineering in designing and evaluating fire safety systems. | CO3 | A | 6 |
| b. | Examine the Anti-Termite Treatment. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the key safety considerations and precautions to take during excavation, especially in deep or hazardous excavation sites. | CO4 | AN | 6 |
| b. | Explain pile driving and its primary purposes in construction and engineering projects. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Inculcate the key safety considerations and precautions that operators and workers must follow when working with cranes to prevent accidents and ensure workplace safety. | CO5 | E | 6 |
| b. | Assess the primary advantages of using prefabrication techniques in construction projects. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Point out the key advantages of using painting robots over traditional manual painting methods in industrial applications. | CO 6 | E | 6 |
| b. | Highlight the role of Robots in Earthwork. | CO 6 | AN | 6 |
|  |  |  |  |  |  |
| 23. | a. | Describe equipment management in a project, and state it’s essential for project success. | CO5 | AN | 6 |
| b. | Summarize the benefits of using energy-efficient air conditioning systems, and how can they contribute to energy savings. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Formulate green building concept, and identify its primary objectives. | CO 1 | A | 6 |
| b. | Paraphrase the advantages of using conveyor systems in material handling compared to manual methods. | CO 4 | AN | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Adopt the construction practices adopted in the field. |
| CO2 | Demonstrate basic knowledge of construction equipment. |
| CO3 | Identify the equipment types for different construction projects. |
| CO4 | Evaluate the material handling equipment and the equipment productivity. |
| CO5 | Demonstrate construction project management skills. |
| CO6 | Adapt automation in construction sites. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 1 | 6 | 6 | 6 | - | 23 |
| CO2 | 1 | 4 | - | 6 | 6 | - | 17 |
| CO3 | 1 | 3 | 12 | - | - | - | 16 |
| CO4 | 3 | 2 | 6 | 12 | - | - | 23 |
| CO5 | 2 | 3 | 12 | 6 | 6 | - | 29 |
| CO6 | 3 | 1 | - | 6 | 6 | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2017** | **Duration** | **3hrs** |
| **Course Name** | **DISASTER PREPAREDNESS AND PLANNING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define disaster. | | CO1 | R | 1 |
| 2. | List the type of disasters. | | CO1 | R | 1 |
| 3. | Define vulnerability. | | CO1 | R | 1 |
| 4. | Identify a suitable example of natural disaster. | | CO1 | A | 1 |
| 5. | Describe disaster management act. | | CO6 | U | 1 |
| 6. | List the type of risks. | | CO2 | R | 1 |
| 7. | Define SDRF (State Disaster Response Force). | | CO6 | R | 1 |
| 8. | Identify the general effects of a hazards. | | CO44 | R | 1 |
| 9. | Define climate change. | | CO1 | R | 1 |
| 10. | List any two nodal agencies of India for disaster preparedness. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare zone 0 and zone 2 for the classification of hazardous areas. | | CO6 | U | 3 |
| 12. | Explain steps to risk assessment. | | CO5 | U | 3 |
| 13. | Identify the agencies for disaster management. | | CO1 | R | 3 |
| 14. | Differentiate positive and negative role of media in effective disaster management. | | CO1 | U | 3 |
| 15. | Explain the preparation of disaster management plan. | | CO4 | U | 3 |
| 16. | Illustrate the problems associated with recovery. | | CO3 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Report on any current events as case study for natural disasters. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Interpret environmental management system. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Write environmental risk assessment and draw the possible framework. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Articulate hazardous location classification using a suitable diagram. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain classification of disaster, types and health effects. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain disaster management plans at various levels. | CO5 | U | 6 |
|  | b. | Describe the role of various departments of the central government in disaster management. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. |  | Summarize the disaster management cycles with examples. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Examine significant national level entities responsible for disaster management decision making. | CO6 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recall the types of disasters and its causes. |
| CO2 | Understand disaster cycle and assess the risks. |
| CO3 | Apply disaster concepts to disaster management |
| CO4 | Analyze relationship between development and disasters. |
| CO5 | Decide the roles and responsibilities of organizations and institutions to society and its  Organizational structure. |
| CO6 | Design the disaster management and mitigation plan. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 4 | 13 | 1 | - | - | 23 |
| CO2 | 1 |  | 12 | - | - | - | 13 |
| CO3 | - | 29 | - | - | - | - | 27 |
| CO4 | 1 | 3 | - | - | - | - | 4 |
| CO5 | 1 | 15 |  | - | - | - | 16 |
| CO6 | 13 | 16 | 12 | - | - | - | 41 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2019** | **Duration** | **3hrs** |
| **Course Name** | **DESIGN OF PRECAST CONCRETE STRUCTURES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Select the suitable minimum standard thickness for slab element. | | CO1 | R | 1 |
| 2. | Name any one of the crane used in precast erection. | | CO2 | R | 1 |
| 3. | Identify the suitable prestressed concrete system for bridges. | | CO2 | U | 1 |
| 4. | Give an example of a mixed construction in Precast buildings. | | CO2 | U | 1 |
| 5. | Name the two main systems in the slab-column systems. | | CO2 | R | 1 |
| 6. | Mention the casting tolerance for the thickness of a prefabricated brick panel. | | CO2 | R | 1 |
| 7. | List any four Prestressed precast concrete elements. | | CO5 | R | 1 |
| 8. | Identify the purpose of Internal ties. | | CO6 | R | 1 |
| 9. | What is the condition for Anchoring of ties in slabs? | | CO6 | R | 1 |
| 10. | Write the name of the frame that enables components to be designed to act together, resulting in shallower depth. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate homogeneous and non-homogeneous wall. | | CO2 | U | 3 |
| 12. | Define prestressed concrete. | | CO1 | U | 3 |
| 13. | Tell the facial elements of Prefabricated structure. | | CO2 | R | 3 |
| 14. | Discuss briefly about mixed structural system of a Precast building. | | CO2 | U | 3 |
| 15. | Review and discuss on different tensioning device. | | CO5 | U | 3 |
| 16. | Differentiate between wire, strand, tendon and cable. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Identify various elements that are used in precast construction, also discuss the standardization and tolerances in precast products. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain different stages in lifting, erection and transportation of precast elements with neat sketches. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Classify and explain the categories of Precast Structural system. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain any two different types of structural connections used in a Precast construction. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the Design considerations and requirements of Precast structure in detail as per IS 15916:2011. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the different types of Precast Frames in detail. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the methods of Prestressed Concrete in detail. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write a case study on “Water into Precast – Chicago Riverwalk Project”. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the suitable prefabrication building system |
| CO2 | Explain the behavior of precast elements |
| CO3 | Classify different types of joints for prefabricated structures |
| CO4 | Analyse the building system and joints |
| CO5 | Design the components of precast building system |
| CO6 | Appraise the possibilities of progressive collapse |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 15 |  |  |  |  | 16 |
| CO2 | 6 | 32 | 12 |  |  |  | 50 |
| CO3 |  | 12 |  |  |  |  | 12 |
| CO4 |  |  |  |  |  |  | - |
| CO5 | 2 | 30 |  |  |  |  | 32 |
| CO6 | 2 |  | 12 |  |  |  | 14 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2020** | **Duration** | **3hrs** |
| **Course Name** | **ARTIFICIAL INTELLIGENCE IN PROJECT MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define heuristic search. | | CO3 | R | 1 |
| 2. | State precision and recall. | | CO6 | R | 1 |
| 3. | Describe unsupervised data. | | CO6 | U | 1 |
| 4. | Identify the key components of Bayesian networks. | | CO3 | U | 1 |
| 5. | Name the inspiration behind genetic algorithms. | | CO3 | R | 1 |
| 6. | Define fuzzy logic. | | CO2 | R | 1 |
| 7. | Name the type of technology used by a robotic total station. | | CO1 | U | 1 |
| 8. | Explain the term model training in AI. | | CO5 | U | 1 |
| 9. | Name the types of risk in construction projects. | | CO2 | R | 1 |
| 10. | List the factors to minimize the effect of risk with AI. | | CO1 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe depth-first search. | | CO3 | U | 3 |
| 12. | Enumerate the types of Naive Bayes classifiers. | | CO3 | R | 3 |
| 13. | State optimal route planning and mention its significance. | | CO1 | R | 3 |
| 14. | Illustrate a sample tabulation obtained for risk management analysis. | | CO1 | U | 3 |
| 15. | Explain cost-time trade-off. | | CO4 | U | 3 |
| 16. | Explain the role of AI in aiding employee productivity. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain knowledge representation and its various types in a detailed manner. | CO6 | U | 6 |
|  | b. | Interpret the steps involved with Forward and Backward Reasoning and their application in problem-solving. | CO3 | U | 6 |
| 18. | a. | Explain Bayes' theorem and outline the strengths of Naive Bayes. | CO3 | U | 6 |
|  | b. | Determine the process of building decision trees and mention their advantages. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the steps for design selection using Artificial Neural Networks (ANN). | CO3 | U | 6 |
|  | b. | Explain the optimization of design parameters, scheduling, and resource allocation in genetic algorithms. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Write about rule-based estimation and highlight the benefits of expert systems. | CO5 | A | 6 |
|  | b. | State fuzzy logic and its application in civil engineering. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 21. | a. | Identify common marking challenges in civil engineering. | CO1 | U | 6 |
|  | b. | Interpret the role of AI in cost estimation. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Identify the key factors for forecasting and list various methods for predicting project success. | CO5 | U | 6 |
|  | b. | Explain Monte Carlo simulation with detailed steps. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Summarize general implementation strategies in cost estimation. | CO1 | U | 6 |
|  | b. | List certain challenges related to estimation in civil engineering. | CO1 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write about the influence of AI in civil engineering. | CO1 | A | 4 |
|  | b. | Explain the major distribution models and mention two limitations for each model. | CO6 | U | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the problems in Civil Engineering and solve using AI |
| CO2 | Formulate problems and make decisions |
| CO3 | Explain various search algorithms for problem solving |
| CO4 | Apply Artificial Intelligence in real time problems |
| CO5 | Participate in the design of systems that act intelligently and |
| CO6 | Assess the applicability, strengths and weaknesses of the basic |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 16 | 16 | 4 | - | - | - | 36 |
| CO2 | 2 | - | - | - | - | - | 2 |
| CO3 | 5 | 28 | 6 | - | - | - | 39 |
| CO4 | - | 9 | - | - | - | - | 9 |
| CO5 | - | 9 | 6 | - | - | - | 15 |
| CO6 | 1 | 16 | 6 | - | - | - | 23 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2031** | **Duration** | **3hrs** |
| **Course Name** | **CONCRETE TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Enumerate the raw materials required for the manufacturing of cement. | | CO1 | R | 1 |
| 2. | List the bogue’s compounds. | | CO1 | R | 1 |
| 3. | Name any two factors that determine the grading of aggregates | | CO2 | R | 1 |
| 4. | Define the term aggregate and its types. | | CO2 | R | 1 |
| 5. | Define the term workability of concrete. | | CO3 | R | 1 |
| 6. | State the types of segregation in concrete. | | CO3 | R | 1 |
| 7. | Define the term concrete mix design. | | CO4 | R | 1 |
| 8. | Give the mix proportion for M15 and M20. | | CO4 | R | 1 |
| 9. | State the use of ferrocement. | | CO5 | R | 1 |
| 10. | List the advantage of non-destructive test over the destructive test of concrete. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Identify the field test procedure used for cement. | | CO1 | U | 3 |
| 12. | Describe the Elongation index and flakiness index. | | CO2 | U | 3 |
| 13. | Interpret the advantages of kelly ball test. | | CO3 | U | 3 |
| 14. | Infer the formula to compute the target average compressive strength of concrete at 28 days. | | CO4 | U | 3 |
| 15. | Differentiate between polymer concrete and geopolymer concrete. | | CO5 | U | 3 |
| 16. | Summarize the working principle of impact echo test. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the procedures for measuring Strength and fineness of cement. | CO1 | U | 6 |
|  | b. | Summarize the procedures for standard consistency and soundness test. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the crushing value and impact value for coarse aggregate. | CO2 | U | 6 |
|  | b. | Classify aggregate based on the origin, and shape. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Interpret the factors affecting the strength and workability. | CO3 | U | 6 |
|  | b. | Explain the durability properties of concrete. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Estimate the step wise procedure for mix design data by Indian Standard Method.  Design Data  Characteristics compressive strength -20N/mm2  Maximum nominal size aggregates -20mm(angular)  Degree of workability – 0.9 CF  Degree of quality control – Good  Type of exposure – Mild  Fine aggregate – Zone II  Test data of materials  Specific gravity of cement – 3.16  Specific gravity of fine aggregate – 2.46  Specific gravity of coarse aggregate – 2.73  Specific gravity of water – 1.0  Slump – 50mm | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Summarize the light weight concrete, types, and its properties. | CO5 | U | 6 |
|  | b. | Discuss the characteristics and usage of polymer concrete. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Examine the characteristics and usage of fibre reinforced concrete. | CO5 | A | 6 |
|  | b. | Explain the characteristics of high strength concrete and its applications. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Write the principle and procedure of RCPT test. | CO6 | A | 6 |
|  | b. | Write the principle and procedure of Rebound hammer test with figures. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Assess the principle and procedure of ultra sonic pulse velocity test. | CO6 | E | 6 |
|  | b. | Decide the factors that influence the test condition in rebound hammer test. | CO6 | E | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Categorize the construction materials, their components and manufacturing process |
| CO2 | Identify the quality control properties of concrete making materials |
| CO3 | Design the mix design of concrete based on various parameters |
| CO4 | Predict the properties of concrete in fresh and hardened concrete |
| CO5 | Adopt the different types of concrete in details |
| CO6 | Demonstrate non- destructive techniques on concrete structures |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 |  |  |  |  | 17 |
| CO2 | 2 | 15 |  |  |  |  | 17 |
| CO3 | 2 | 15 |  |  |  |  | 17 |
| CO4 | 2 | 3 |  | 12 |  |  | 17 |
| CO5 | 1 | 15 | 12 |  |  |  | 28 |
| CO6 | 1 | 3 | 12 |  | 12 |  | 28 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20CE2034** | **Duration** | **3hrs** |
| **Course Name** | **REPAIR AND REHABILITATION OF STRUCTURES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | | **BL** | | **Marks** | |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | | | | |
| 1. | List out the causes of distress. | | CO1 | | R | | 1 | |
| 2. | Name the three types of materials commonly found in structures prone to distress. | | CO1 | | R | | 1 | |
| 3. | List some materials used as protective surface coatings. | | CO3 | | R | | 1 | |
| 4. | Name three factors that can have adverse effects on concrete structures. | | CO2 | | R | | 1 | |
| 5. | Write the methods to control carbonation. | | CO3 | | U | | 1 | |
| 6. | List any two Semi destructive testing methods. | | CO3 | | R | | 1 | |
| 7. | List the different types of shoring. | | CO4 | | R | | 1 | |
| 8. | Define Shoring. | | CO5 | | R | | 1 | |
| 9. | List some materials used as protective surface coatings. | | CO4 | | R | | 1 | |
| 10. | List three methods commonly used in local retrofitting for improving structural integrity. | | CO6 | | R | | 1 | |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | | | | |
| 11. | Compare preventive and predictive maintenance. | | CO2 | | U | | 3 | |
| 12. | Explain the effect of cover thickness in RCC structures. | | CO5 | | U | | 3 | |
| 13. | Discuss the effect of carbonation on reinforced concrete structures. | | CO3 | | U | | 3 | |
| 14. | What are the semi-destructive testing methods used for damage assessment? | | CO2 | | U | | 3 | |
| 15. | How will you strengthen the footings in building structures? | | CO4 | | U | | 3 | |
| 16. | Explain the process of demolishing structural elements in a building or construction project. | | CO1 | | U | | 3 | |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | | | | |
| 17. | a. | Discuss the various types of failures in RCC structures and provide a detailed explanation. | | CO1 | | U | | 12 |
|  |  |  | |  | |  | |  |
| 18. | a. | Explain different nondestructive techniques with principles and applications. | | CO3 | | U | | 12 |
|  |  |  | |  | |  | |  |
| 19. | a. | Explain the steps involved in reinforcing steel cleaning. | | CO4 | | U | | 6 |
|  | b. | Illustrate the general surface preparation methods and procedures. | | CO4 | | U | | 6 |
|  |  |  | |  | |  | |  |
| 20. | a. | Explain corrosion, its prevention, and remedial measures in detail. | | CO2 | | U | | 12 |
|  |  |  | |  | |  | |  |
| 21. | a. | Explain with neat sketches illustrating the strengthening techniques for various structural elements. | | CO5 | | A | | 12 |
|  |  |  | |  | |  | |  |
| 22. | a. | Explain the different repair methods of various types of cracks. | | CO4 | | A | | 12 |
|  |  |  | |  | |  | |  |
| 23. | a. | Explain RCPT test used in concrete. | | CO3 | | U | | 6 |
|  | b. | How will you repair the structures affected by corrosion? | | CO4 | | U | | 6 |
| **COMPULSORY QUESTION** | | | | | | | | |
| 24. | a. | Illustrate the different methods of demolition techniques. | | CO6 | | U | | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand distress and damages to concrete steel and masonry structures. |
| CO2 | Inspect the structures for its maintenance. |
| CO3 | Interpret damage of structures using various tests. |
| CO4 | Apply of repair techniques to damage structures. |
| CO5 | Evaluate the strength of structural elements. |
| CO6 | Retrofit and strengthen RCC and Steel structures. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 | - | - | - | - | 17 |
| CO2 | 1 | 18 | - | - | - | - | 19 |
| CO3 | 2 | 22 | - | - | - | - | 24 |
| CO4 | 2 | 21 | 12 | - | - | - | 35 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 12 | - | - | - | - | 13 |
|  | | | | | | | **124** |

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| **Course Code** | **20CE2036** | **Duration** | **3hrs** |
| **Course Name** | **MUNICIPAL WASTE MANAGEMENT** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List any two benefits of recycling. | | CO3 | R | 1 |
| 2. | Define E-Waste. | | CO1 | R | 1 |
| 3. | Define “Brown” waste. | | CO3 | R | 1 |
| 4. | Define composting. | | CO6 | R | 1 |
| 5. | List any two examples of biomedical waste. | | CO3 | R | 1 |
| 6. | Define waste segregation. | | CO3 | R | 1 |
| 7. | List any one difference between processing and separation. | | CO3 | R | 1 |
| 8. | Describe waste exchange. | | CO3 | R | 1 |
| 9. | Define incineration technology. | | CO3 | R | 1 |
| 10. | Describe the composition of solid waste. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain the types of composting according to its nature. | | CO1 | U | 3 |
| 12. | A community produces the following on annual basics:   |  |  | | --- | --- | | Fraction | Tons per year | | Mixed house waste | 230 | | Recyclables | 25 | | Commercial waste | 45 | | Construction and Demolition debris (C & D) | 120 | | Leaves and miscellaneous | 50 | | Treatment plant sludge | 5 |   The recyclables are collected separately and processed at a material recovery facility. The mixed household waste and the commercial waste go to the landfill, as do the leaves and miscellaneous solid waste. The sludge is dried and applied on land (not into the landfill), and C & D wastes are used to fill a large ravine. Identify the diversion. | | CO4 | A | 3 |
| 13. | Explain the advantages of incineration. | | CO3 | U | 3 |
| 14. | Describe the types of the transfer station. | | CO3 | R | 3 |
| 15. | List any three advantages of the biogas plant. | | CO4 | R | 3 |
| 16. | Explain the need for transfer operations. | | CO3 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. |  | Define:  1. Municipal Solid Waste (MSW)  2. TYpes and sources.  3. MSW properties.  4. Benefits of MSW. | CO1 | R | 12 |
| 18. |  | Discuss the silent feature of the solid waste management rule 2016 and the need for solid waste management. | CO2 | U | 12 |
| 19. | a. | Discuss the waste sampling and characterization plan. | CO2 | U | 6 |
|  | b. | Articulate the labeling using a neat and clean diagram. | CO5 | A | 6 |
| 20. |  | Articulate solid waste disposal methods using neat and clean diagrams. | CO6 | A | 12 |
| 21. |  | Explain the collection of solid waste and the types of collection systems using a neat and clean diagram. | CO2 | U | 12 |
| 22. |  | Discuss biomedical waste by comparing the methods of disposal of biomedical waste and their segregation. | CO3 | U | 12 |
| 23. |  | Discuss biogas plants with their types using a neat and clean diagram. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Articulate Swachh Bharat Mission for municipal solid waste by using any case study. | CO5 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Analyze the nature and characteristics of municipal solid wastes. |
| CO2 | Sort out the functional elements for solid waste management. |
| CO3 | Apply the techniques and methods used in transformation, conservation and recovery of materials from solid waste. |
| CO4 | Identify and design waste containment systems. |
| CO5 | Gain knowledge in regulatory requirements regarding municipal solid waste management. |
| CO6 | Apply the basic scientific principles for solving practical waste management challenges. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 13 | 3 | - | - | - | - | 16 |
| CO2 | - | 30 | - | - | - | - | 30 |
| CO3 | 10 | 18 | - | - | - | - | 28 |
| CO4 | 4 | - | 3 | - | - | - | 7 |
| CO5 | - | - | 18 | - | - | - | 18 |
| CO6 | 1 | 12 | 12 | - | - | - | 25 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2037** | **Duration** | **3hrs** |
| **Course Name** | **NOISE POLLUTION AND ITS CONTROL** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define noise pollution. | | CO1 | R | 1 |
| 2. | List any two impacts of noise pollution. | | CO | R | 1 |
| 3. | State noise-health problems. | | CO | R | 1 |
| 4. | Identify the difference between noise and sound. | | CO | R | 1 |
| 5. | Describe types of noise. | | CO1 | U | 1 |
| 6. | List two remedies of noise pollution. | | CO5 | R | 1 |
| 7. | Define decibels scale. | | CO | R | 1 |
| 8. | Enumerate noise barrier work. | | CO4 | R | 1 |
| 9. | Define OSHA. | | CO5 | R | 1 |
| 10. | List any two challenges of noise pollution. | | CO | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | State noise rating. | | CO | R | 3 |
| 12. | Interpret L10, L50, and L90 | | CO1 | U | 3 |
| 13. | Describe noise assessment. | | CO | R | 3 |
| 14. | Illustrate public education on noise pollution. | | CO5 | U | 3 |
| 15. | Explain offensive noise. | | CO | U | 3 |
| 16. | Define Psychoacoustic. | | CO1 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain Sound Level Meter (SLM) using block diagram. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Classify the noise pollution level and its harmful effects. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Write about Environmental Protection Act 1986. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Articulate sound-absorbing materials, specify the prerequisites for a quality sound absorbent, and detail three distinct types of such materials. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Summarize the types of noise pollution sources. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Interpret the physiological effects and manifestations of noise pollution. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | While recording weighted sound levels, four readings have been at a site at different times of the day. These reading areas are 20, 56, 66, and 42 dB. Analyze the average noise produced by the source. | CO2 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the Indian standard and guidelines for noise pollution. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the nature and characteristics of noise pollution |
| CO2 | Analyze the noise pollution problems |
| CO3 | Detect the various effects of noise pollution |
| CO4 | Apply suitable preventive measures and identify the technologies and methods to control of noise |
| CO5 | Choose suitable noise adsorbent materials |
| CO6 | Gain knowledge about the various noise pollution regulations |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 9 | 31 | 12 | - | - | - | 52 |
| CO2 | 1 | 12 | - | 12 | - | - | 25 |
| CO3 | 1 | 12 | - | - | - | - | 13 |
| CO4 | 5 | - | - | - | - | - | 5 |
| CO5 | 2 | 3 | - | - | - | - | 5 |
| CO6 | - | 12 | 12 | - | - | - | 24 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2039** | **Duration** | **3hrs** |
| **Course Name** | **IRRIGATION ENGINEERING AND HYDRAULIC STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Classify irrigation based on source. | | CO1 | R | 1 |
| 2. | Mention the crop seasons followed in India. | | CO1 | R | 1 |
| 3. | Define cropwater requirement. | | CO2 | R | 1 |
| 4. | Elaborate irrigation scheduling. | | CO2 | U | 1 |
| 5. | Write the formula for conveyance efficiency. | | CO3 | U | 1 |
| 6. | List the advantages of drip irrigation. | | CO3 | U | 1 |
| 7. | State the disadvantages of free flooding method of irrigation. | | CO4 | U | 1 |
| 8. | Define silt pressure. | | CO4 | R | 1 |
| 9. | Mention any two control hydraulic structures used in irrigation systems. | | CO5 | U | 1 |
| 10. | State the purpose of cofferdam and canal fall. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare sprinkler and drip irrigation methods. | | CO2 | U | 3 |
| 12. | Relate delta and duty. | | CO1 | U | 3 |
| 13. | If wheat requires about 9.5cm of water every 28days, and the base period for wheat is140days, estimate delta for wheat. | | CO6 | A | 3 |
| 14. | Draw the hydraulic profile of a dam and mark its various zones indicating their purposes. | | CO5 | U | 3 |
| 15. | List the methods of surface irrigation. | | CO3 | R | 3 |
| 16. | State the demerits of irrigation. | | CO2 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the necessity of irrigation with respect to rainfall pattern and crops cultivated. | CO1 | U | 6 |
|  | b. | List the merits of irrigation. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Elaborate the factors that are considered for the estimation of cropwater requirement. | CO2 | A | 9 |
|  | b. | Determine the delta for a crop when its duty is 432 hectares/cumec on the field, if the base of the crop is 150 days. | CO2 | A | 3 |
|  |  |  |  |  |  |
| 19. | a. | Mention the irrigation efficiencies and also their applications. | CO3 | U | 6 |
|  | b. | Explain any 3 conventional irrigation methods with their merits and demerits. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Elaborate the components of drip irrigation and installation procedures. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Enumerate various methods applied for improving duty. | CO4 | A | 6 |
|  | b. | Discuss the stages of reservoir planning and the criteria for selection of site for dam construction. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Elucidate the control structures to regulate flows in an irrigation system and their purposes. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the On farm development works. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Elaborate water pricing methods followed for canal irrigation in different states of India. | CO6 | An | 6 |
|  | b. | Discuss the water quality standards that are followed for irrigation. | CO2 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | state the concepts of duty, crop and crop seasons |
| CO2 | classify the irrigation methods |
| CO3 | demonstrate the irrigation methods |
| CO4 | examine irrigation structures |
| CO5 | appraise and design of impounding structures and cross drainage works |
| CO6 | construct and operate the irrigation projects |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 18 |  |  |  |  | 20 |
| CO2 | 1 | 4 | 18 |  |  |  | 23 |
| CO3 | 3 | 14 |  |  |  |  | 17 |
| CO4 | 1 | 13 | 6 |  |  |  | 20 |
| CO5 |  | 16 | 6 |  |  |  | 22 |
| CO6 |  | 13 | 3 | 6 |  |  | 22 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2044** | **Duration** | **3hrs** |
| **Course Name** | **SUSTAINABLE DESIGN OF CAMPUS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define green building. | | CO1 | R | 1 |
| 2. | State international standards for technical energy systems. | | CO2 | R | 1 |
| 3. | Define food security. | | CO3 | R | 1 |
| 4. | Describe water recycling. | | CO4 | U | 1 |
| 5. | State buffer zones. | | CO5 | R | 1 |
| 6. | Identify the width of a bicycle lane when designing walking and cycling spaces. | | CO5 | U | 1 |
| 7. | State the assessment and planning for designing walkable spaces. | | CO5 | R | 1 |
| 8. | Give examples of low water landscaping. | | CO4 | U | 1 |
| 9. | Describe food self-sufficiency. | | CO3 | U | 1 |
| 10. | Define vermicomposting. | | CO1 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the steps taken for paperless communication and responsible paper usage at the university | | CO1 | R | 3 |
| 12. | Illustrate the process of energy flow analysis in a building | | CO2 | U | 3 |
| 13. | Interpret the opportunities for self-producing sustainable food systems | | CO3 | U | 3 |
| 14. | Describe the key components of water efficiency. | | CO4 | U | 3 |
| 15. | State the importance of thermal comfort in classroom environments. | | CO5 | R | 3 |
| 16. | Identify the first and most critical step in designing a sustainable campus. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | List the steps to reinforce a successful recycling program on campus. | CO1 | R | 6 |
|  | b. | Interpret potential outcomes of the research on green engineering for waste management at Gadjah Mada University and LDUS. | CO1 | U | 6 |
| 18. | a. | Write a case study on Waste-to-Energy (WTE) Campus in Jamnagar, Gujarat, India | CO2 | A | 8 |
|  | b. | Explain energy conservation in buildings. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the key dimensions of food security. | CO3 | U | 6 |
|  | b. | Differentiate between organic and sustainable agriculture. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the types of water reuse. | CO4 | U | 6 |
|  | b. | Summarize the uses of recycled water and challenges of water reuse. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain SBS symptoms, causes, and prevention. | CO5 | U | 6 |
|  | b. | Explain the effects of room temperature on behavior and academic performance. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | List some effective student-led events and activities that promote sustainability awareness and engagement across the campus. | CO6 | R | 6 |
|  | b. | Write the steps for the execution plan of a sustainability committee consisting of students, faculty, and administrative staff to oversee and manage sustainable initiatives. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Infer strategies for creating clean air zones around universities. | CO5 | U | 8 |
|  | b. | State the effects of poor indoor air quality. | CO5 | R | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the steps the university has taken to promote sustainability in the areas of food, water, health, and energy among students, faculty, and staff. | CO6 | A | 8 |
|  | b. | Write about the potential of green spaces with native plants to support biodiversity on a campus. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the Waste management concepts in the institute |
| CO2 | Apply sustainability principles for Energy |
| CO3 | Analyze the importance of food and sustainability |
| CO4 | Apply Water related sustainability concepts |
| CO5 | Analyse the concepts related to health and sustainability |
| CO6 | Evaluate a strategy for developing sustainable institute |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 11 | 6 |  |  |  |  | 17 |
| CO2 | 1 | 7 | 8 |  |  |  | 16 |
| CO3 | 1 | 16 |  |  |  |  | 17 |
| CO4 |  | 17 |  |  |  |  | 17 |
| CO5 | 9 | 15 | 6 |  |  |  | 30 |
| CO6 | 6 | 3 | 18 |  |  |  | 27 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2051** | **Duration** | **3hrs** |
| **Course Name** | **GLOBAL CLIMATE CHANGE AND ITS IMPACT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the disadvantage of coal. | | CO1 | R | 1 |
| 2. | Describe the impacts of particulate matter. | | CO1 | R | 1 |
| 3. | State atmospheric layers. | | CO2 | R | 1 |
| 4. | Define stockholm convention. | | CO6 | R | 1 |
| 5. | Describe coriolis force. | | CO3 | U | 1 |
| 6. | List any two name of green house gases. | | CO1 | R | 1 |
| 7. | Define air pollution. | | CO1 | R | 1 |
| 8. | Enumerate ocean circulation. | | CO2 | R | 1 |
| 9. | Identify the impacts of climate change. | | CO1 | R | 1 |
| 10. | Define climate. | | CO1 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Illustrate the impacts of flood. | | CO1 | U | 3 |
| 12. | Interpret Ramsar Convention-1971. | | CO6 | U | 3 |
| 13. | Identify food security dimensions. | | CO3 | R | 3 |
| 14. | Describe land – sea breeze. | | CO2 | R | 3 |
| 15. | Explain the types of storm. | | CO3 | U | 3 |
| 16. | Given the following temperature and elevation data, determine the stability of the atmosphere.  Elevation (m) Temperature (oC)  2.00 14.35  324.00 11.13 | | CO3 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate the recent trend of climate modelling. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain International agreements and protocols. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Interpret potential climate adaptation strategies for maintaining water‐related ecosystem services. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Articulate atmospheric stabilities using neat and clean diagram. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Summarize the impact of air pollution on living and non-living things. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Write about global wind circulation. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the scientific methods used to determine past climates. | CO3 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Write about Inter-governmental Panel on Climate Change (IPCC). | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the climate and its change |
| CO2 | List the factors affecting global climate change |
| CO3 | Analyze the impacts of global climate change |
| CO4 | Explain the importance of climate change in various fields |
| CO5 | Develop Climate Change Models |
| CO6 | Study the impacts of climate change across the Globe |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 6 | 15 | - | - | - | - | 21 |
| CO2 | 2 | 3 | - | - | - | - | 5 |
| CO3 | - | 16 | 3 | - | - | - | 19 |
| CO4 | - | 12 | - | - | - | - | 12 |
| CO5 | - | 12 | 24 | - | - | - | 36 |
| CO6 | 4 | 15 | 12 | - | - | - | 31 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2052** | **Duration** | **3hrs** |
| **Course Name** | **GREEN BUILDINGS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define waste. | | CO1 | R | 1 |
| 2. | List the types of air pollution. | | CO6 | R | 1 |
| 3. | Define SDGs (Sustainable Development Goals). | | CO1 | R | 1 |
| 4. | Identify a suitable example of point sources. | | CO6 | A | 1 |
| 5. | Describe acoustic materials. | | CO6 | U | 1 |
| 6. | List any two benefits of water conservation. | | CO1 | R | 1 |
| 7. | Define air pollution model. | | CO6 | R | 1 |
| 8. | Identify the general effects of ozone depletion. | | CO1 | R | 1 |
| 9. | Define SMOG. | | CO6 | R | 1 |
| 10. | List any two impacts of air pollution on human health. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare line sources and area sources in air pollution. | | CO6 | U | 3 |
| 12. | Explain the benefits of rainwater harvesting. | | CO1 | U | 3 |
| 13. | Identify the use of the water saving plumbing systems. | | CO4 | R | 3 |
| 14. | Differentiate indoor and outdoor air pollution. | | CO6 | U | 3 |
| 15. | Discuss the site selection for green buildings. | | CO3 | U | 3 |
| 16. | Illustrate an overview for air pollution modeling procedure. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Report any case study on rain water harvesting system for green buildings. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Describe wind energy with its application for green buildings. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Write project management and certification in the context of green buildings. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Articulate sustainable development goals using a suitable diagram. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain biogas treatment plant for organic waste material management. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Determine the effective height of a stack, if the stack is 203 m tall with 1.07 m inside diameter. Wind velocity is 3.56 m/s. Air temperature is 13 °C. Barometric pressure is 1000 millibars. Stack gas velocity is 9.14 m/s having 149 °C temperature. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Summarize the use of local building materials. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Define the following rating system   * LEED * GRIHA | CO2 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the factors influencing the Green building concept |
| CO2 | Identify and Compare different rating system |
| CO3 | Select the proper site and adopt green building techniques |
| CO4 | Plan energy-efficient building envelopes and reduce the carbon foot print |
| CO5 | Select the Building material and reduce, reuse and recycle waste |
| CO6 | Evaluate the performance of Green buildings and enhance indoor air quality |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 3 | 24 | - | - | - | 31 |
| CO2 | 24 | - | 12 | - | - | - | 36 |
| CO3 | - | 3 | - | - | - | - | 3 |
| CO4 | 3 | 12 | - | - | - | - | 15 |
| CO5 | - | 12 | - | - | - | - | 12 |
| CO6 | 4 | 10 | 13 | - | - | - | 27 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE2053** | **Duration** | **3hrs** |
| **Course Name** | **SMART BUILDINGS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Explain the concept of Internet of Things (IoT) in the context of smart buildings. | | CO1 | U | 1 |
| 2. | State the impact of information and communication technologies on smart buildings. | | CO1 | R | 1 |
| 3. | Name a type of mobile application commonly used in smart buildings. | | CO1 | R | 1 |
| 4. | List the key components of a Building Management System (BMS). | | CO4 | R | 1 |
| 5. | Explain the concept of a Building Automation System (BAS). | | CO2 | U | 1 |
| 6. | Define Integrated Building Management System (IBMS). | | CO3 | R | 1 |
| 7. | List one advantage of implementing a Building Management System. | | CO6 | R | 1 |
| 8. | Describe the purpose of HVAC Control Panels in smart buildings. | | CO1 | U | 1 |
| 9. | Explain the principles of fire protection systems in buildings. | | CO5 | U | 1 |
| 10. | List the components involved in a CCTV system for security in buildings. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Interpret how IoT and Cloud Applications enhance smart buildings with an example. | | CO1 | U | 3 |
| 12. | Explain the advantages of a Building Automation System (BAS). | | CO2 | U | 3 |
| 13. | Describe the operation of fire alarm systems in smart buildings, emphasizing their role in fire management and life safety. | | CO4 | U | 3 |
| 14. | Write the components of structural health monitoring systems in smart buildings | | CO5 | A | 3 |
| 15. | List the key benefits of a case study on Chicago's most interconnected building, focusing on smart health monitoring and asset longevity. | | CO4 | R | 3 |
| 16. | Infer from a case study of Chicago's most interconnected building, emphasizing smart health monitoring and asset longevity, and highlight the key benefits and outcomes. | | CO1 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the concept of "Smart Buildings" and provide real-world IoT examples. | CO1 | U | 6 |
|  | b. | Describe the role of Artificial Intelligence in building management systems and its impact on smart buildings. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain systems integration in building management, focusing on IBMS. Provide examples. | CO6 | U | 6 |
|  | b. | Write the integration of various systems in a building, including IBMS, and explain its role in both regular and emergency building operation. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Identify the colorless, odorless, naturally occurring gas that comes from the decay of radioactive elements in soils, and discuss how it relates to the design of fire safety and security systems for smart buildings. | CO4 | R | 6 |
|  | b. | Explain the role of different communication networks such as BACNet, Modbus, and LON in HVAC control, and describe their applications. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | List the stages of fire and the principles of operation of fire sensors and detectors, and explain their importance in fire protection systems. | CO5 | R | 6 |
|  | b. | Interpret the term "Security design" and its role in integrating building management systems within intelligent buildings. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe security system concepts and components like access control, CCTV, and alarm systems and their role in building security. | CO2 | U | 6 |
|  | b. | Write about the operation and significance of structural health monitoring systems in preventing structural failures. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Name a mobile application used in smart buildings and describe its role in enhancing building management. | CO1 | R | 6 |
|  | b. | Define EPBX and explain its role in improving communication within the building. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the primary purpose of Internet of Things (IoT) in smart buildings and its role in enhancing building efficiency and occupant experience. | CO1 | U | 6 |
|  | b. | Describe a Building Automation System's (BAS) contribution to building efficiency and its importance in modern building management. | CO4 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Interpret microprocessor-based control and programmable logic controllers in building electronics, with practical examples in building management. | CO6 | U | 6 |
|  | b. | Explain the importance of satellite communication and fiber optic backbones in smart buildings, using real-world case studies. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the system of Smart Technology. |
| CO2 | Implement the design principles and strategy in Smart buildings. |
| CO3 | Illustrate philosophy of building automation systems. |
| CO4 | Analyze the intelligent building design concepts. |
| CO5 | Design fire safety and security systems for intelligent buildings. |
| CO6 | Integrate the building management systems and adopt them in intelligent buildings. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 14 | 26 | - | - | - | - | 40 |
| CO2 | - | 10 | 6 | - | - | - | 16 |
| CO3 | 1 | - | - | - | - | - | 1 |
| CO4 | 17 | 9 | - | - | - | - | 26 |
| CO5 | 6 | 7 | 3 | - | - | - | 16 |
| CO6 | 1 | 18 | 6 | - | - | - | 25 |
|  | | | | | | | **124** |



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| **Course Code** | **20CE3001** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED STRUCTURAL ANALYSIS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Analyze the continuous beams using Matrix flexibility method. Take EI is constant.  UNIT – IV FLEXIBILTY AND STIFFNESS METHOD | CO1 | An | 16 |
|  |  |  |  |  |  |
| 2. | a. | Analyse the portal frame ABCD shown in figure by matrix flexibility method and sketch the bending moment diagram.  Solved] Analyze the portal frame ABCD shown in figure by slope  deflection... | Course Hero | CO1 | An | 16 |
|  |  |  |  |  |  |
| 3. | a. | Explain in detail the step by step procedure of the Matrix stiffness for a statically determinate and in-determinate structure using semi-automatic method. | CO2 | U | 16 |
|  |  |  |  |  |  |
| 4. | a. | Analyze the continuous beams using Matrix Stiffness method.  UNIT – IV FLEXIBILTY AND STIFFNESS METHOD | CO2 | An | 16 |
|  |  |  |  |  |  |
| 5. | a. | Discuss the steps involved in the analysis of continuous beam using Direct Stiffness method. | CO4 | An | 16 |
|  |  |  |  |  |  |
| 6. | a. | Analyze the truss shown in figure by direct stiffness method.  See the source image | CO5 | An | 16 |
|  |  |  |  |  |  |
| 7. | a. | Explain in detail the step by step procedure of analysis of truss element using static condensation technique. | CO5 | U | 8 |
|  | b. | How will you analyze a grid floor by using matrix methods? | CO5 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Discuss the procedure of substructuring technique in matrix displacement method. | CO3 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the degrees of freedom and formulate flexibility and stiffness matrix |
| CO2 | Analyze the truss using stiffness methods |
| CO3 | Analyze the beams elements using appropriate methods |
| CO4 | Analyze the elements using advanced methods |
| CO5 | Evaluate the structural stability of frames |
| CO6 | Analyze the elements using software tools |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 32 | - | - | 32 |
| CO2 | - | 16 | - | 16 | - | - | 32 |
| CO3 | - | - | - | 20 | - | - | 20 |
| CO4 | - | - | - | 16 | - | - | 16 |
| CO5 | - | 16 | - | 16 | - | - | 32 |
| CO6 | - | - | - | - | - | - | - |
|  | | | | | | | **132** |



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| **Course Code** | **20CE3003** | **Duration** | **3hrs** |
| **Course Name** | **STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Determine the natural frequency and natural period of the system consisting of a mass of 100 kg attached to a horizontal cantilever beam through the linear spring k2. The cantilever beam has a thickness of 0.8cm and a width of 1.2 cm. E=2.1 x 106 kg/cm2, L=70 cm and k= 10kg/cm. | CO1 | A | 6 |
|  | b. | A platform weighing 7 x 102 N is supported on four columns. The columns are identical and clamped at both ends. It has been determined experimentally that a force of 1.75 x105 N horizontally applied to the platform produces a displacement of 2.54mm, Damping is 5% of critical damping. Determine the following, i) undamped natural frequency, ii) absolute damping coefficient, iii) logarithmic decrement. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 2. | a. | Determine the natural frequency and mode shape of the system shown in the figure  2k m k m 2k | CO2 | A | 16 |
|  |  |  |  |  |  |
| 3. | a. | Derive the Fourier series expression for the given periodic loading function and write the expression for the response of a SDOF system. | CO1 | A | 16 |
|  |  |  |  |  |  |
| 4. | a. | Find the response of a two degree of freedom system whose mass and Stiffness Matrices are given by the following.  and    The forcing function . The system starts at rest.  Find its response by newmark’s method method.  Use time step as 0.1 sec, α =0.25 and δ=0.5. | CO3 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | A three storey building located in Chennai has floor height of 3m and weight of m1= m2=2500kN, m3=2200kN, resting on medium rock, designed for an office building. Calculate the forces in each level for the data given below:   |  |  |  |  | | --- | --- | --- | --- | |  | **Mode 1**  **T=0.86** | **Mode 2**  **T=0.265** | **Mode 3**  **T=0.145** | | Roof | 1.000 | 1.000 | 1.000 | | 2nd floor | 0.904 | 0.216 | -0.831 | | 1st floor | 0.716 | -0.701 | -0.574 | | CO3 | A | 16 |
|  |  |  |  |  |  |
| 6. | a. | “Ductile detailing of structures enhances the shear capacity of the structures”. Explain the procedure for designing the RC beam, column and joints as per codal provisions. | CO5 | U | 16 |
|  |  |  |  |  |  |
| 7. | a. | Write a detailed note on seismic retrofitting methods. | CO4 | U | 8 |
|  | b. | Enumerate the lessons learnt from post-earthquakes. | CO4 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Explain different types of vibration control methods. | CO6 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the elements of vibratory system and develop mathematical models |
| CO2 | Determine the fundamental frequency and mode of vibration of structural elements |
| CO3 | Estimate the response of structures subjected to dynamic forces |
| CO4 | Apply theory of dynamics to structures subjected to seismic forces |
| CO5 | Illustrate the codal provisions for seismic resistant design |
| CO6 | Recommend suitable alternate techniques and retrofitting methods |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 32 | - | - | - | 32 |
| CO2 | - | - | 16 | - | - | - | 16 |
| CO3 | - | - | 32 | - | - | - | 32 |
| CO4 | 4 | 12 | - | - | - | - | 16 |
| CO5 | - | 16 | - | - | - | - | 16 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **20CE3008** | **Duration** | **3hrs** |
| **Course Name** | **THEORY AND APPLICATIONS OF CEMENT COMPOSITES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the strength gain mechanism of fiber reinforced high strength cementitious composites. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Classify different types of fibers and polymers in the development of cementitious composites. | CO1 | R | 20 |
|  |  |  |  |  |  |
| 3. | a. | Write the microstructure properties and pore structure characterization of cement composites. | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss in detail the following mechanical properties of fiber reinforced high strength cementitious composites.  i)Compressive strength  ii)Tensile strength  iii)Flexural strength | CO2 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Analyze the influence of nano materials on strength and durability properties of cement composites. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the corrosion mechanism evaluation and resistance of fiber reinforced high strength cementitious composites. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 7. | a. | Describe the properties and application of Shrinkage compensating concrete. | CO4 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | List different applications of fiber reinforced high strength cementitious composites with suitable examples. | CO1 | R | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Evaluate any two types of cement composites as a case study with suitable application. | CO6 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Classify the materials as per orthotropic and anisotropic behaviour |
| CO2 | Formulate constitutive behaviour of composite materials |
| CO3 | Estimate strain constants using theories applicable to composite materials |
| CO4 | Compare the mechanical behavior based on the approaches to stiffness |
| CO5 | Adopt nanomaterials in cement composites |
| CO6 | Develop the new cement composites |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 40 | - | - | - | - | - | 40 |
| CO2 | - | 60 | - | - | - | - | 60 |
| CO3 | - | - | - | - | - | - | - |
| CO4 | 20 | - | 20 | - | - | - | 40 |
| CO5 | - | - | - | 20 | - | - | 20 |
| CO6 | - | - | - | - | 20 | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **20CE3015** | **Duration** | **3hrs** |
| **Course Name** | **BRIDGE ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 x 16= 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Recognize the code book by which railway bridges are being designed and also state how the design loads are determined for different gauges of rails. | CO1 | R | 5 |
|  | b. | Design the deck slab of an RCC Tee beam bridge for a major river crossing in a National Highway for the following data:  Clear width of roadway - 7.5m  Wearing coat - 100mm  No. of main girders - 3  Span (c/c of bearing) - 20m  Spacing of cross girder - 5m c/c  Loading - IRC Class AA tracked vehicle  M20 grade of concrete and Fe 415 grade steel is used | CO4 | A | 15 |
|  |  |  |  |  |  |
| 2. | a. | Distinguish between a culvert and bridge. | CO1 | U | 5 |
|  | b. | How would you determine the maximum bending moment and shear force for the design of a longitudinal girder of RCC Tee beam bridge for the following data?    Clear width of roadway - 7.5m  Wearing coat - 80mm  No. of main girders - 3  Span (C/c of bearing) - 15m  Spacing of cross girder - 5m c/c  Loading - IRC Class AA tracked vehicle  M20 grade of concrete  Fe 415 grade steel is use | CO3 | An | 15 |
|  |  |  |  |  |  |
| 3. | a. | Can you brief the design procedure of a post-tensioned box girder bridge? | CO2 | U | 5 |
|  | b. | Design a post- tensioned prestressed concrete slab bridge for a national highway crossing to suit the following data:  Width of carriage way = 7.5m  Foot path = 1m on either side  Kerbs = 600mm wide  Clear Span = 8 m  Type of loading = IRC Class AA or Class A  whichever gives the worst  effect  Materials – M40 grade concrete and 7mm diameter high tensile wires with an ultimate tensile strength of 1500 N/mm2 housed in cables with 12 wires and anchored by Freyssinet anchorages of 150mm diameter. Compressive strength at transfer, fci = 35 N/mm2. Loss ratio = 0.8. | CO4 | A | 15 |
|  |  |  |  |  |  |
| 4. | a. | Can you suggest the materials by which arch bridges can be built with appropriate reasons? | CO2 | U | 5 |
|  | b. | A post-tensioned Prestressed concrete slab is to be designed for a road bridge for the following data:  Width of carriageway - 7.5 m  Kerbs - 600mm wide  Foot path - 1m on either side  Clear span - 12m  Type of loading - IRC Class AA tracked vehicle  Materials - M50 grade concrete, 7mm HTS wires of Ultimate Stress 1600N/mm2  The cube compressive strength at transfer is 45N/mm2  Determine the maximum bending moment and shear forces on the bridge. | CO4 | A | 15 |
|  |  |  |  |  |  |
| 5 | a. | How would you summarize the basic functions of a pier? | CO2 | U | 5 |
|  | b. | Verify the stability of the abutment shown in Fig.1. The other salient details are given below:   * 1. Materials of the abutment - concrete   2. Density of the soil - 19 kN/m3   3. Coefficient of friction - 0.6   4. Angle of repose of the soil ϕ = 20°   Live load on the bridge: IRC Class AA (tracked)  Span of the bridge = 9m  Angle of friction between the soil and concrete = δ = 16°  The bridge deck consists of three longitudinal girders 1.5m depth with a deck slab of 300mm thick. | CO5 | E | 15 |
|  |  |  |  |  |  |
| 6. | a. | List the components of a steel trussed girder railway bridge. | CO1 | R | 5 |
|  | b. | How would you explain the design procedure of a trussed girder bridge? | CO3 | An | 15 |
|  |  |  |  |  |  |
| 7. | a. | Can you outline the advantages of composite bridges? | CO1 | R | 5 |
|  | b. | How would you assess the condition of bridges using health monitoring devices? | CO5 | E | 15 |
| **PART – B (1 x 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. |  | How would you assess the failure of a bridge or appraise on the features of construction of a major bridge? | CO6 | E | 20 |



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|  | **COURSE OUTCOMES** |
| CO1 | Classify bridges according to loading and site conditions |
| CO2 | Explain the behaviour of different types of bridges |
| CO3 | Analyze different types of bridges |
| CO4 | Design the different components of bridges |
| CO5 | Appraise on the quality investigation of bridge structures |
| CO6 | Investigate the reasons for the failure of bridge structures |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 15 | 5 |  |  |  |  | 20 |
| CO2 |  | 15 |  |  |  |  | 15 |
| CO3 |  |  |  | 20 |  |  | 20 |
| CO4 |  |  | 45 |  |  |  | 45 |
| CO5 |  |  |  |  | 15 |  | 15 |
| CO6 |  |  |  |  | 20 |  | 20 |
|  | | | | | | | **145** |



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| **Course Code** | **20CE3016** | **Duration** | **3hrs** |
| **Course Name** | **CONDITIONAL ASSESSMENT OF EXISTING STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Describe the detailed procedure to be followed to test the Core samples as per IS 456:2000 in RCC building. Also, explain the procedure to interpret the data. | CO3 | R | 16 |
|  |  |  |  |  |  |
| 2. | a. | Describe the key elements and methodologies involved in a comprehensive visual investigation of structures. | CO1 | R | 16 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the key criteria and considerations that determine when a detailed assessment becomes mandated for evaluating damage or deterioration in buildings. | CO2 | U | 16 |
|  |  |  |  |  |  |
| 4. | a. | Prepare a detailed case study report for evaluating the Fire damaged RCC building. Also, discuss the role of NDT in conditional assessment. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Describe the recommended strategies for identifying, preventing, and remedying seepage issues to ensure the long-term integrity and safety of the structure. | CO4 | U | 16 |
|  |  |  |  |  |  |
| 6. | a. | Discuss the key steps involved in conducting a comprehensive conditional assessment of infrastructure or assets. | CO6 | U | 16 |
|  |  |  |  |  |  |
| 7. | a. | Explain the most reliable and effective testing methods and techniques for accurately assessing the extent and severity of corrosion and carbonation in concrete and metal structures. | CO5 | U | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | List the common types of damage that can affect HVAC, pumping and electrical systems in both residential and commercial settings, and what are the best practices for assessing, repairing, and maintaining these damaged systems to ensure safety and functionality. | CO6 | R | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the procedure for identifying the structure exposed to aggressive environment. |
| CO2 | Apply the guidelines for structural condition assessment of existing buildings. |
| CO3 | Identify techniques for evaluating concrete masonry and wood. |
| CO4 | Select the destructive and non destructive techniques to suite the projects. |
| CO5 | Interpret and use destructive and nondestructive test results. |
| CO6 | Evaluate and report the conditional assessment of existing structure. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 16 | - | - | - | - | - | 16 |
| CO2 | - | 16 | - | - | - | - | 16 |
| CO3 | 16 | - | - | - | - | - | 16 |
| CO4 | - | 16 | - | - | - | - | 16 |
| CO5 | - | 16 | 16 | - | - | - | 32 |
| CO6 | 20 | 16 | - | - | - | - | 36 |
|  | | | | | | | **132** |



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| **Course Code** | **20CE3017** | **Duration** | **3hrs** |
| **Course Name** | **FRACTURE MECHANICS OF CONCRETE STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the different types of cracks. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the significance of stress intensity factors in determining the critical conditions for crack growth and fracture. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Explain how fatigue cracking occurs in concrete structures and the impact of cyclic loading. | CO2 | U | 12 |
|  | b. | Discuss the common environmental factors that can contribute to environment-assisted cracking in concrete. | CO2 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain how external loads, such as bending and axial tension, lead to the formation of cracks in concrete. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain Griffith's criteria for the critical stress required to propagate a crack in a brittle material. | CO3 | U | 12 |
|  | b. | Explain the concept of stress intensity factors and their role in assessing crack growth in materials. | CO3 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Compare and contrast R curves for different materials and loading conditions, emphasizing their role in characterizing the resistance to crack growth. | CO3 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Describe the key features of band models used in modeling deformation and damage. | CO4 | U | 10 |
|  | b. | Summarize the differences between linear and nonlinear material models in the context of quasi-brittle materials. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the purpose and advantages of using fibers in concrete, particularly in fiber-reinforced concrete (FRC). | CO5 | U | 15 |
|  | b. | Explain numerical modeling in the context of concrete analysis and simulation. | CO5 | U | 5 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the role of plasticity models in capturing concrete's nonlinear behavior, such as post-peak softening. | CO6 | U | 10 |
|  | b. | Summarize the factors that affect the shape and position of failure surfaces for quasi-brittle materials. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Classify the various types of cracks. |
| CO2 | Comprehend the fundamentals of fracture mechanics. |
| CO3 | Identify the cracking of concrete structures based on fracture mechanics. |
| CO4 | Implement stress intensity factor for notched members. |
| CO5 | Apply fracture mechanics models to high strength concrete and FRC structures. |
| CO6 | Ascertain the associated and non-associated flow cracks. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 40 | - |  | - | - | 40 |
| CO2 | - | 20 | - | 20 | - | - | 40 |
| CO3 | - | 20 | 20 | - | - | - | 40 |
| CO4 | - | 10 | - | 10 | - | - | 20 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **20CE3018** | **Duration** | **3hrs** |
| **Course Name** | **DESIGN OF PRE-STRESSED CONCRETE STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | How would you relate Primary Tension failure with Primary Compression failure? | CO1 | U | 4 |
|  | b. | How would you evaluate the creep losses in prestressed concrete with reference to codal norms? | CO3 | R | 12 |
|  |  |  |  |  |  |
| 2. | a. | How would you analyze a prestressed concrete beam under different  loading condition against deflection with reference to the IS Code? | CO3 | An | 4 |
|  | b. | Determine the Limit State Moment of Resistance of the mid-span section of a slab using codal method as well as theoretical method for the following data:   1. Effective span - 12m 2. Live load - 20kN/m 3. M45 grade of concrete and 7mm diameter high tensile wires of ultimate strength 1520 MPa, The cube strength of concrete is 35.6N/mm2 4. Breadth b - 1000mm 5. Depth D - 440mm 6. Eccentricity of prestressing wire - 138mm below the centroidal axis 7. Area of prestressing steel - 6 Freyssinet cables of 7mm diameter wires 8. Initial Prestressing force - 3059933N   Check whether this section has adequate safety factor with respect to limit state of collapse. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 3. | a. | How would you summarize the durability aspects of a prestressed concrete structure? | CO2 | U | 4 |
|  | b. | Evaluate the adequacy of the given prestressed concrete girder for shear and suggest suitable reinforcement.  Breadth of the top flange = 500mm  Thickness of top flange = 100mm  Thickness of web = 120mm  Breadth of bottom flange = 350mm  Thickness of bottom flange = 180mm  Clear depth of web = 500mm  Eccentricity of prestressing wire = 278.3mm below the centroidal axis  Prestressing steel = 3 Freyssinet cables of 7mm diameter wires  Initial Prestressing force = 1446588N  Live load on the beam = 15kN/m  Span of the beam = 15m  fck = 40N/mm2 & Ultimate stress in steel is 1580N/mm2 | CO3 | An | 12 |
|  |  |  |  |  |  |
| 4. | a. | How would you appraise the influencing parameters of deflection in a prestressed concrete beam? | CO2 | E | 4 |
|  | b. | The solid end block of a post tensioned prestressed beam of 25m span, with three cables, each of 7-15mm strands, tensioned to 1200kN is shown in figure. The anchorage plates are square with a side length with a side of 180mm. Design the end block for bursting forces and sketch the details of reinforcement according to the provisions of the IS 1343-2012 | CO4 | A | 12 |
|  |  |  |  |  |  |
| 5. | a. | How would you apply the design rules for torsion in prestressed concrete beams? | CO4 | A | 4 |
|  | b. | Illustrate with suitable sketch, the cable profile for an I section having the following dimensions  Breadth of the top flange = 500mm  Thickness of top flange = 100mm  Thickness of web = 120mm  Breadth of bottom flange = 350mm  Thickness of bottom flange = 180mm  Clear depth of web = 500mm  Eccentricity of prestressing wire = 278.3mm below the centroidal axis  Prestressing steel = 3 Freyssinet cables of 7mm diameter wires  Initial Prestressing force = 1446588N  Live load on the beam = 15kN/m  Span of the beam = 15m | CO4 | A | 12 |
|  |  |  |  |  |  |
| 6. | a. | How would you construct a road slab on composite prestressed concrete road bridge? | CO5 | U | 4 |
|  | b. | Summarize the design procedure of prestressed concrete flat slab with column drop. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 7. | a. | Categorize the different types of prestressed concrete sleepers with their applications. | CO2 | An | 4 |
|  | b. | How would you explain the application of prestressing in pile foundation? | CO2 | A | 12 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Design a Post Tensioned prestressed concrete slab for a span of 8m carrying a uniformly distributed load of 15kN/m. M45 grade of concrete and 7mm diameter HTS wires of ultimate strength of 1600MPa were used. The cube compressive strength at transfer is 40N/mm2. | CO4 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Distinguish between different prestressing techniques with their principles |
| CO2 | Apply the concepts of prestressing techniques in the real time problems |
| CO3 | Analyse prestressed concrete structural elements |
| CO4 | Design prestressed concrete structural elements |
| CO5 | Appraise on the quality of PSC structures |
| CO6 | Investigate the rationale for failure of a PSC structure |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| CO2 | 0 | 4 | 12 | 4 | 4 | 0 | 24 |
| CO3 | 12 | 0 | 12 | 16 | 0 | 0 | 40 |
| CO4 | 0 | 0 | 56 | 0 | 0 | 0 | 56 |
| CO5 | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| CO6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | | | | | | | **128** |



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| **Course Code** | **20CE3019** | **Duration** | **3hrs** |
| **Course Name** | **EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | List the different types of measurement systems with a detailed description. | CO3 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss in detail about the functions of LVDT and its application in Structural element testing. | CO4 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | What is ground penetrating radar? Describe its principle and applications. | CO4 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write the key factors to be considered while conducting experiment/formulating test setup with suitable examples. | CO3 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Discuss the causes and types of experimental errors. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain different types of crack measuring devices and procedure for evaluating crack pattern. | CO5 | E | 20 |
|  |  |  |  |  |  |
| 7. | a. | List different measurement systems and its application in Structural health monitoring. | CO6 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write short notes on shake table test with neat sketches, list the instruments involved in the experiment. | CO4 | R | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Prepare a case study report for conducting the experiment to evaluate load deflection behavior of Steel beam. | CO1 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Implement the principles of measurements for static and dynamic response of structures |
| CO2 | Plan various experiments and the instruments |
| CO3 | Adopt the various measuring devices for various parameters |
| CO4 | Choose the appropriate data recorders and improve data interpretation |
| CO5 | Evaluate the distress in structures |
| CO6 | Analyze the structure by non-destructive testing methods and model analysis |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 20 | - | 20 | - | - | - | 40 |
| CO2 | - | - |  | - | - | - | - |
| CO3 | 20 | - | 20 | - | - | - | 40 |
| CO4 | 40 | 20 | - | - | - | - | 60 |
| CO5 | - | - | - | - | 20 | - | 20 |
| CO6 | 20 | - | - | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **20CE3022** | **Duration** | **3hrs** |
| **Course Name** | **CEMENT AND CONCRETE CHEMISTRY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe the differences between ordinary Portland cement (OPC) and blended cements in terms of composition and properties. | CO1 | U | 10 |
|  | b. | Explain the characteristics of blended cement. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the phase diagram of cement chemistry system with a neat sketch. | CO1 | A | 10 |
|  | b. | Compare different types of cement. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Evaluate the impact of cracking on the permeability of cement paste and its consequences for the long-term durability of concrete. | CO2 | An | 10 |
|  | b. | Explain the role of water in the hydration of cement and its impact on the formation of calcium silicate hydrates (C-S-H). | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the various rheological properties of cement. | CO2 | U | 10 |
|  | b. | Describe the features “interfacial transition zone (ITZ)”. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the corrosion in concrete in chlorides solutions. | CO3 | U | 10 |
|  | b. | Describe the relationship between water-cement ratio and pore structure in cement paste. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Evaluate the impact of curing on the formation of microcracks and the overall permeability of concrete. | CO3 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Discuss the significance of the chloride threshold level in concrete and its relationship to the risk of corrosion | CO4 | U | 10 |
|  | b. | Explain different chemical binders used in concrete. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the application of poly carboxylate ether based materials with an example. | CO5 | U | 10 |
|  | b. | Describe the mechanism by which water reducer’s work to reduce the water content in a concrete mix. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the Transmission Electron Microscopy (TEM) with neat sketch. | CO6 | U | 10 |
|  | b. | Explain thermo analytical techniques in cement chemistry. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Classify the phase system of cement |
| CO2 | Explain the cement hydration process |
| CO3 | Analyse the properties of cement paste and concrete |
| CO4 | Illustrate the hydration of cement with mineral admixtures |
| CO5 | Examine the properties of hardened paste |
| CO6 | Adopt modern micro structure analysis technique |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 30 | 10 | - | - | - | 40 |
| CO2 | - | 30 | - | 10 | - | - | 40 |
| CO3 | - | 20 | - | 20 | - | - | 40 |
| CO4 | - | 20 | - | - | - | - | 20 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **20CE3024** | **Duration** | **3hrs** |
| **Course Name** | **SUSTAINABLE CONSTRUCTION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Discuss in detail the various principles of green building design | CO1 | U | 10 |
|  | b. | List the various components of built environment. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss in detail the factors considered in the need of sustainable buildings. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Explain in detail the need of sustainable design. | CO2 | U | 10 |
| b. | Explain in detail the impact of buildings on the environment. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss the impact of energy-efficient and environment-friendly buildings on indoor air quality and human health. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Discuss the role of landscaping in sustainable building design. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss the advantages and disadvantages of using photovoltaic systems in buildings. | CO5 | U | 8 |
|  | b. | Summarize the impact of photovoltaic that affects the energy efficiency and carbon footprint of the building. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the contribution of LEED towards green building. | CO5 | E | 10 |
|  | b. | List the advantages and disadvantages of LEED rating system in India. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8 | a. | Infer GRIHA and how does GRIHA certification contribute to energy efficiency, water conservation and waste reduction in buildings? | CO6 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 9. | a. | Recommend the sustainable construction practices to be implemented in the development of new office building in an urban area to minimize environmental impact and maximize resource efficiency, economic viability and meeting the needs of occupants. | CO6 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify sustainable design aspects |
| CO2 | Evaluate the life cycle assessment |
| CO3 | Design building based on environmental aspects |
| CO4 | Incorporate energy efficiency in design of buildings |
| CO5 | Design environmental friendly buildings |
| CO6 | Apply green building ratings |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 10 | - | - | - | - | 20 |
| CO2 | - | 30 | - | - | - | - | 30 |
| CO3 | - | 30 | - | - | - | - | 30 |
| CO4 | - | 20 | - | - | - | - | 20 |
| CO5 | 10 | 8 | - | - | 22 | - | 40 |
| CO6 | - | - | 20 | - | 20 | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **21CE3003** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED DESIGN OF CONCRETE STRUCTURAL SYSTEMS** | **Max. Marks** | **100** |

**IS 456, IS 875, IS 1893, 1S 13920 are permitted**

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the different type of cracks that develop in structural concrete with examples. | CO6 | U | 8 |
|  | b. | Explain the long term deflection and how IS code limits the deflection? | CO1 | U | 8 |
|  |  |  |  |  |  |
| 2. | a. | A three story RC building is located in seismic zone II on soft soil. The framing system of the building is moment-resisting frame without brick masonry infill panels. Find the base shear and its distribution along the height of the building. Column sections: 300mmx500mm, Beam sections: 230mmx380mm, Slab: 125mm thick RCC slab on all floors. Size of building 30x30m (equal bays in both direction), Height of each floor – 3.5m, Live load - 4kN/m2. Assume the relevant data. | CO2 | An | 16 |
|  |  |  |  |  |  |
| 3. | a. | Analyze and Design the Flat slab structural system for the following details.  Panel size – 8x8m  Live load- 5kN/m2  Size of column – 600x600mm  M40 grade of concrete and Fe550 steel  Provide suitable drop panel | CO3 | An | 16 |
|  |  |  |  |  |  |
| 4. | a. | Discuss about the inelastic behavior of concrete. | CO4 | U | 8 |
|  | b. | Explain the concept of plastic hinges. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 5. | a. | Calculate the design wind pressure of RC building for the following data; consider both methods as per IS 875 PIII  Height of building – 30m (each floor 5m)  Size of building – 25mx25m  Location of building – Coimbatore  Assume the relevant data | CO2 | An | 8 |
|  | b. | Explain the design procedure of deep beams and sketch the typical reinforcement details. | CO4 | U | 8 |
| 6. | a. | Evaluate the details of ductile reinforcement for a beam of size 300x500mm, subjected to the following loads. Span – 4m, M30 concrete and Fe 500 steel, as per IS 13920.   |  |  |  |  | | --- | --- | --- | --- | |  | DL | LL | SL | | Moment (kNm) | 110 | 50 | 185 | | Shear (kN) | 90 | 40 | 80 | | CO4 | E | 16 |
| 7. | a. | Evaluate the design strength of shear wall of length 6m and thickness of 200mm for the following data, Check the requirements of Boundary elements.  Axial load (DL+LL) – 3000kN  Bending moment (DL+LL) – 400kNm, Bending moment (EL) – 5500kNm  Base shear (EL) – 1600kN  EL – Earthquake load  Grade of concrete – M40, Grade of steel – Fe550 | CO5 | E | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Explain the types, functions, and design considerations of shear wall with neat sketches. | CO2 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the behavior of structural elements |
| CO2 | Calculate the loads acting on a RC structure according to code provisions |
| CO3 | Design the RC structures for its behavior |
| CO4 | Design and detail the structural drawings using IS codes |
| CO5 | Apply the structural systems based on the field requirement |
| CO6 | Apply suitable techniques for failure of structures |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 8 | - | - | - | - | 8 |
| CO2 | - | 20 | - | 24 | - | - | 44 |
| CO3 | - | - | - | 16 | - | - | 16 |
| CO4 | - | 24 | - | - | 16 | - | 40 |
| CO5 | - | - | - | - | 16 | - | 16 |
| CO6 | - | 8 | - | - | - | - | 8 |
|  | | | | | | | **132** |



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| **Course Code** | **22CE2002** | **Duration** | **3hrs** |
| **Course Name** | **SMART CITIES: THE FUTURE OF CITY LIFE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define securities in smart cities. | | CO1 | R | 1 |
| 2. | List any two benefits of green buildings. | | CO1 | R | 1 |
| 3. | Define smart city. | | CO1 | R | 1 |
| 4. | Identify application of sensor technology in smart cities. | | CO2 | A | 1 |
| 5. | Describe types of solar systems. | | CO3 | U | 1 |
| 6. | List any two challenges for urban poverty. | | CO5 | R | 1 |
| 7. | Define Radio Frequency Identification (RFID). | | CO2 | R | 1 |
| 8. | Identify any two characteristics of small cities. | | CO1 | R | 1 |
| 9. | Define IoT. | | CO2 | R | 1 |
| 10. | List any two Sustainable Development Goals. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain the features of green building. | | CO1 | U | 3 |
| 12. | Interpret the role of social media in smart cities. | | CO4 | U | 3 |
| 13. | Define SEWA. | | CO5 | R | 3 |
| 14. | Explain water treatment facilities using sensor technology. | | CO2 | U | 3 |
| 15. | Describe vehicle to vehicle technology. | | CO3 | U | 3 |
| 16. | List the advantages of mobile cloud computing. | | CO2 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Report any case study on smart cities in India. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the application of solar energy in smart cities. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Report recent trends on urban poverty. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Articulate sustainable development goals using a suitable diagram. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain project management framework using neat and clean diagram. | CO3 | U | 6 |
|  | b. | Illustrate disaster management cycle. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Write recent applications of computer vision in the context of smart cities. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Summarize policies in the context of smart cities. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Define the following terms in detail.   * Smart environment * Smart economy * Smart living * Smart building | CO1 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the concept of smart cities |
| CO2 | Classify the components of smart city |
| CO3 | Examine the sustainability requirements for the various components |
| CO4 | Design the systems required for smart city |
| CO5 | Apply the regulations and policies |
| CO6 | Summarize the performance of various systems |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 16 | 3 | - | - | - | - | 19 |
| CO2 | 5 | 3 | 1 | - | - | - | 9 |
| CO3 | 1 | 16 | 12 | - | - | - | 29 |
| CO4 | - | 3 | - | - | - | - | 3 |
| CO5 | 4 | - | - | - | - | - | 4 |
| CO6 | - | 24 | 36 | - | - | - | 60 |
|  | | | | | | | **124** |



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| **Course Code** | **23CE3002** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED CONCRETE TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)**  **IS 456:2000, ACI 211 and IS 10262:2019 are permitted** | | | | | |
| 1. | a. | Explain the procedure of cement manufacturing method using a detailed flowchart. | CO1 | U | 8 |
|  | b. | Discuss the Bogue’s compounds in detail. | CO1 | R | 8 |
|  |  |  |  |  |  |
| 2. | a. | Write the different tests used to examine the aggregate quality | CO1 | A | 8 |
|  | b. | List various types of admixtures and its characteristics used to modify the concrete performance | CO1 | R | 8 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the hydration process, reaction, and its effects of fresh concrete. | CO2 | U | 8 |
|  | b. | Examine the heat evolution pattern of cement in detail. | CO2 | R | 8 |
|  |  |  |  |  |  |
| 4. | a. | Describe the rheological properties of self-compacting concrete. | CO3 | R | 8 |
|  | b. | Write the steps involved in designing the concrete mix. | CO5 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Explain the hardened properties of concrete and factors affecting concrete strength. | CO3 | U | 8 |
|  | b. | Define the term shrinkage in concrete and discuss its types. | CO3 | R | 8 |
|  |  |  |  |  |  |
| 6. | a. | Summarize the procedure involved in ultra-sonic pulse velocity and rebound hammer tests used to assess the concrete performance. | CO4 | U | 8 |
|  | b. | Briefly explain the methodology used for conducting rebar bar locator and corrosion analyzer tests in off-shore structures. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 7. | a. | Design the concrete mix of grade M25 using Indian Standard Method  Specific gravity of cement – 3.12  Specific gravity of fine aggregate – 2.6  Specific gravity of coarse aggregate – 2.7  Slump – 91 mm  Use 20 mm aggregate | CO5 | An | 8 |
|  | b. | List the steps involved in designing concrete mix based on ACI 211 guidelines. | CO5 | R | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Write the ready-mix concrete production process with a flow chart describing its methodology. | CO6 | A | 10 |
|  | b. | Write short notes on special concretes and its properties used for infrastructure development. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the properties and testing procedure of concrete materials |
| CO2 | Identify suitable admixtures for concreting |
| CO3 | Determine the properties of fresh and hardened concrete |
| CO4 | Explain the field application of non-destructive testing of concrete |
| CO5 | Design concrete mix as per IS standard |
| CO6 | Describe the proportion for high performance concrete |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 16 | 8 | 8 | - | - | - | 32 |
| CO2 | 8 | 8 |  |  |  |  | 16 |
| CO3 | 16 | 8 |  |  |  |  | 24 |
| CO4 |  | 8 | 8 |  |  |  | 16 |
| CO5 | 8 |  | 8 | 8 |  |  | 24 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **23CE3005** | **Duration** | **3hrs** |
| **Course Name** | **PROJECT MANAGEMENT IN LEAN CONSTRUCTION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the principles of lean thinking in construction and discuss how identifying customer value contributes to the overall efficiency of the construction process. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the advanced lean construction tools and techniques, and how do they enhance efficiency and productivity in the construction industry. | CO5 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Write the error-proofing techniques contribute to quality control in various industries, and what are some common methods used for preventing errors. | CO5 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discover the effectiveness of incorporating energy-efficient design and construction practices in reducing the overall environmental impact of a construction project. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Discuss the diverse technological innovation employed in lean construction methodologies, examining their roles in boosting project efficiency and curbing waste within the construction sector. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Evaluate the Case study on lean construction project - The University of California, Merced. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the significant discoveries and reflections stemming from the implementation of lean construction practices, these insights provide valuable guidance for future construction endeavors to enhance the overall project outcome. | CO3 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Analyze and draw attention to the differences between lean construction techniques and the project management approaches used in standard construction procedures. Explain the benefits that come with using lean building techniques as well. | CO6 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the principles of Lean Six Sigma method in construction. | CO5 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the fundamental principles of Lean thinking in construction. |
| CO2 | Summarize the benefits of implementing Lean principles in construction project management. |
| CO3 | Identify the key components of the Last Planner System |
| CO4 | Analyze a project’s constraints and uncertainties for effective management. |
| CO5 | Evaluate the effectiveness of Lean techniques. |
| CO6 | Create a project schedule using Lean technologies. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 20 | - | - | - | - | 20 |
| CO2 | - | - | - | 20 | - | - | 20 |
| CO3 | - | 20 | - | - | 20 | - | 40 |
| CO4 | - | 20 | - | - | - | - | 20 |
| CO5 | 20 | 40 | - | - | - | - | 60 |
| CO6 | - | - | - | 20 | - | - | 20 |
|  | | | | | | | **180** |