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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## January / February 2025 Semester End Main Examinations

**Programme: B.E.** **Semester: V**

**Branch: Civil Engineering** **Duration: 3 hrs.**

**Course Code: 23CV5PEACT** **Max Marks: 100**

**Course: Advanced Concrete Technology**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of IS: 10262 – 2019 is permitted

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | **UNIT - I** | ***CO*** | ***PO*** | **Marks** |
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| 1 | a) | List the different chemical admixtures used in concrete and discuss the mechanism of action of the important chemical admixtures in modifying the fresh properties of concrete. | *CO1* | *PO 1* | **10** |
| | b) | Describe the benefits and properties of Limestone Calcined Clay Cement (LC3) | *CO1* | *PO1* | **6** |
| | c) | Discuss the role of Nano materials in improving the performance of concrete. | *CO1* | *PO1* | **4** |
| | | **OR** | | | |
| 2 | a) | Explain the interfacial transition zone (ITZ) with a sketch and how it can be strengthened by adding supplementary cementitious materials (SCMs). | *CO1* | *PO1* | **10** |
| | b) | Discuss the differences in the composition, uses, and environmental impact of OPC, blended cement, and composite cement. | *CO1* | *PO1* | **6** |
| | c) | Summarize the properties of construction demolition aggregates and their use in concrete production. | *CO1* | *PO1* | **4** |

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| | | | **UNIT - II** | | | |
| | 3 | a) | Design M40 grade Self-compacting concrete **(SCC)** mix using IS 10262-2019 guidelines for the following data.<br>Type of cement- OPC 53 grade<br>Nominal size of aggregate -20 mm<br>Exposure condition- Moderate<br>Slump – 100mm<br>Degree of site Control-Good<br>Type of aggregate- Crushed angular aggregate<br>Total Powder content-520 kg/$m^3$<br>Maximum cement content- 450 kg/$m^3$<br>Chemical admixture-PCE-based super plasticizer<br>Mineral admixture- Fly ash<br>The specific gravity of cement-3.10<br>The specific gravity of Fly ash- 2.00<br>The specific gravity of fine aggregates-2.60<br>The specific gravity of coarse aggregates- 2.65<br>The specific gravity of superplasticizer-1.05 | *CO2* | *PO3* | **12** |
| | | b) | Define High-Performance Concrete (HPC) and explain its composition. Highlight the advantages and applications of HPC in modern construction. | *CO2* | *PO1* | **8** |
| | | | **OR** | | | |
| | 4 | a) | Design M40 grade Self-compacting concrete **(SCC)** mix using IS 10262-2019 guidelines for the following data.<br>Type of cement- PPC conforming to IS 1489 (Part 1)<br>Nominal size of aggregate -20 mm<br>Exposure condition- Severe<br>Slump – 100mm<br>Degree of site Control-Good<br>Type of aggregate- Crushed sub angular aggregate<br>Total Powder content-520 kg/$m^3$<br>Maximum cement content- 450 kg/$m^3$<br>Chemical admixture-PCE-based super plasticizer<br>Mineral admixture- GGBS<br>The specific gravity of cement-3.10<br>The specific gravity of Fly ash- 2.80<br>The specific gravity of fine aggregates-2.65<br>The specific gravity of coarse aggregates- 2.70<br>The specific gravity of superplasticizer-1.10 | *CO2* | *PO3* | **12** |

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| | | b) | Summarize the evolution of different types of high-performance concrete with their relevance in modern construction industry. | *CO2* | *PO1* | **8** |
| | | | **UNIT - III** | | | |
| | 5 | a) | Discuss the materials used in Ultra High-Performance Concrete (UHPC) and their role in enhancing various properties. Explain the particle packing mechanism used in UHPC. | *CO2* | *PO1* | **10** |
| | | b) | List the different fibers used in fiber-reinforced concrete. Explain the effect of fiber addition on the fresh properties of concrete. | *CO2* | *PO1* | **10** |
| | | | **OR** | | | |
| | 6 | a) | Explain the durability characteristics of Ultra High-Performance Concrete (UHPC and its performance towards the resistance to environmental factors like chemical attacks. | *CO2* | *PO1* | **10** |
| | | b) | Discuss the applications of Ultra High-Performance Concrete (UHPC) in construction and its economic benefits, considering factors like carbon units and embodied energy. | *CO2* | *PO1* | **10** |
| | | | **UNIT - IV** | | | |
| | 7 | a) | Define Alkali-Activated Concrete (AAC). Discuss the raw materials used in the production of AAC and explain the chemical reactions involved in the activation process. | *CO2* | *PO1* | **10** |
| | | b) | Design geopolymer concrete mix by assuming the Density of geopolymer concrete is 2400kg/$m^3$.<br>The molarity of NaOH is - 12<br>The ratio of NaOH: $Na_2SiO_3$ - 1.5<br>Water content in $Na_2SiO_3$- 35%<br>Total water content – 170 l/$m^3$<br>Fly ash - 15%<br>GGBS - 5%<br>Coarse Aggregate - 60%<br>Fine aggregate - 40% | *CO2* | *PO2* | **10** |
| | | | **OR** | | | |
| | 8 | a) | Explain the properties of Alkali-Activated Concrete, including its mechanical strength, durability, and environmental benefits in comparison with Ordinary Portland Cement concrete? | *CO2* | *PO1* | **10** |
| | | b) | Design geopolymer concrete mix by assuming the Density of geopolymer concrete is 2400kg/$m^3$.<br>The molarity of NaOH is - 12<br>The ratio of NaOH: $Na_2Sio_3$ – 2.20<br>Water content in $Na_2SiO_3$- 35%<br><br>Total water content – 165 l/$m^3$<br>Fly ash - 14%<br>GGBS - 6%<br>Coarse Aggregate - 55%<br>Fine aggregate - 45% | *CO2* | *PO2* | **10** |

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| | | | **UNIT - V** | | | |
| | 9 | a) | Define the term "rheology" in the context of concrete. Discuss the key factors affecting the rheology of fresh concrete, including materials and environmental conditions. | *CO2* | *PO1* | **10** |
| | | b) | Explain the rheological behavior of 3D printable concrete and the key challenges and considerations in achieving proper rheology for 3D printing applications? | *CO2* | *PO1* | **10** |
| | | | **OR** | | | |
| | 10 | a) | Explain the factors affecting the rheology of fresh concrete. | *CO2* | *PO1* | **10** |
| | | b) | List and explain the different types of rheometers used to measure the rheological properties of fresh concrete. | *CO2* | *PO1* | **10** |

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