JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATION- 2025
Ph.D.-1st Semester (Civil Engineering)

COURSE CODE (CREDITS): 18P1WGE101 (3) MAX. MARKS: 25

COURSE NAME: Research Methodologies Incl Quantitative Metds & Comp Appls

COURSE INSTRUCTORS: Dr. KAUSHAL KUMAR MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*
(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems. (c) Scientific Calculator is allowed.

Q.No	Question	CO	Marks
Q1	Using ***Bogue's equations***, calculate the percentage of **C_3S, C_2S, C_3A, and C_4AF** for a cement sample whose oxide composition is: CaO = 64%, SiO_2 = 21%, Al_2O_3 = 5%, Fe_2O_3 = 4%, SO_3 = 2%. Interpret the type of cement based on the result.		4
Q2	Give a detailed explanation of Alkali-Silica Reaction (ASR) and Alkali-Carbonate reaction, including reactive minerals, chemical reactions, damage mechanism, and methods to identify and prevent these reactions in concrete structures.		4
Q3	Discuss how Fly Ash, GGBS, Silica Fume, and Metakaolin contribute to concrete performance in terms of pozzolanic reactivity, microstructure refinement, strength development, and durability improvements.		3
Q4	Fresh concrete undergoes phenomena such as segregation, bleeding, and plastic shrinkage. Explain the mechanisms behind these phenomena and discuss methods for minimizing each in practice.		3
Q5	Explain the formation and significance of the interfacial transition zone in hardened concrete and discuss how it influences strength, stiffness, and durability.		4
Q6	Describe the mechanisms of alkali–silica reaction and alkali–carbonate reaction, comparing their causes, expansion mechanisms, and preventive strategies		3
Q7	Describe the mechanism of sulphate attack on concrete, including chemical reactions involving gypsum, ettringite, and magnesium sulfate, and explain the resulting deterioration and preventive measures.		4