JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3EXAMINATION- 2025

M.Tech-I Semester (CE)

COURSE CODE (CREDITS):3 MAX. MARKS: 35

COURSE NAME: Construction Techniques(10M11CE111)

COURSE INSTRUCTORS: Prof. Ashok Kumar Gupta MAX. TIME: 2 Hours

*Note:(a)Questions number 1 is compulsory and attempt any 6 questions from Q2.to Q8.*

*(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems. Calculator is allowed.*

| Q.No | Question | Marks |
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| Q1 | **Answer the following objectives questions with proper justification.**<br>1. **What is the minimum subgrade CBR required for flexible pavements on low-volume rural roads as per IRC-SP-72-2015?**<br>a) 2%<br>b) 4%<br>c) 5%<br>d) 3%<br>2. **For flexible pavement design, the minimum thickness of the base course for ESAL applications between 100,000 and 10,00,000 is:**<br>a) 150 mm<br>b) 225 mm<br>c) 250 mm<br>d) 300 mm<br>3. **According to the guidelines, what is the required CBR value for a Gravel Subbase used in pavement construction?**<br>a) 15%<br>b) 10%<br>c) 20%<br>d) 25%<br>4. **How often should moisture content and in-situ density measurements be tested during the construction of subgrade layers?**<br>a) Twice a week<br>b) Once a day<br>c) At least 3 tests daily<br>d) Once every 2 days<br>5. **The Serviceability Rating System (SRS) in the IRC guidelines for rural roads is based on:** | 5 |

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| | a) Maximum Traffic Load<br>b) Pavement Thickness<br>c) Terminal Serviceability Index (TSI)<br>d) Pavement Material Strength<br>6. **For low volume rural roads, if the subgrade CBR value is 6%, and the traffic load exceeds 2 MSA, which material should be used for the base course to minimize cost while ensuring durability?**<br>a) Gravel<br>b) Cement Stabilized Base<br>c) Soil Stabilized with Lime<br>d) Fly Ash Stabilized Soil<br>7. **Which of the following is a key advantage of Lift-up Slab Construction in high-rise buildings?**<br>a) Requires fewer workers<br>b) Reduces overall construction time<br>c) Requires no crane or heavy machinery<br>d) Increases overall material costs<br>8. **What is the primary benefit of using lime stabilization in expansive soil?**<br>a) It improves soil's resistance to freeze-thaw cycles<br>b) It reduces the plasticity index and swelling potential<br>c) It increases the water-holding capacity of soil<br>d) It improves the density of the soil<br>9. **In brick masonry construction, what is the main purpose of using snap headers?**<br>a) To create stronger vertical alignment in walls<br>b) To provide a decorative finish to the wall surface<br>c) To create a structural bond at the end of the brick wall<br>d) To allow easy passage for electrical conduits<br>10. **When using trench fill foundations, which of the following is most critical to ensure the foundation's stability?**<br>a) The width of the trench must be wider than the foundation base<br>b) The trench should be excavated with a uniform depth and level across the length<br>c) The concrete filling should be poured in layers to avoid air pockets<br>d) The trench should be reinforced with steel mesh. | |
| Q2 | You are tasked with calculating the amount of mortar required for a one-brick thick wall (215 mm thick) constructed using English Bond. Given the following: | 5 |

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| | • The wall's total length is 12 meters and height is 3 meters.<br>• Each brick has a nominal size of 215 × 102.5 × 65 mm (working dimensions).<br>• The mortar joint thickness is 10 mm.<br>Calculate the amount of mortar used. | |
| Q3 | Consider a construction project where cost-effectiveness and time-saving are essential. Discuss the use of Lift-up Slab construction technique in such a scenario.<br>• Describe the Lift-up Slab method, its advantages in terms of reducing construction time and labor costs.<br>• How can this technique contribute to the overall sustainability of the construction process, particularly in areas with limited labor resources or harsh weather conditions?<br>Identify the challenges faced while using this method and propose mitigation strategies | 5 |
| Q4 | Given an expansive soil with a high Free Swell Index (FSI) of 70%, you are required to stabilize it using a combination of 20% pond ash and 4% lime kiln dust (LKD).<br>• Determine the expected improvement in the soil's Unconfined Compressive Strength (UCS) and the California Bearing Ratio (CBR).<br>• What challenges might arise when using this mixture for subgrade stabilization in an area with high moisture fluctuations?<br>• How would you adjust the mix if the soil contains more than 25% silt content? | 5 |
| Q5 | In the construction of a subgrade layer, you are tasked with using an expansive soil (plasticity index > 30) from the field that shows significant moisture variation. The moisture content in the soil ranges between 12% to 20%. Using the specified guidelines, propose a stabilization method for the soil to prevent shrinkage and swelling.<br>• Calculate the required field compaction and moisture levels to be achieved.<br>• What quality control tests will you apply during construction to ensure the subgrade layer meets the required specifications?<br>• How would you modify the subgrade compaction if the moisture content exceeds the optimum moisture content by 2%? | 5 |
| Q6 | A project requires stabilization of expansive soil with a high Free Swell Index (FSI) of 60%. You are provided with pond ash (PA) and lime kiln dust (LKD). Based on the study, mix 10% PA and 6% LKD. Predict the potential | 5 |

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| | improvements in the Unconfined Compressive Strength (UCS) and California Bearing Ratio (CBR) based on the mixture. Discuss the expected synergistic effect and its applicability to improve subgrade performance for low-volume road construction. | |
| Q7 | Evaluate the impact of innovative cost-effective construction techniques (such as modular construction, 3D printing, and prefabrication) on the overall lifecycle cost, sustainability, and project delivery time in comparison to traditional construction methods. Discuss the challenges and opportunities in integrating these techniques into large-scale construction projects." | 5 |
| Q8 | You are tasked with designing a flexible pavement for a rural road with an ESAL traffic load of 600,000 over its 10-year life. The subgrade has a CBR of 4%. Using the IRC-SP-72-2015 guidelines, calculate the minimum required base and sub-base thicknesses for this pavement. Justify your approach based on the design catalogue and provide the recommended solutions for this traffic category. | 5 |