Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester M.Tech Degree Regular and Supplementary Examination December 2023 (2022 Scheme)

Discipline: CIVIL ENGINEERING

Course Code & Name: 221TCE010 - ANALYSIS AND DESIGN OF PAVEMENT SYSTEMS

(Relevant IRC codes/charts are permitted)

Max. Marks: 60   Duration: 2.5 Hours

PART A

Answer all questions. Each question carries 5 marks   Marks

1   With the aid of a neat sketch, explain the component layers and their functions for flexible pavement.   (5)

2   What are the assumptions in Burmister's theory? What are the advantages of Burmister's theory over Boussinesq's?   (5)

3   Describe how the modulus of the subgrade reaction of soil is determined through a plate load test.   (5)

4   State the concept and assumptions made in Westergaard's analysis for rigid pavement design.   (5)

5   Explain how the dimensions and spacing of Tie bars are designed.   (5)

PART B

Answer any 5 questions. Each question carries 7 marks

6

(a) Explain the significance of the following for the design of pavement (i) Traffic growth rate (ii) Lane distribution factor (iii) Vehicle damage factor.   (3)

(b) List any four benefits of pavement design based on the M-E method.   (2)

(b) Explain the main features of mix design by Superpave technology   (2)

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(a) Determine the required thickness of an airfield flexible pavement based on Burmister's theory using the following plate load test data and other parameters. The diameter of the plate used was 75 cm. Pressure observed at 1.25 mm deflection when plate load test is conducted on subgrade is 0.82 kg/cm². Pressure observed at 1.25 mm deflection when plate load test was conducted on the base course, 16 cm thick is 2.1 kg/cm². The design wheel load is 23000 kg, tire pressure is 15 kg/cm². Allowable deflection 1.25 mm.   (5)

(b) A circular load of radius 15 cm with a uniform contact pressure of 7.0

kg/cm2 is applied on the surface of a homogeneous elastic mass. Determine the vertical stress under the centre of the load at a depth of 45 cm from the surface. (2)

8   (a) List out any six benefits of pavement design based on the MEPD method. (3)

(b) The CBR value of subgrade soil is 4%. The different pavement materials available near the construction site include sandy soil with CBR 10%, Poorly graded gravel with CBR 25%, Broken stone with CBR 90%, and Bituminous concrete surfacing a minimum of 5 cm thick. Design the pavement structure for 1500 cvpd with a 7.5% growth rate. (4)

9   (a) Calculate the stresses at the interior, edge, and corner regions of a cement concrete pavement using Westergaard's stress equation with the following data. Wheel load (P) = 5100 Kg, Modulus of elasticity of cement concrete (E) = 3×10^5 Kg/cm^2 Pavement thickness h = 18 cm, modulus of subgrade reaction K = 6.0 Kg/cm^3 radius of the contact area is 15 cm and Poisson's ratio = 0.15. Also, determine the probable location where the crack is likely to develop due to corner loading. (5)

(b) Outline the principle of rigid pavement design using the stress equation. (2)

10   (a) Describe the different steps used for the design of dowel bars as per IRC? (5)

(b) What are the functions of joints in CC pavement (2)

11   Describe with a neat sketch the Longitudinal joints and any two types of transverse joints (7)

12   (a) What are the various factors affecting the design of highway pavements? (5)

(b) What are the limitations of Boussinesq's theory? (2)

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