APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

Q. P. Code: TE0821103-I (Pages: 3)

Name: .....

Reg. No: .....

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DECEMBER 2021

Branch: Civil Engineering **Specialization: Transportation Engineering**

08CE6203 PAVEMENT ANALYSIS AND DESIGN

(Common to TE)

Time: 3 hours **Max. Marks: 60**

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.
(IRC Codes, Charts and Tables can be used wherever necessary.)

Q. No.	Module 1	Marks
1.a	What is the role of admixtures in pavement quality concrete?	3
	Answer b or c	
b	Explain Marshal Stability test method of mix design for bituminous mixes. Plot the sample graphs to determine optimum binder content. List out the standard specifications.	6
c	Describe any two tests on bitumen with the corresponding standard specifications.	6

Q. No.	Module 2	Marks
2.a	Differentiate between highway and airport pavements.	3
	Answer b or c	
b	With a neat sketch explain the functions of different layers of a flexible and rigid pavement.	6
c	Explain how climatic variation affects pavement design and performance.	6

Q. No.	Module 3	Marks
3.a	Write a note on stress inducing factors in flexible pavements.	3

Answer b or c

b	Determine the deflection values under a wheel load of 60 KN and contact pressure of 0.7 N/mm^2 in a homogeneous mass of soil at a depth of z=2.5 a upto a radial distance of r= 4a. Take the modulus of elasticity of subgrade as $8N/mm^2$. Sketch the deflection curve.	6
c	A full depth asphalt pavement is 28. 75 inches thick with an E= 200,000 psi. It rests directly over a sub grade having an E= 10,000 psi. Through the use of 3 layer theory, compute the horizontal tensile strain at the bottom of the asphalt concrete layer and the vertical compressive strain at the top of the sub grade layer for a pre load of 40,000 pounds, 150 psi pressure.	6

Q. No.	**Module 4**	**Marks**
4.a	What are the different approaches in Flexible Pavement Design? Bring out salient features of each approach.	3

Answer b or c

b	A particular highway section requires a new pavement. The design period for the highway is 20 years. Due to uncertainty in traffic growth along the highway corridor, a 2 stage construction was planned with each stage being 10 years long. A pavement structure consisting of a HMA layer over a 12 inch untreated aggregate base was chosen for the highway. The resilient modulus at the construction site is 10000 psi. A traffic surveyed showed that the annual average daily truck traffic in the highway is currently 200 with an average truck factor of 2. The survey also found that the traffic is equally distributed in both directions and the design lane carried 60% of the total traffic in each direction. Assuming a traffic growth rate of 5% per annum and a limiting damage ratio of 0.6 at the end of the first stage, determine the thickness of HMA layer to be placed in each stage. (Assume a surface course of 2 inch thickness.)	6
c	Explain in detail the AASHTO design procedure of flexible pavement design	6

Q. No.	**Module 5**	**Marks**
5.a	Discuss about the critical stresses and their combinations in concrete pavements.	4

Answer b or c

b	Explain in detail the PCA method of rigid pavement design	8

c	A 6m x 4m slab is experiencing a thermal gradient of 0.5 °C/ cm over a thickness of 20 cm. Determine the curling stress along the length of the slab at (i) The center of the slab (ii) The mid span of the long edges of the slab.	8

Q. No.	Module 6	Marks
6.a	Write the function of providing dowel bars and tie bars in Cement concrete pavement.	4
	Answer b or c	
b	Explain in detail the procedure for the design of tie bars in the cement concrete pavements	8
c	Design a dowel bar system for a cement concrete slab for the following conditions. Design wheel load is 4100 kg, 40% load transfer, slab thickness of 20cm, with a joint width of 2 cm. Permissible flexural stress in dowel bar is 1400kg/cm^2 Permissible shear stress in dowel bar=1000 kg/cm^2 Permissible bearing stress in concrete= 100 kg/cm^2 K value of subgrade=100 kg/cm^3, E= 3x10^5 kg/cm^2, μ=0.15.	8