APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

Q. P. code :TC1172 **(pages: 3)** **Name:**

Reg No:

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2017
Civil (Transportation Engineering)

08CE6203 **PAVEMENT ANALYSIS AND DESIGN**

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

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

(Charts and tables can be used wherever necessary.)

Q.no.	Module 1	Marks
1.a	Explain Dynamic modulus and flow number of bituminous mixes.	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	Discuss the properties and tests on pavement quality concrete.	6

Q.no.	Module 2	Marks
2.a	Differentiate between highway and airport pavements.	3
	Answer b or c	
b	What are the various factors affecting the design of highway pavements. Explain in detail the effect of traffic.	6
c	Calculate the design volume for a particular highway section if the design period is 20 years. The current AADT is 5000 vehicle/ day, the average truck factor is 1.9, the directional distribution factor is 0.6, the lane distribution factor is 0.8 and the traffic is expected to grow at 5 % per annum for the first 10 years, 6% per annum for the next 7 years and 8% per annum for the rest of the design period.	6

Q.no.	Module 3	Marks
3.a	What are the assumptions in Burmister's theory? What are the advantages of Burmister's theory over Boussinesq's?	3
	Answer b or c	
b	Determine the thickness of a flexible pavement by Burmister's two layer theory for a wheel load of 40 KN and a tyre pressure of 0.5 MN/ m^2. The modulus of elasticity of the pavement material is 120 MN/ m^2 and the sub grade is 12 MN/m^2. The value of Fw for E1/E2 of 10 can be taken as under:	6

Thickness of the top layer	Fw
0.5a	0.8
1a	0.5
2a	0.3

The allowable deflection is 0.5cm.

c	A pavement structure is comprised of the following layers – 5.75 inch asphalt concrete surface E= 400,000 psi, 23 inches of granular base, E = 20,000 psi and a sub grad having an E= 10,000psi. All layers are assumed to have μ=0.5. Calibrate the horizontal tensile strain at the bottom of Asphalt concrete layer and the vertical compressive strain at the top of the sub grade layer under the centerline of a 40,000 pound wheel load, 150 psi pressure.	6

Q.no.	Module 4	Marks
4.a	Discuss the similarities and the differences between the Asphalt Institute and IRC method of flexible payment design.	3
	Answer b or c	
b	Explain in detail the AASHTO design procedure of flexible pavement design.	6
C	A stage construction is planned for a full depth asphalt pavement with a sub grade resilient modulus of 5000 psi. The design period is 30 years and is divided into 3 stages. The first 5 years, the middle 10 and last 15 years. The first 5 years traffic on the design lane is 20,000 equivalent 18 kip. Single-axle load applications and the annual growth rate is 3.5%. If the damage ratios at the end of each stage are 0.5, 0.75 and 1 respectively, determine the thickness of HMA to be placed at each stage by AI method.	6

Q.no.	Module 5	Marks
5.a	Compare the mechanism used in rigid and flexible pavements for handling stresses due to decrease in temperature.	4
	Answer b or c	
b	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
c	Design a suitable concrete pavement (4.5x 3.5cm) as per IRC, situated at Kanpur, for design wheel load of 4100 kg and tyre pressure of 7 kg/cm2. The CBR value of the sub grade soil is found to be 4. 5%. The forecasted traffic intensity at the end of design life is 1000 CV/ day. Assume other parameters wherever necessary.	8

Q.no.	Module 6	Marks
6.a	Discuss the similarities and differences in the process of designing jointed plain concrete pavements and jointed reinforced concrete pavements as per PCA design method.	4
	Answer b or c	
b	Explain the need and requirements of joints in cement concrete pavements. What are the various types of joints? Explain the need of spacing in concrete pavements.	8
c	(i) Explain the procedure for the design of tie bars in the cement concrete pavements (ii) Design a tie bar system for a cement concrete pavement. Slab thickness is 20mm, slab width is 3.35m No.of lanes to be tied is 2, and coefficient of friction between slab and subgrade is 1.5 , weight of slab is 80kg/m2, allowable working stress in steel is 1400kg/cm2. Maximum permissible bond stress in plain bars is 17.5 kg/cm2 and deformed bars is 24 kg/cm2.	8