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Eighth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Pavement Design

Time: 3 hrs.

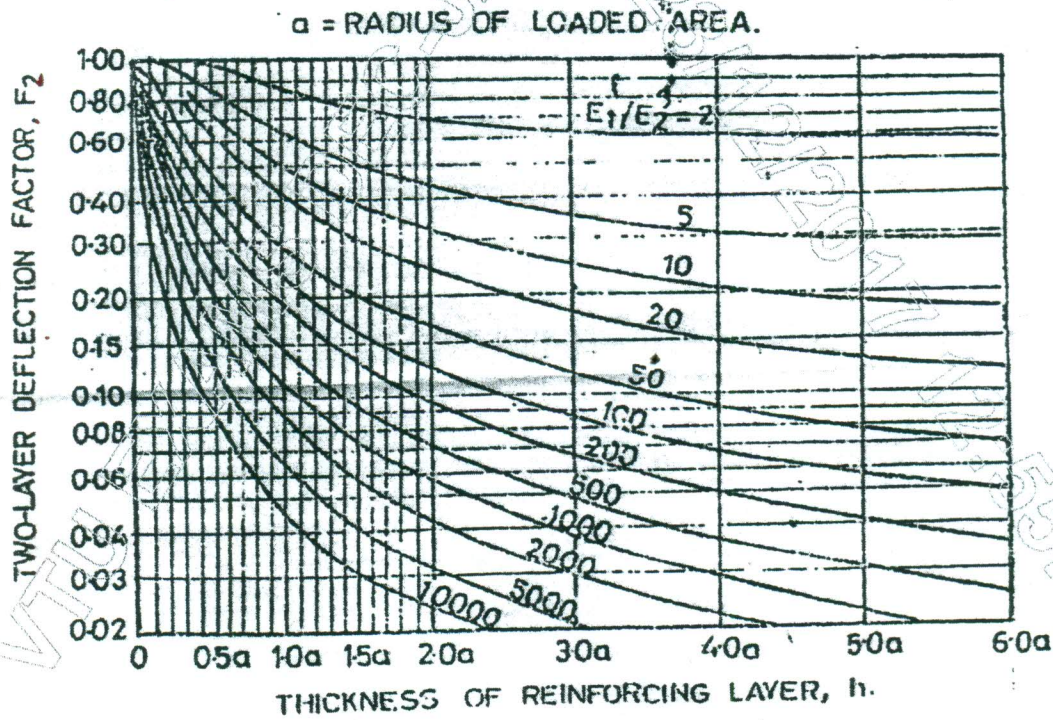
Max. Marks:100

Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.
2. Use of Charts is permitted.

PART - A

1.
 - a. Describe the desirable characteristics of pavements. (06 Marks)
 - b. Explain the three important design strategies of pavements. (06 Marks)
 - c. Bringout a comparison between the important characteristics of flexible and rigid pavements. (08 Marks)

2.
 - a. What is frost action? What are its effects and remedial measures? (06 Marks)
 - b. List the principles, assumptions and limitations of Boussinesq's theory. (06 Marks)
 - c. A plate load test was carried out on subgrade using 300 mm dia plate and corresponding to deflection of 5 mm, the load sustained on the plate per unit area was 0.8 N/mm². The test was repeated on base course of thickness 300 mm and unit load sustained was 0.45 N/mm² at the same deflection. [Use chart Fig.Q2(c)]
 - i) Find the EP/ES ratio.
 - ii) What should be the thickness of base course so as to sustain wheel load of 50 kN and contact pressure of 0.6 N/mm² so that maximum deflection does not exceed 5 mm?



DEFLECTION FACTORS BY BURMISTER TWO-LAYER THEORY.

Fig.Q2(c)

(08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



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- 3 a. Describe the significance of wheel load and tyre pressure in pavement design. (06 Marks)
b. Explain the step by step procedure of determining ESWL by equivalent deflection criteria. (06 Marks)
c. Calculate the design repetitions for 20 years period for various wheel loads equivalent to 22.68 kN wheel load using the following survey data on a four lane road. (08 Marks)

Wheel load, kN	ADT, both directions	% of traffic volume
22.68	Traffic volume	13.17
27.22	considering	15.30
31.75	growth = 215	11.36
36.29		14.11
40.82		6.21
45.36		5.84

- 4 a. Explain the principle and design steps of McLeod method of pavement design. (08 Marks)
b. Design a flexible pavement consisting of 80 mm thick bituminous surface with 100 N/mm^2 , WBM base coarse of E value 40 N/mm^2 and 200 mm moorum subbase coarse with E value 20 N/mm^2 by Kansas method using the following data:
Design wheel load = 60 kN
 $P = 0.7 \text{ N/mm}^2$
E value of subgrade = 9 N/mm^2
Traffic coefficient = $11/6$
Rainfall coefficient = 0.9 (12 Marks)

PART - B

- 5 a. With a sketch, explain how warping stresses are developed in CC pavements. Indicate the Bradbury's equations used to determine warping stresses at the three critical locations. (08 Marks)
b. A CC pavement of 200 mm thickness has longitudinal joint at 3.5 m and transverse joint at 4.5 m spacing. Modulus of subgrade reaction is 0.1 N/mm^3 and modulus of elasticity of CC is $3 \times 10^4 \text{ N/mm}^2$. Find the wheel load stresses at interior edge and corner regions of the slab due to wheel load of 51 kN with radius of contact area 150 mm. Also find the location of crack development. Use Westergaard's equations. (12 Marks)
- 6 a. What are the uses of tie bars in cc pavements? Indicate the steps in design of tie bars. (08 Marks)
b. The design thickness of a cc pavement is 260 mm considering a design axel load (98th percentile load) of 120 kN on single axel and M40 concrete with characteristic compressive strength of 40 N/mm^2 . The radius of relative stiffness is found to be 622 mm. If the elastic modulus of dowel bar steel is $2 \times 10^5 \text{ N/mm}^2$, modulus of dowel concrete interaction is 415 N/mm^3 and joint width is 18 mm, design the dowel bars for 40% load transfer considering edge loading. (12 Marks)
- 7 a. Describe the general causes of flexible pavement failures. (06 Marks)
b. Explain the following: i) Alligator cracking; ii) Reflection cracking. (06 Marks)
c. Describe the step by step procedure of conducting Benkelman beam deflection studies for structural evaluation of flexible pavement and subsequent determination of overlay thickness. (08 Marks)
- 8 a. Explain the causes and maintenance of the following in rigid pavements:
i) Cracks ii) Joints (08 Marks)
b. Explain the common types of failure in rigid pavements. (12 Marks)