CBCS SCHEME

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15CV833

Eighth Semester B.E. Degree Examination, June/July 2019
Pavement Design

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data, if any may be assumed.
3. Use of relevant charts is permitted.

Module-1

1 a. Draw neat sketch of cross section of a flexible pavement and describe the functions of each layer. **(08 Marks)**

b. Determine the deflection values under a wheel load of 60kN and contact pressure 0.7 N/mm^2 in a homogeneous mass of soil at a depth of Z = 2.5a upto a radial distance of r = 5a. Take modulus of elasticity of subgrade as 8 N/mm^2. Sketch the deflection curve. Use Fig.Q.1(b). **(08 Marks)**

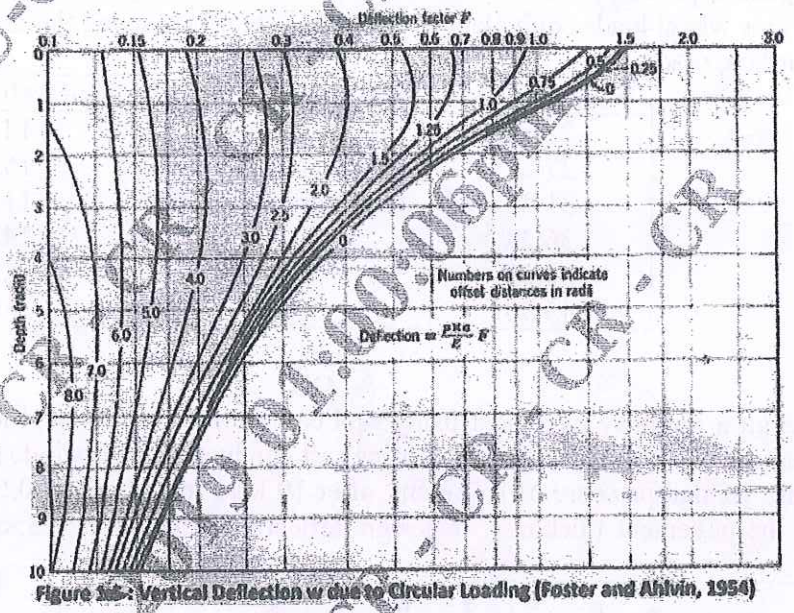

Figure 3.6: Vertical Deflection w due to Circular Loading (Foster and Ahlvin, 1954)

Fig.Q.1(b)

OR

2 a. Compare the salient features of flexible and rigid pavements. **(08 Marks)**

b. A plate load test was carried out on subgrade using 300mm diameter plate and corresponding to a deflection of 5mm, the load sustained on the plate per unit area was 0.08 N/mm^2. The test was repeated on base course of thickness 300mm and unit load sustained was 0.45 N/mm^2 at the same deflection. Find:

i) Elastic modulus of subgrade and the ratio EP/ES.

ii) What should be the thickness of base course as to sustain wheel load of 50kN and contact pressure 0.6 N/mm^2 so that maximum deflection does not exceed 5mm. Use Fig.Q.2(b). **(08 Marks)**

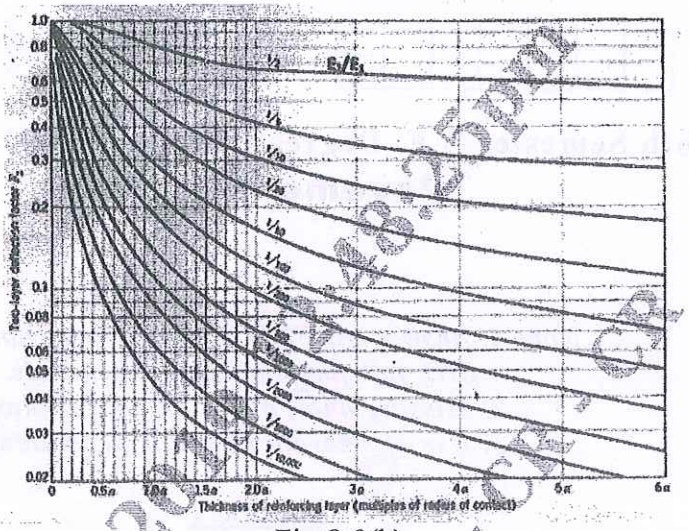

Fig.Q.2(b)

Module-2

3 a. Explain what is trust action. What are the factors affecting frost action and what are the remedial measures? **(08 Marks)**

b. Explain Equivalent Wheel factor (EWL). Calculate design repetitions for 20 years period for various wheel loads equivalent to 22.68kN wheel load using the following survey data on a four lane road. **(08 Marks)**

Wheel load, kN	AOT, both directions	% of traffic volume
22.68	Total volume of	13.17
27.22	traffic consisting of	15.30
31.75	traffic growth = 21.5	11.36
36.29		14.11
40.82		6.21
45.36		5.84

OR

4 a. Design a highway pavement using McLeod method for a wheel load of 5100 kg with tyre pressure 6.5 kg/km^2. The plate bearing test conducted on subgrade soil using 30cm diameter. Plate yielded pressure of 2.5kg/cm^2 after 10 load repetitions at 0.5cm deflection. What will be the pavement thickness, if design deflection is taken as 0.35cm? Use Fig.Q.4a(i) and Fig.Q.4a(ii).

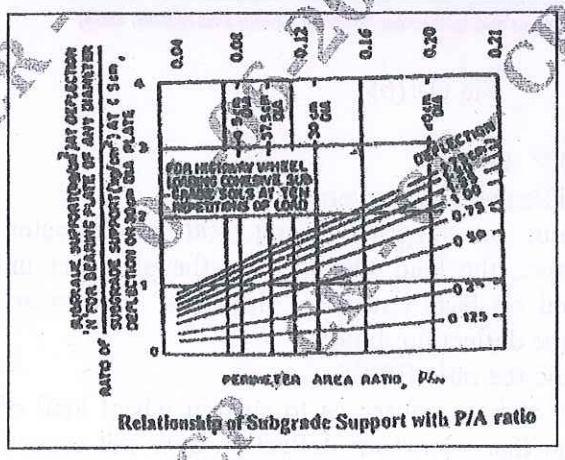

Fig.Q.4a(ii)

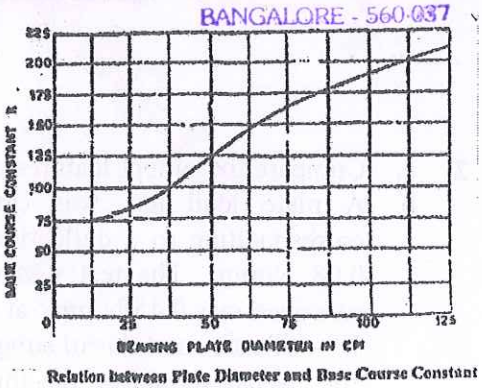

Fig.Q.4a(i)

b. Design the pavement by triaxial method using the following data:
Wheel load = 51 kN, radius of contact area = 150 mm
Traffic coefficient = 1.5,
Rainfall coefficient = 0.9
Design deflection = 2.5mm
E of subgrade = 10 N/mm^2
E of base course = 40 N/mm^2
E of 75mm thick bituminous concrete surface = 100 N/mm^2. **(08 Marks)**

Module-3

5 a. List the general causes of flexible pavement failures and describe the failures in sub base and base courses. **(08 Marks)**

b. Explain the step by step procedure of conducting Benkleman Beam deflection studies for evaluation of flexible pavement surface condition. **(08 Marks)**

OR

6 a. Briefly explain the typical types of flexible pavement failures. **(08 Marks)**

b. Existing black top pavement was tested using Benkleman beam. The observations recorded at a pavement temperature of 43°C are given below. Compute the thickness of bituminous concrete overlay taking allowable deflection as 1.25mm, factor of subgrade moisture as content as 2 and accuracy 84%.
1.46, 1.52, 1.56, 1.76, 1.96, 1.74, 1.68, 1.74, 1.96, 1.42, 1.56, 1.62mm. **(08 Marks)**

Module-4

7 a. As per IRC 58-2002, explain the procedure of design of rigid pavements. **(08 Marks)**

b. Calculate the wheel load stresses at edge and corner regions of a CC pavement using modified equations and the following data: wheel load = 51 kN $E = 3 \times 10^4$ N/mm^2 $\mu = 0.15$ pavement thickness = 180mm, radius of contact area = 150mm and modulus of subgrade reaction = 0.06 N/mm^3. **(08 Marks)**

OR

8 a. Explain, how warping stresses are formed in cc pavements. Describe the Bradbury's equations to calculate warping stresses at critical locations. **(08 Marks)**

b. The design thickness of a CC pavement is 26cm, considering a design axel load (98th percentile load) of 12000 kg on single axel and M40 concrete with characteristic compressive strength of 400 kg/cm^2, radius of relative stiffness 62.2 cm, elastic modulus of dowel / steel 2×10^6 kg/cm^2, modulus of dowel concrete interaction 41500 kg/cm^3 and joint width 1.8cm, design the dowel bars for 40% load transfer considering edge loading. Take diameter of dowel bar = 3cm, spacing = 25cm. **(08 Marks)**

Module-5

9 a. What are the factors considered in design of rigid pavements? Explain any three factors. **(08 Marks)**

b. List the typical failures in rigid pavements and explain any three of them. **(08 Marks)**

OR

10 a. With sketches, describe the various types of joints and their requirements, in rigid pavements. **(08 Marks)**

b. Determine spacing between contraction joints for a 3.5m slab width having thickness of 200mm, friction 1.5, for the following two conditions:
i) Planche cement concrete, allowable Sc = 0.08 N/mm^2
ii) Reinforced cement concrete, 10mm diameter bars at 0.3m spacing. **(08 Marks)**

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