CBCS SCHEME

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17CV833

Eighth Semester B.E. Degree Examination, July/August 2022
Pavement Design

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Missing data if any may be assumed suitably.*
3. *Use of IRC37-2001 and IRC58-2002 is permitted.*
4. *Use of relevant chart is permitted.*

Module-1

1 a. What is Pavement? Describe the desirable characteristics of Pavement. **(07 Marks)**
b. Differentiate between Flexible Pavement and Rigid Pavement. **(07 Marks)**
c. Explain briefly the functions of different components of Pavement. **(06 Marks)**

OR

2 a. Explain Boussinesq's theory with assumptions and limitations. **(08 Marks)**
b. Differentiate between Highway Pavement and Airfield Pavement. **(04 Marks)**
c. Plate bearing tests were conducted using 30 cm diameter plate on soil subgrade and over a base course of thickness 45 cm. The pressure yielded at 0.5 cm deflection on the subgrade and base course were 1.25 kg/cm^2 and 10 kg/cm^2 respectively.
Design the thickness requirements of flexible pavement for a wheel load of 5100 kg with tyre pressure of 7 kg/cm^2 for an allowable deflection of 0.5 cm using Burmister's two layer deflection factor chart. Use Fig. Q2 (c). **(08 Marks)**

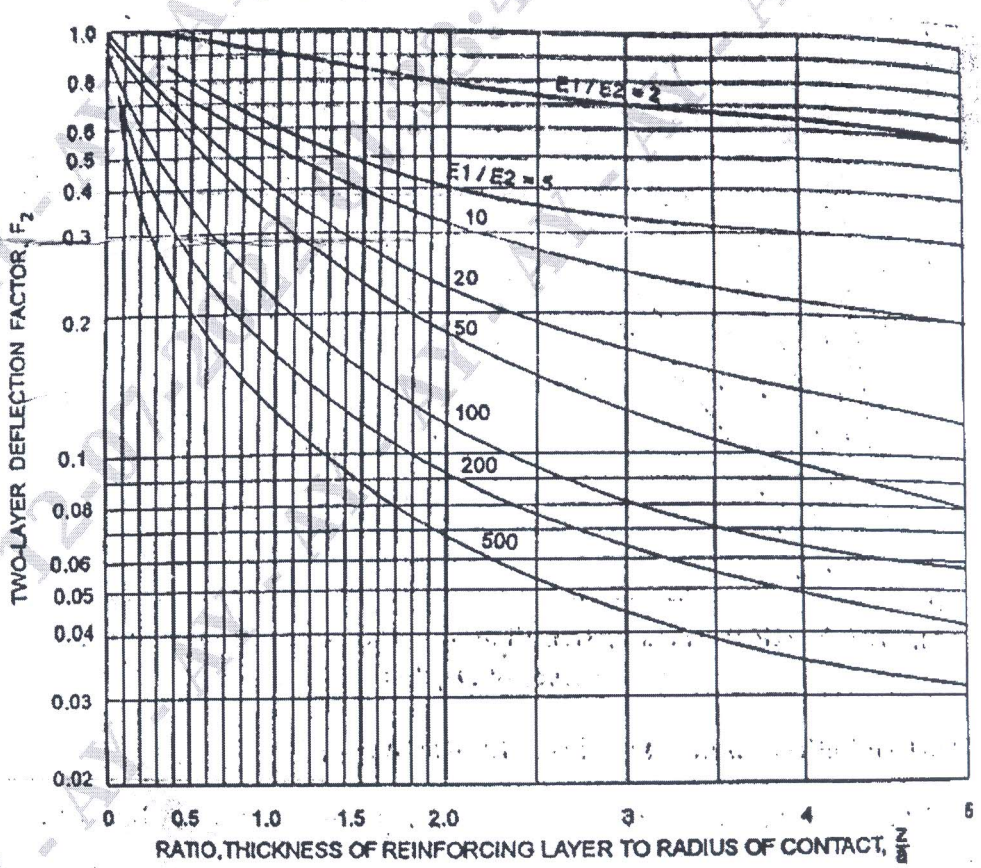

Fig. Q2 (c)

Module-2

3 a. Explain briefly Frost action. **(04 Marks)**

b. Calculate ESWL of a dual wheel assembly carrying 2044 kg each for pavement thickness of 15, 20 and 25 cms. Centre to Centre tyre spacing = 27 cm and distance between the walls of the tyres = 11 cm. **(08 Marks)**

c. Calculate design repetitions for 20 years period for various wheel loads equivalent to 2268 kg wheel load using the following traffic survey data on a four lane road.

Wheel load kg	Average Daily Traffic (both directions)	Percentage of Total traffic volume
2268	Total volume (Considering traffic growth) 215	13.17
2722		15.30
3175		11.76
3629		14.11
4082		6.21
4536		5.84

(08 Marks)

OR

4 a. Design the pavement section by traiaxial method using the following data:
Wheel load = 4100 kg
Radius of contact area = 15 cm
Traffic co-efficient, X = 1.5
Rainfall co-efficient, Y = 0.9
Design deflection, $\Delta = 0.25$ cm
E-value of subgrade soil $E_S = 100$ kg/cm^2
E-value of base course material $E_b = 400$ kg/cm^2
E-value of 7.5 cm thick bituminous concrete surface course = 1000 kg/cm^2. **(10 Marks)**

b. Design the pavement for construction of a new bypass with the following data:
(i) Two lane single carriage way.
(ii) Initial traffic in the year of completion of construction = 400 CVPD (sum of both directions)
(iii) Traffic growth rate per annum = 7.5%
(iv) Design life = 15 years.
(v) Vehicle damage factor (based on axle load survey) = 2.5 (Standard axles per commercial vehicle)
(vi) Design CBR of subgrade soil = 4%. **(10 Marks)**

Module-3

5 a. Explain briefly different types of flexible Pavement failures. **(06 Marks)**

b. List and explain different types of Highway Maintenance works. **(06 Marks)**

c. Explain briefly the Functional evaluation of flexible pavement by visual inspection and unevenness measurements. **(08 Marks)**

OR

6 Write short notes on:

a. Falling weight deflectometer (FWD) method. **(06 Marks)**

b. Ground Penetrating Radar (GPR) method. **(06 Marks)**

c. Benkleman Beam Deflection (BBD) method. **(08 Marks)**

Module-4

7 a. Explain Westergaard's Analysis of stresses in rigid pavements with assumptions and equations. **(08 Marks)**

b. Using the data given below, calculate the wheel load stresses at,
(i) interior (ii) edge and (iii) Corner regions of a cement concrete pavement using Westergaard's stress equations. Also determine the probable location where the crack is likely to develop due to corner loading.
Wheel load I = 5100 kg ;
Modulus of Elasticity of cement concrete, $E = 3.0 \times 10^5$ kg/cm^2
Pavement thickness h = 18 cm
Poisson's ratio of concrete $\mu = 0.15$
Modulus of subgrade reaction K = 6.0 kg/cm^2
Radius of contact area, a = 15 cm **(12 Marks)**

OR

8 a. Explain the procedure for design of rigid pavements as per IRC 58-2002. **(10 Marks)**

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

Module-5

9 a. List the typical failures in rigid pavement. Explain any two of them with neat figures. **(10 Marks)**

b. Explain briefly the different types of joints in CC pavements with neat sketches. **(10 Marks)**

OR

10 a. Write short notes on:
(i) Desirable properties of subgrade. **(05 Marks)**
(ii) Requirements of joints. **(05 Marks)**

b. Determine the spacing between the contraction joints for 3.5 m slab width having thickness of 20 cm and friction co-efficient = 1.5 for the following two cases:
(i) For plain cement concrete, allowable stress in tension = 0.8 kg/cm^2.
(ii) For reinforced cement concrete, 1 cm dia bars at 0.3 m spacing. **(10 Marks)**

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