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10CV833

Eighth Semester B.E. Degree Examination, Jan./Feb. 2021

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 specified charts and tables is permitted.

PART – A

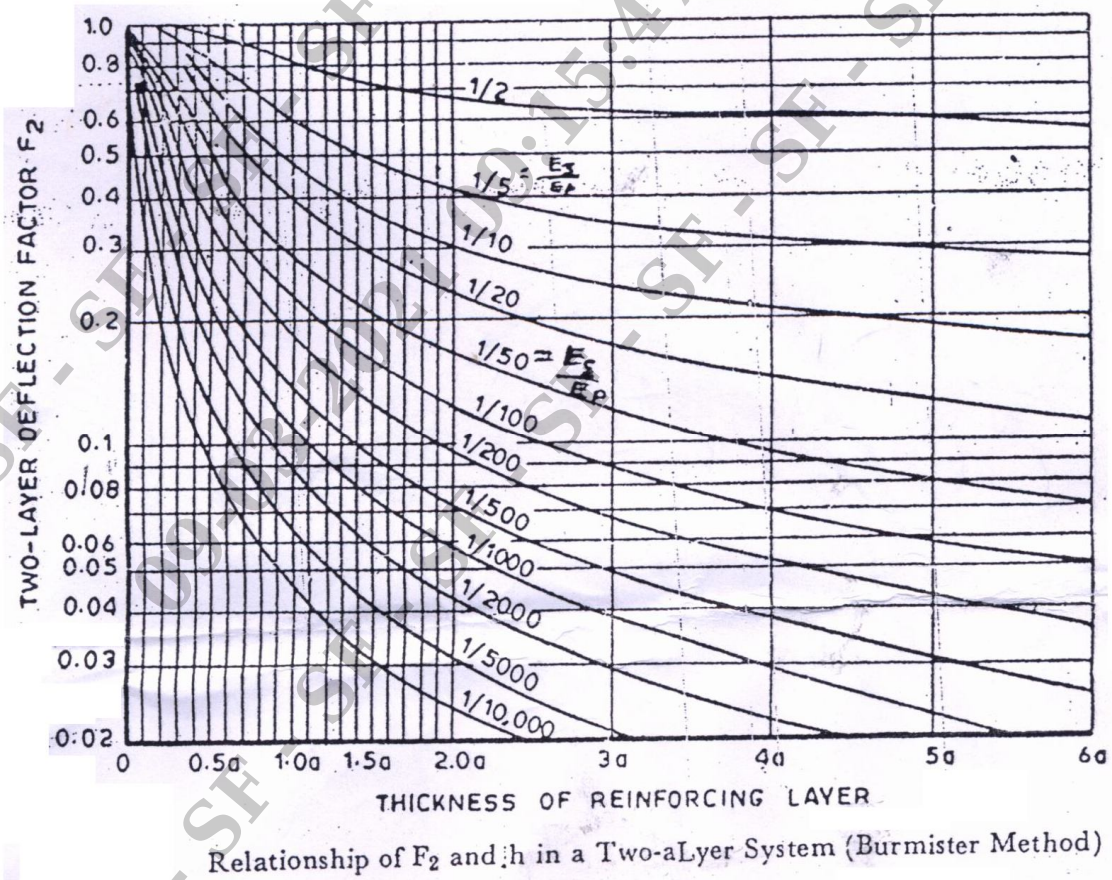
1 a. With a neat sketch of cross section of flexible type pavement, explain the various components and briefly bring out their functions. **(10 Marks)**

b. Bring out the differences between highway pavements and airfield pavements. **(05 Marks)**

c. Explain the differences between rigid and flexible pavements. **(05 Marks)**

2 a. Explain any three factors that affect design and performance of highway pavements. **(06 Marks)**

b. Plate bearing tests were conducted with a 75 cm diameter plate on soil subgrade and a granular base. The stress noticed, when the deflection was 0.25 cm on the subgrade soil was 0.07 MN/m^2. On the base course, the same plate yielded 0.25 cm deflection under a stress of 0.14 MN/m^2. Design the pavement for an allowable deflection of 0.5 cm, under a wheel load of 40 kN and a tyre pressure of 0.5 MN/m^2. [Refer Fig.Q2(b)] **(14 Marks)**



Relationship of F_2 and h in a Two-aLyer System (Burmister Method)

Fig.Q2(b)

3 a. Write Mc-Leod's procedure for determining equivalent wheel load factors. **(10 Marks)**

b. 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 4 lane road. **(10 Marks)**

Wheel Load , kN	ADT, Both Directions	% of Traffic Volume
22.68	Traffic volume	13.17
27.22	considering growth = 215	15.30
31.75		11.36
36.29		14.11
40.82		6.21
45.36		5.84

4 a. Explain briefly CBR method by cumulative standard axle load for the design of flexible highway pavements. **(10 Marks)**

b. Design a flexible highway pavement section on triaxial method (Kansas method) using the following data:
Wheel load = 44 kN; Radius of contact area = 160 mm; Traffic coefficient X = 1.7
Rainfall coefficient Y = 0.95 ; Design deflection = 2.8 mm ; E-value of subgrade soil, $E_S = 100 \times 10^2$ kN/m^2 ; E-value of base course material, $E_b = 400 \times 10^2$ kN/m^2 ;
E-value of 75 mm thick Bituminous concrete surface course = 1000×10^2 kN/m^2 **(10 Marks)**

PART – B

5 a. Explain the following:
(i) Radius of relative stiffness (ii) Radius Resisting Section
(iii) Modulus of subgrade reaction (iv) Fatigue behaviour of concrete **(10 Marks)**

b. Calculate the stresses at interior, edge and corner regions of a c.c pavement using Westerguard's stress equations for the following data:
Wheel load = 51 kN ; Modulus of elasticity of concrete = 0.3×10^8 kN/m^2 ;
Poisson's ratio of concrete = 0.15 ; Pavement thickness = 18 cm ; Modulus of subgrade reaction = 6.0×10^4 kN/m^3 ; Radius of contact area = 15 cm **(10 Marks)**

6 a. What are the uses of Tie Bars in CC pavements? Indicate the steps in the design of Tie Bars with sketches. **(10 Marks)**

b. Determine the spacing between contraction joints for 3.5 m slab width having thickness of 20 cm. Consider the following two cases:
(i) For plain cement concrete (ii) For reinforced cement concrete
Take f = 1.5, γ for CC = 24 kN/m^3 ; Allowable tensile stress in CC = 80 kN/m^2
Allowable tensile stress in steel = 6×10^4 kN/m^2 ; γ for steel = 75 kN/m^3
Total reinforcement of 60 N/m^2 is provided and is equally distributed in both the directions. Show the details with a sketch. **(10 Marks)**

7 a. Describe the general causes of flexible pavement failures. **(05 Marks)**

b. Explain the following: (i) Alligator cracking (ii) Reflection cracking **(05 Marks)**

c. Describe the step by step procedure of conducting Benkelman beam deflection studies for structure evaluation of flexible pavement and subsequent determination of overlay thickness. **(10 Marks)**

8 a. Explain the causes and maintenance of the following in rigid pavements:
(i) Cracks (ii) Joints **(10 Marks)**

b. Explain the common types of failure in rigid pavements. **(10 Marks)**

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