CBCS SCHEME

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17CV833

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Pavement Design

Time: 3 hrs. Max. Marks: 100

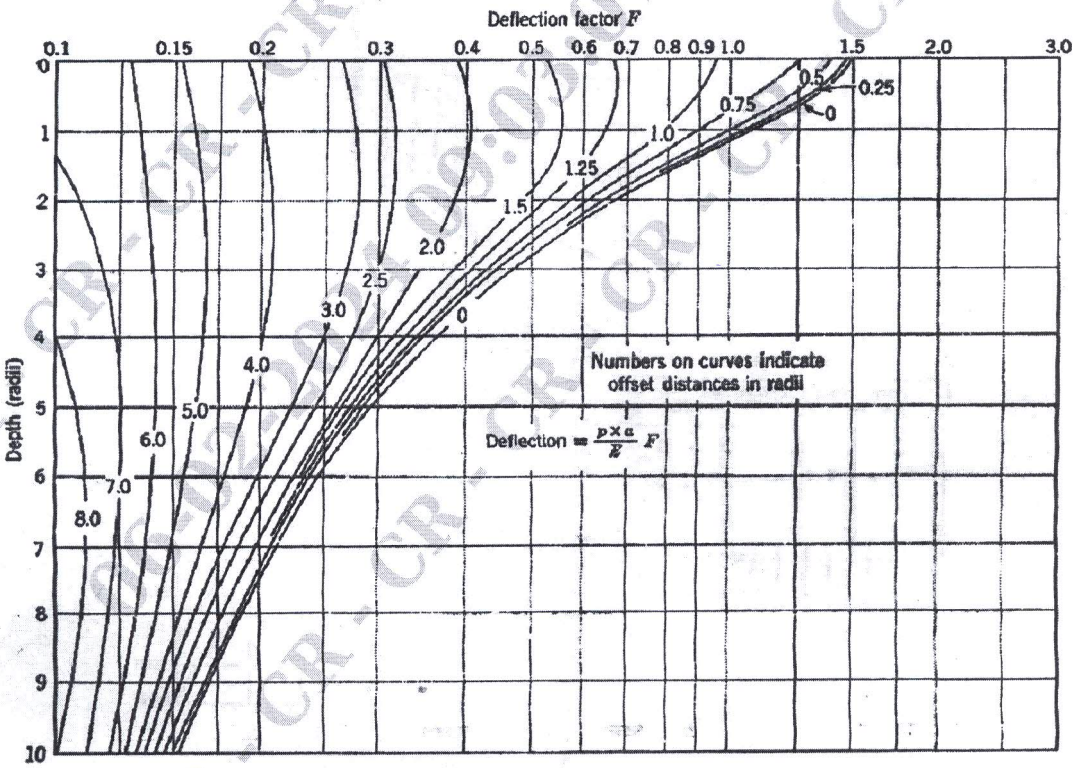
Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Use of handbook/charts is permitted.
3. Missing data, if any, may be suitably assumed.

Module-1

1 a. Draw a detailed cross section of flexible pavement. Briefly explain the components. **(06 Marks)**

b. Bring out the comparison between flexible pavement and rigid pavement. **(06 Marks)**

c. Determine the deflection values a wheel load of 6000kg and contact pressure of 7 kg/cm^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 E = 80kg/cm^2, sketch the deflection curve, (Refer Fig.Q1(c)).



Vertical Deflection Δ due to circular loading (Foster and Ahlvin,1954)

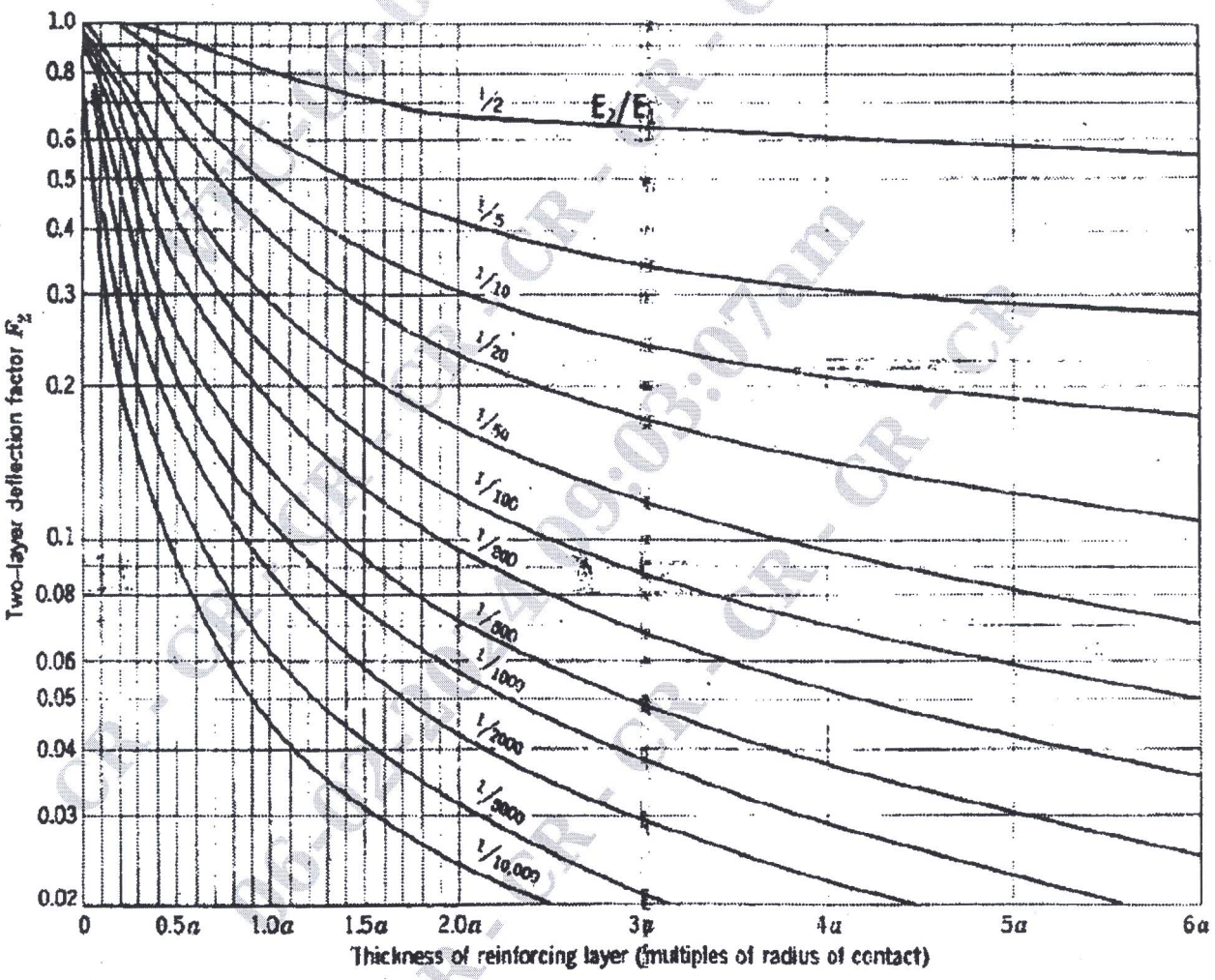
Fig.Q1(c) **(08 Marks)**

OR

2 a. State the assumptions limitations of Boussinesq's theory. **(06 Marks)**

b. Bring out the points of difference between highway and airport pavement. **(06 Marks)**

c. The plate bearing tests were conducted with 30cm plate diameter on soil subgrade and over 15cm base course. The pressure yielded at 0.5 cm deflection are 1.25kg/cm^2 and 4.0kg/cm^2, respectively. Design the pavement section for 4100kg wheel load with tyre pressure of 5kgcm^2 for an allowable defection of 0.5cm using Burmister's approach. (Refer Fig.Q2(c)).



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

Fig.Q2(c)

(08 Marks)

Module-2

3 a. Describe the significance of wheel load and tyre pressure in pavement design. **(06 Marks)**

b. Calculate ESWL of a dual wheel assembly carrying 2044kg each for pavement thickness of 15cm, 20cm and 25cm. Centre to centre tyre spacing is 27cm and distance between the walls of the tyres is 11cm (use graphical method). **(06 Marks)**

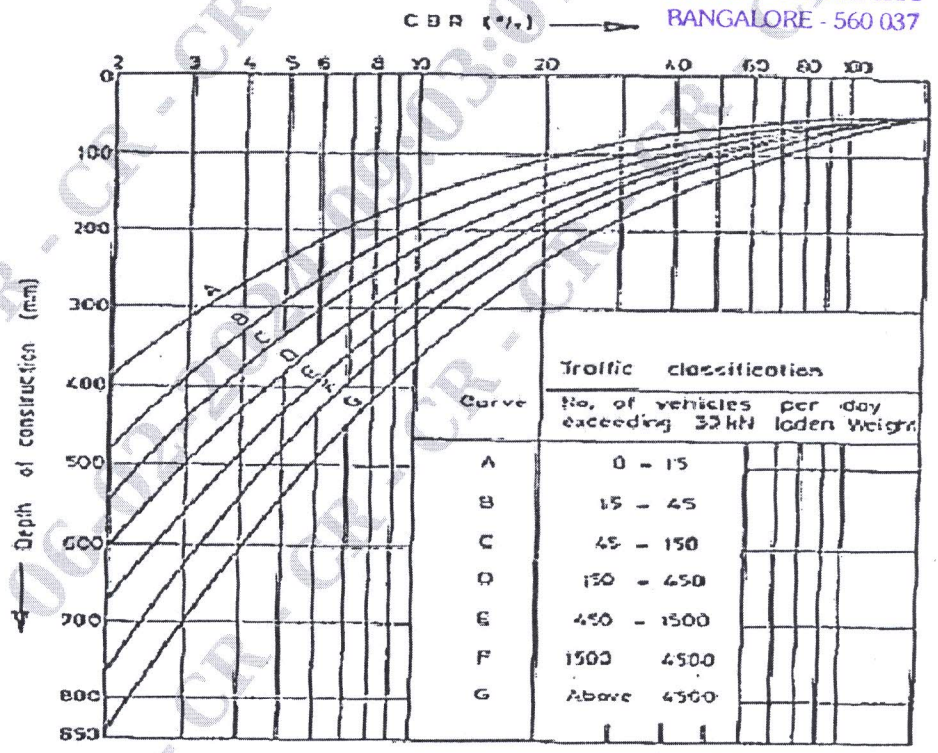
c. Soil subgrade sample was obtained from the project site and the CBR tests were conducted at field density the following were the results :

Penetration in mm	0.0	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0	7.5	10.0	12.5
Load in kg	0.0	5.0	16.2	28.1	40.0	48.5	56.5	67.5	75.2	89.0	99.5	106.5

It is desired to use the following materials for different pavement layers.

i) Compacted sandy soil with 7%CBR
ii) Poorly graded gravel with 20% CBR
iii) Well graded gravel with 95% CBR
iv) Minimum thickness of bituminous concrete surfacing may be taken as 8cm

The traffic survey revealed the present ADT of commercial vehicle as 1200. The pavement construction is to be completed in three years after the last traffic count. Design the pavement section by CBR method as recommended by IRC, using all the four pavement materials. (Refer Fig.Q3(c)).



CBR Design chart recommended by IRC

Fig.Q3(c)

(08 Marks)

OR

4 a. It is proposed to widen an existing 4 lane NH section to 3 lane dual carriage way road. Design the pavement for new carriage way with the following data :

i) Initial traffic in both directions : 4932 CVPD
ii) Construction period : 20 months
iii) Design life : 15 years
iv) Design CBR of soil : 7%
v) VDF : 4.5

(Refer Fig.Q4(a)).

CBR 7%				
Cumulative Traffic (msa)	Total Pavement Thickness (mm)	PAVEMENT COMPOSITION		
		Bituminous Surfacing		Granular Base & Sub-base (mm)
		BC (mm)	DBM (mm)	
10	580	40	60	
20	610	40	90	
30	630	40	110	Base = 250
50	650	40	130	
100	675	50	145	Sub-base = 230
150	695	50	165	

Plate.4. a. Pavement design catalogue; Recommended design for traffic range 10-150 msa

Table Fig.Q4(a) **(10 Marks)**

b. Design the pavement section by triaxial Kansas method using the following data :

i) Wheel load = 4100kg
ii) Radius of contact area = 15cm
iii) Rainfall coefficient (Y) = 0.9
iv) Traffic coefficient (X) = 1.5
v) Design deflection (Δ) = 0.25cm
vi) "E" – value of subgrade = 100kg/cm^2
vii) E-value of base course material = 400kg/cm^2
viii) E-value of 7.5cm thick bituminous concrete surface course = 1000kg/cm^2. **(10 Marks)**

Module-3

5 a. What are the various design factors to be considered in airport pavements? Discuss the significance of each. **(10 Marks)**

b. Write a brief note on different types of failures, causes and maintenance measures in flexible pavement. **(10 Marks)**

OR

6 a. Describe the step by step procedure of conducting BBD studies for structural evaluation of flexible pavement. **(10 Marks)**

b. Write a brief note on falling weight deflectometer. **(10 Marks)**

Module-4

7 a. Explain the following with reference to rigid pavement design :
   i) Radius of relative stiffness
   ii) Equivalent radius of resisting section
   iii) Critical loading positions
   iv) Temperature stresses
   v) Frictional stresses **(10 Marks)**

b. Calculate the stresses at interior, edge and corner regions of a cement concrete pavement using Westergaard's stress equations. Use the following data :

Wheel load (P)	= 5100kg
E	= 3.0×10^5kg/cm^2
Pavement thickness 'h'	= 18cm
Poisson's ratio of concrete μ	= 0.5
Modulus of subgrade reaction, k	= 6.0kg/cm^3
Radius of contact area, a	= 15cm.

(10 Marks)

OR

8 a. List the complete step by step procedure for the design of cement concrete pavements as per IRC 58 – 2002, Gidelines indicate the steps in design of tie bars. **(10 Marks)**

b. What are the uses of tie bars in cement concrete pavement? Indicate the steps in design of tie bars. **(10 Marks)**

Module-5

9 a. Explain the different types of failures, causes and maintenance measures in rigid pavement. **(10 Marks)**

b. Explain the various types of joints in C-C pavement with neat sketches. **(10 Marks)**

OR

10 Write a brief note on :
a. Reinforcement requirements of joints
b. Design of joints
c. LCN method of airport rigid pavement design
d. Design of dowel bars. **(20 Marks)**

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