CBCS SCHEME

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17CV833

Eighth Semester B.E. Degree Examination, July/August 2021
Pavement Design

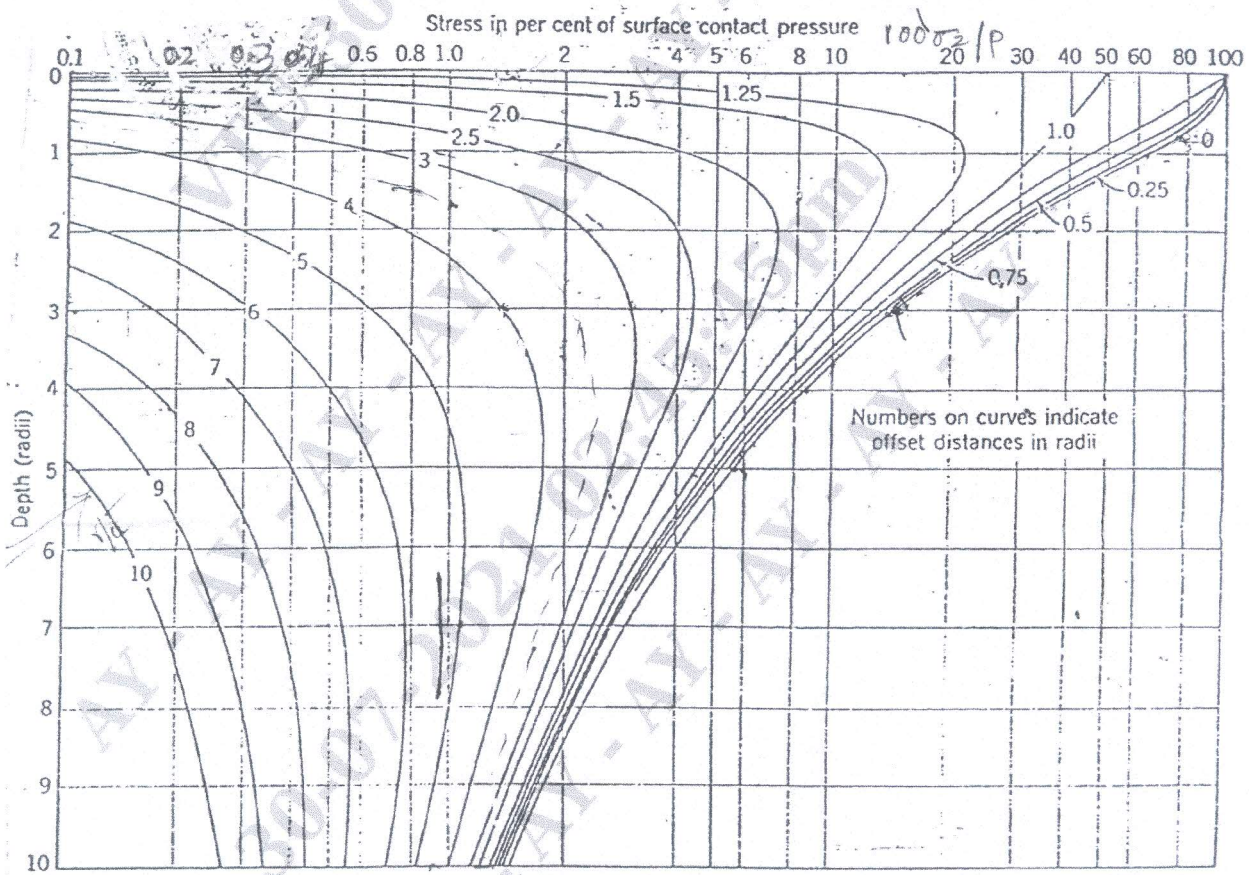
Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Explain the desirable characteristics of the pavement. **(06 Marks)**

b. For a wheel load of 40 kN and a tyre pressure of 0.5 MN/mm^2. If the value of E of the pavement and subgrade is assumed to be uniformly equal to 20 MN/mm^2. Compute deflection at the surface of the pavement. **(07 Marks)**

c. Determine the vertical stress under to the centre of the load at a depth of 45 cm from the surface for a circular load of radius 15 cm with uniform contact pressure of 7.0 kg/cm^2 is applied on the surface of a homogeneous elastic mass. **(07 Marks)**



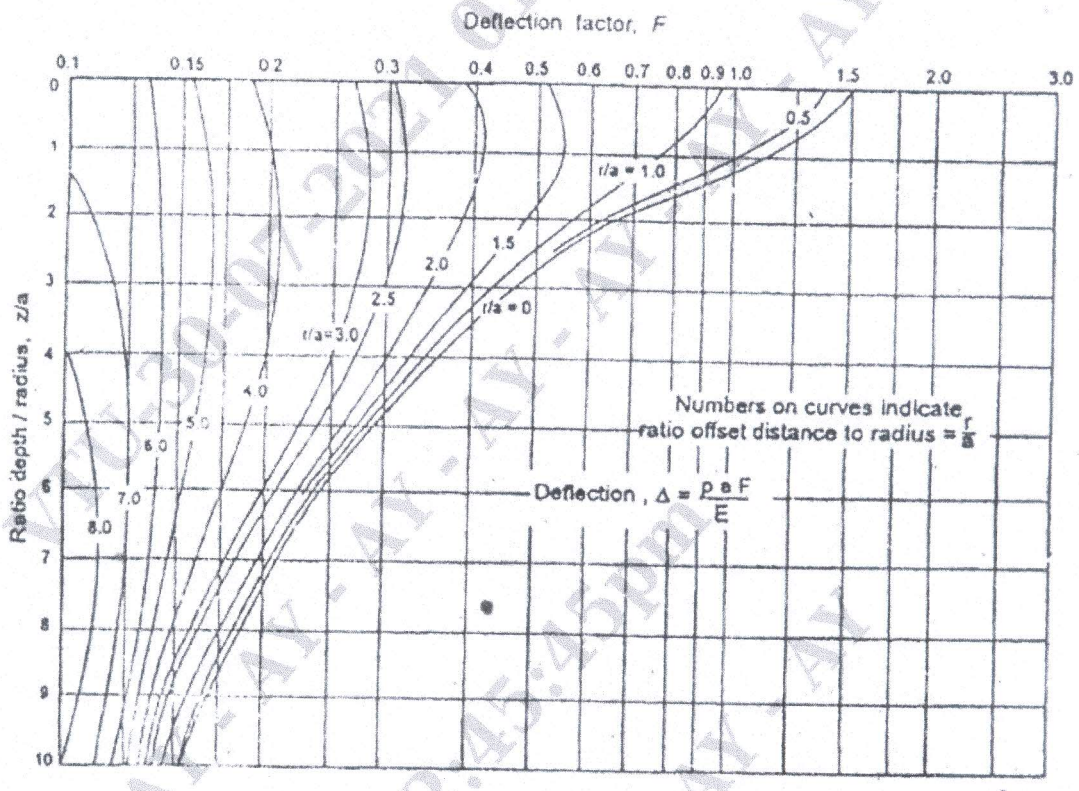
Vertical stress. σ_z. (From Foster and Ahlvin, *Proceedings*, Highway Research Board, 1954.)

Fig. Q1 (c)

2 a. Compare flexible pavement and rigid pavement. **(05 Marks)**

b. Draw a neat sketch of cross section of the flexible pavement and explain function of each layer. **(07 Marks)**

c. Determine the pavement thickness required to limit max deflection of 0.90 cm under a wheel load of 5000 kg at a contact pressure 6 kg/cm^2 and the ε-value of sub grade soil is 50 kg/cm. **(08 Marks)**



Deflection factor chart (single layer)

Fig. Q2 (c)

3 a. Calculate the ESWL of a dual wheel assembly carrying 2400 kg each for pavement for pavement thickness of 20 cm, 25 cm and 30 cm. The centre to centre tyre spacing is 300 mm and the distance between the walls is 120 mm. **(10 Marks)**

b. Design the pavement section by triaxial tent (Kansas method) using the following data
Wheel load = 4100 kg ;
Radius of contact area = 15 cm
Traffic coefficient x = 1.5 ;
Rainfall coefficient y = 0.9
Design deflection Δ = 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)**

4 a. Design the pavement for a two way road on a soil of CBR 4% for an initial traffic of 1200 CV/day. The period of construction is 5 years and the design life is 15 years after opening to traffic. The vehicle damage factor is 2.5. The rate of growth traffic is 8% per annum. Show with a sketch to composition of designed pavement, use chart. **(10 Marks)**

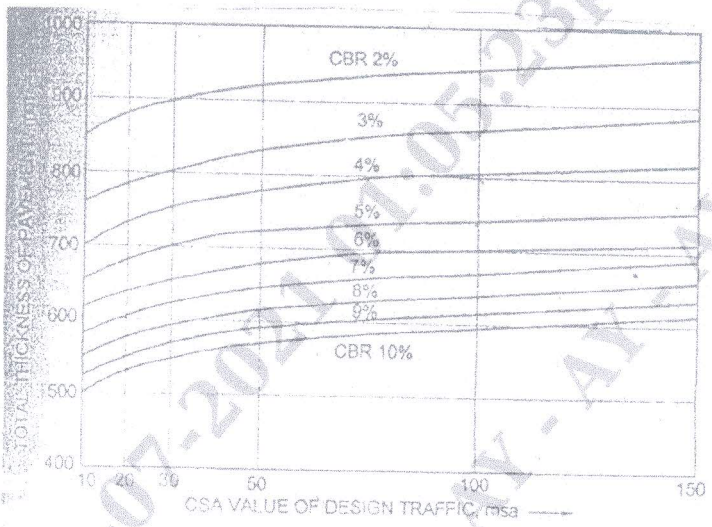


Fig. 7.15 CBR design chart for determination of total pavement thickness for traffic with CSA of 10 to 150 msa

Table 7.4, Pavement design with recommended component layers for cumulative traffic range 10 to 150 msa

CBR, %	CSA, msa	Total pavement thickness, mm	Granular sub-base, mm	Granular base, mm	Dense bituminous Macadam binder course, mm	Bituminous concrete surface course, mm
3	10	760	380	250	90	40
	20	790			120	40
	30	810			140	40
	50	830			160	40
	100	860			180	50
	150	890			210	50
4	10	700	330	250	80	40
	20	730			110	40
	30	750			130	40
	50	780			160	40
	100	800			170	50
	150	820			190	50
6	10	615	260	250	65	40
	20	640			90	40
	30	655			105	40
	50	675			125	40
	100	700			140	50
	150	720			160	50
8	10	550	200	250	60	40
	20	575			85	40
	30	590			100	40
	50	610			120	40
	100	640			140	50
	150	660			160	50
10	10	540	200	250	50	40
	20	565			75	40
	30	580			90	40
	50	600			110	40
	100	630			130	50
	150	650			150	50

Fig. Q4 (a)

b. Calculate the design repetitions for 20 years period for various wheel load equivalent to 2268 kg of wheel load using the following data on a four lane road. The mixed traffic in both direction is 2100 Veh/day.

Load kg	2268	2722	3175	4082	4536	4990	5443
% of total traffic	25	12	9	4	3	2	1

Assume (ELF) for different wheel load.

Wheel load	22.68	27.22	31.72	40.82	45.36	49.90	54.43
ELF	1	2	4	16	32	64	128

5 a. List the general causes of flexible pavement failures and analysis the failure with respect to sub base and base course. **(10 Marks)**

b. Explain with details the various maintenance of operations. **(07 Marks)**

c. Explain maintenance of Bituminous surfaces. **(06 Marks)**

6 a. Justify the evaluation of flexible pavement by present serviceability index method. **(07 Marks)**

b. The BBD data were analysed and modified characteristics deflection value after applying corrections for pavement temperature and subgrade moisture was found to be 2.20 mm, the design traffic in terms of CSA is found to be 20 mSa. Using overlay chart determine the thickness of overlay. **(06 Marks)**

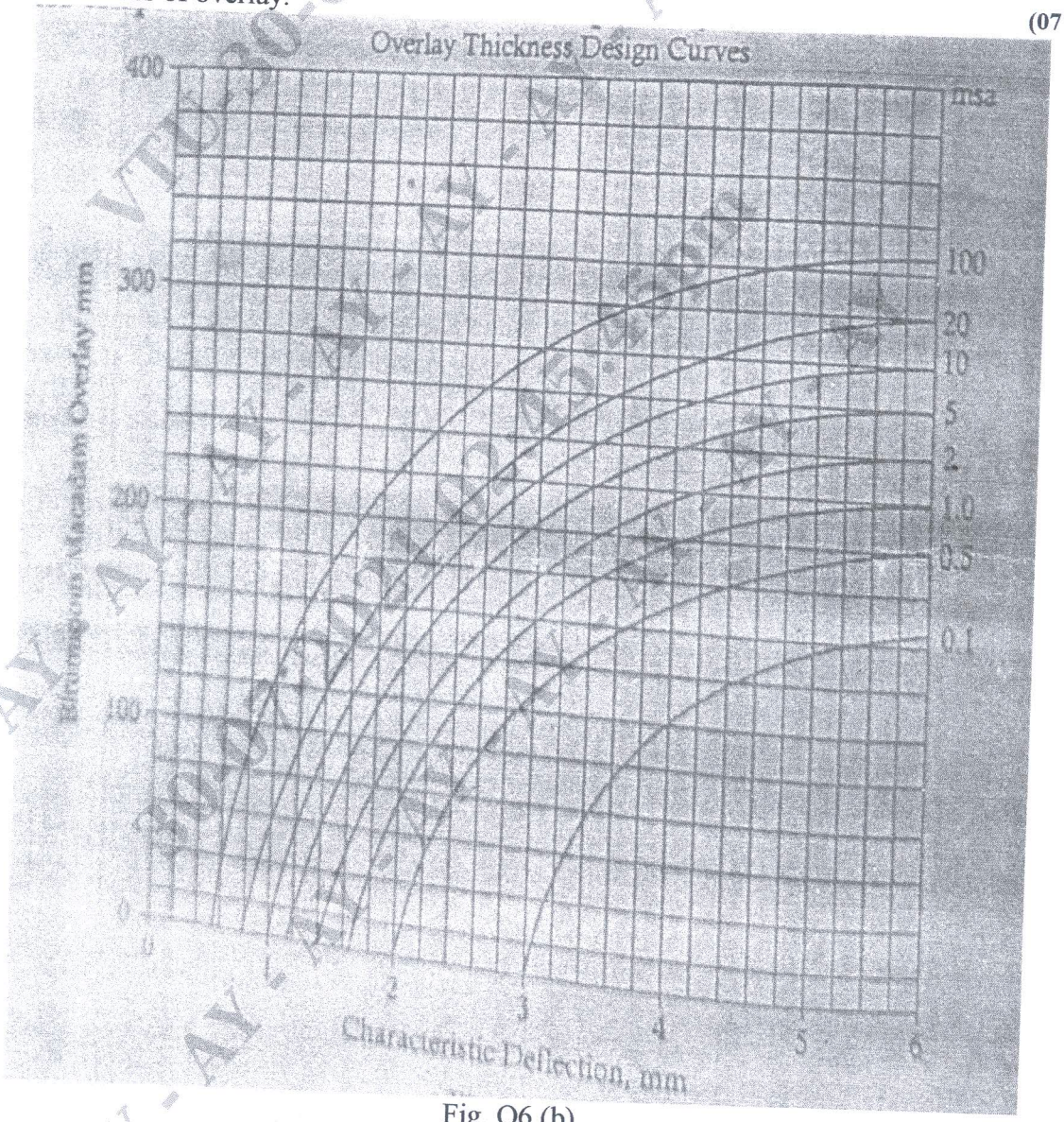
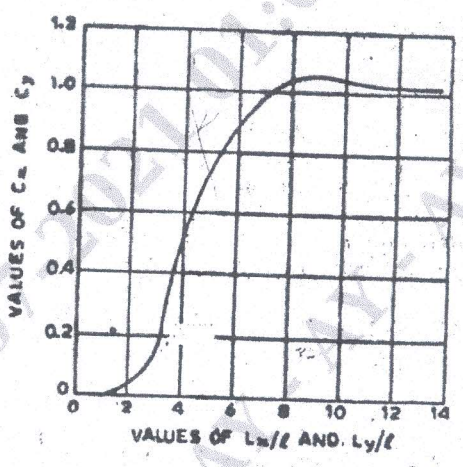


Fig. Q6 (b)

c. List and explain general types of distress in bituminous pavement. **(07 Marks)**

7 a. Determine the warping stress of interior, edge and corner regions in a 28 cm thick cement concrete pavement with transverse joints at 5.5 mt interval and longitudinal joints at 3.5 mt intervals. Modulus of subgrade reaction is 5.0 kg/cm^2. Temperature deterential is 0.80°C per cm slab thickness. If the tyre pressure is 5.0 kg/cm^2 for a wheel load of 51000 kg. Elastic modulus of pavement interval/CC/ E = 3×10^5 kg/cm^2, Poisson's ratio = 0.15. Assume suitable required.

(10 Marks)



Warping Stress Coefficient

Fig. Q7 (a)

b. Write the step by step procedure for the design of concrete pavements as recommended by IRC-58-2002.

(10 Marks)

8 a. Design the dowel bars for the following data design of wheel load. 98 Perceutile angle load is 8000 kg. Slab thickness is 33 cm. Joint width 2 cm, radius of relative stiffness is 103.53 cm, compressive strength of concrete at 28 days is 400 kg/cm^2. Elastic modulus of concrete 0.3×10^5 kg/cm^2 and Poisson's ratio is 0.15. **(10 Marks)**

b. Explain the significance of relative stiffness and radius of resisting section. **(10 Marks)**

9 a. Evaluate the various design factors to be considered in Air port pavement. **(10 Marks)**

b. With the help of neat sketches, explain "mud pumping" in concrete pavements. **(10 Marks)**

10 a. Explain with neat sketches the various types of joints in C.C pavements and its functions. **(10 Marks)**

b. Explain the various types of failures in cement concrete pavements and their causes. **(10 Marks)**

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