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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 20CV6PEPAD **Max Marks: 100**
Course: Pavement Design

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) List any four advantages and limitations of flexible and rigid pavements. **10**

b) Total wheel load of a dual wheel load assembly is 12000 kg. The centre to centre spacing and clear space in the dual wheels are 30 cm and 10 cm respectively. Calculate the ESWL for pavement thickness (i) 40 cm and (ii) 70 cm. **10**

UNIT - II

2 a) Enumerate the steps involved in the determination of modulus of subgrade reaction by conducting Plate load test with a neat sketch. **12**

b) Determine the total thickness of flexible pavement assuming single layer elastic theory and using the following data: Design wheel load=4200 kg; Tyre pressure is 6 kg/cm^2; Elastic modulus=150 kg/cm^2; Permissible deflection=2.5 mm. **08**

UNIT - III

3 a) Discuss the principle of CBR method of pavement design. List its advantages and limitations. **10**

b) Design a highway pavement for a wheel load of 4100 kg with a tyre pressure of 5 kg/cm^2 by McLeod method. The plate bearing test was carried out on a subgrade soil using 30 cm diameter plate which yielded a pressure of 2.5 kg/cm^2 after 10 repetitions of load at 0.5 cm deflection. Ratio of unit subgrade support on 30 cm and 37.5 cm diameter plates at 0.5 cm deflection are 1.0 and 0.8 respectively. Base Course constant for the above diameter plates are 80 and 100 respectively. **10**

OR

4 a) List the IRC guidelines in the design approach of flexible pavement and mention the design factors considered. **10**

b) The initial traffic after completion of construction of a two lane undivided highway is estimated to be 300 cv per day. Design the flexible pavement for a life of 10 years using the following table and the data given. Design CBR value=5%; Growth rate of cv=6.0% p.a; Average VDF value of cv=2.5. **10**

CBR(%)	CSA, msa	Total Pavement thickness, mm	GSB,mm	GB,mm	Binder course, mm	Surface course, mm
4	1	480	255	225		20PC
	2	540	265	225	50BM	20PC
	3	580	280	250	50BM	20PC
	5	620	285	250	60BM	25SDBC
	10	700	330	250	80 BM	40BC
6	1	390	165	225		20PC
	2	450	175	225	50BM	20PC
	3	490	190	250	50BM	20PC
	5	535	210	250	50BM	25SDBC
	10	615	260	250	65 BM	40BC

UNIT - IV

5 a) Discuss the Westergaard's stress analysis for the determining of wheel load stresses in rigid pavements. **08**

b) A CC pavement of slab thickness 18cm is constructed over a granular sub base having modulus of reaction of 8.5 kg/cm^2. The maximum temperature differential between the top and bottom of the slab during summer day and night is found to be 18˚C. The spacing between the transverse contraction joint is 4.5 m and that between the longitudinal joints is 3.5m. The design wheel load is 5100 kg, radius of contact area is 15 cm, E value of CC is $3x10^5$ kg/cm^2, poisons ratio is 0.15 and coefficient of thermal expansion of CC is $10x10^{-6}$ per ˚C and friction coefficient is 1.5. Using the edge and corner load stress charts given by IRC and chart for the warping stress coefficient shown in Figure 5(b), find the worst combination of stresses at the edge. **12**

UNIT - V

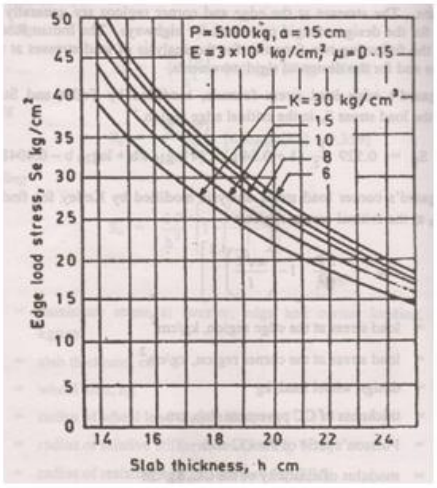
6 a) Discuss the steps involved in the design of Concrete pavements as per IRC standards. **12**

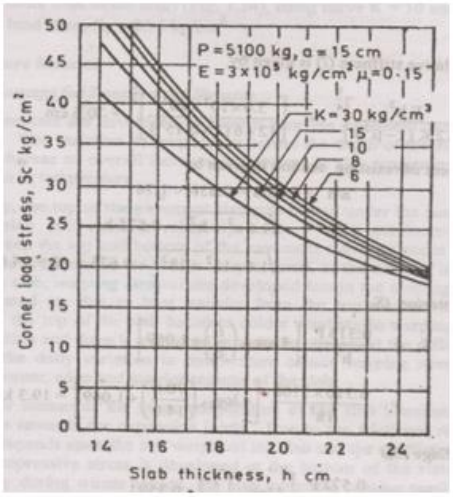
b) A CC pavement has a thickness of 18 cm and has lane width of 3.6m. Design the tie bars along the longitudinal joints using the data given below: S_S in steel tie bars=1400 kg/cm^2; W=2400 kg/m^3; f=1.5; S_B in deformed bars=24.6 kg/cm^2. **08**

OR

7 a) Discuss the concept of White Topping commonly adopted in practice. **08**

b) The design thickness of a CC pavement is 26 cm considering a design axle load (98^{th} percentile load) of 12000 kg on single axle and M-40 concrete with characteristic compressive strength of 400 kg/cm^2. The radius of relative stiffness is found to be 62.2 cm. If the elastic modulus of dowel bar steel is $2x10^6$ kg/cm^2, modulus of dowel concrete interaction is 41,500 kg/cm^2 and joint width is 1.8 cm, design the dowel bars for 40% load transfer considering edge loading. **12**





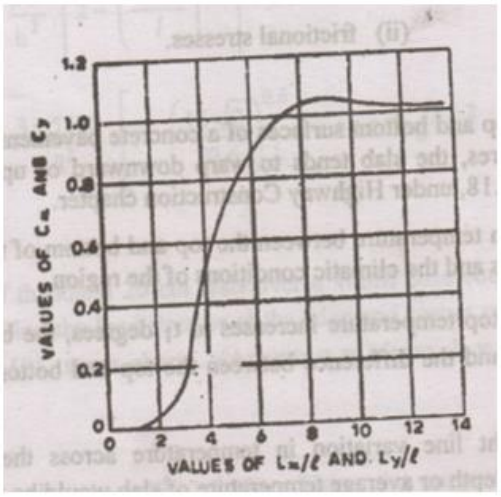


Figure 5(b)

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