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Eighth Semester B.E. Degree Examination, Jan./Feb. 2023
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 relevant charts is permitted.
3. Missing data, if any, may be assumed suitably.

Module-1

1   a.   What are the different layers of flexible pavement? Explain the functions of each.   **(08 Marks)**
    b.   Explain assumptions of Boussinesq's theory.   **(04 Marks)**
    c.   Design thickness of a flexible pavement by Burmister's two layer analysis, for a wheel load of 40 kN and a tyre pressure of 0.5 MN/m². The modulus of elasticity of the pavement material is 150 MN/m² and that of subgrade is 30 MN/m². The value of F_w the displacement factor can be taken from Fig.Q1(c).
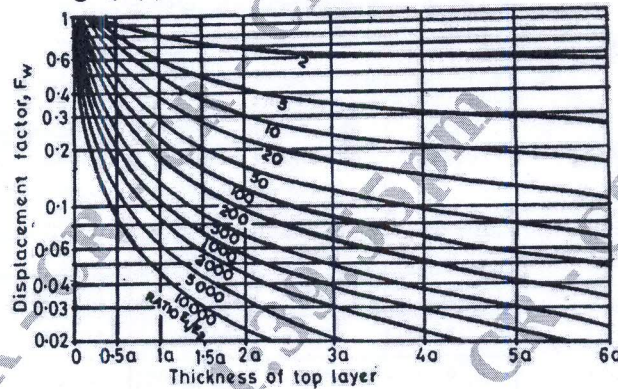

Fig.Q1(c)   **(08 Marks)**

OR

2   a.   Compare the salient features of flexible and rigid pavement.   **(08 Marks)**
    b.   Plate bearing tests were conducted with a 75cm diameter plate on a soil subgrade and a granular base. The stress noticed when the deflection was 0.25 cm on the subgrade soil was 0.07 MN/m². On the base course, the same plate yielded 0.25 cm deflection under a stress of 0.14 MN/m². Design the pavement for an allowable deflection of 0.5cm, under a wheel load of 40 kN and a tyre pressure of 0.5 MN/m² (Refer Fig.Q1(c)).   **(12 Marks)**

Module-2

3   a.   Calculate the design repetition for 10 years period for wheel load equivalent to 2268 kg wheel load using the following traffic survey data on a four lane road.

Wheel load (kg)	Average daily traffic ADT in both directions	% of total traffic volume
2268		14.15
2722	Total volume 230	16.40
3175	Consider traffic growth	12.50
3629		13.20
4082		7.80
4536		6.20

(08 Marks)

b. Explain following factors :
   i) Design wheel load   ii) Contact pressure
   iii) Climate factors   iv) Subgrade strength and drainage   **(12 Marks)**

OR

4 a. Explain determination of ESWL by Graphical method. Also draw the neat sketch. **(10 Marks)**
  b. Design the pavement for construction of a new bypass with the following data:
    Two lane single carriageway.
    Initial traffic in the years of completion of construction is 500 CVPD.
    Traffic growth rate is 7.5%.
    Design life : 10 years
    Vehicle damage factor = 2.5
    CBR = 5%
    Use IRC 37 : 2001 chart given in Fig.Q4(b).
    IRC:37-2001

PAVEMENT DESIGN CATALOGUE
PLATE 1 – RECOMMENDED DESIGNS FOR TRAFFIC RANGE 1-10 msa

Cumulative Traffic (msa)	Total Pavement Thickness (mm)	PAVEMENT COMPOSITION			
		Bituminous Surfacing		Granular Base (mm)	Granular Sub-base (mm)
		Wearing Course (mm)	Binder Course (mm)		
1	430	20 PC		225	205
2	490	20 PC	50 BM	225	215
3	530	20 PC	50 BM	250	230
5	580	25 SDBC	55 DBM	250	250
10	660	40 BC	70 DBM	250	300

CBR 5%

Fig.Q4(b)   **(10 Marks)**

Module-3

5 a. Explain the step by step procedure of conducting Benkleman beam deflection studies for evolution of flexible pavement surface condition. **(08 Marks)**
  b. Explain functional evolution of pavement by unevenness index. **(04 Marks)**
  c. What are the objectives of Highway maintenance? **(08 Marks)**

OR

6 a. Calculate the thickness of an airport flexible pavement for an ESWL of 40 kN. The subgrade has a CBR of 5. The tyre pressure is 1.4 MN/m^2. **(10 Marks)**
  b. Briefly explain the typical types of flexible pavement failure. **(10 Marks)**

Module-4

7 a. List the typical failures in Rigid pavements and explain any three of them. **(08 Marks)**
  b. Explain Radius of Relative stiffness. **(04 Marks)**
  c. As per IRC explain the steps involved in the design of Dowel bars in rigid C.C. pavements. **(08 Marks)**

OR

8 a. Using the data given below, calculate the wheel load stresses at interior, edge and 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, P = 5100 kg, $E = 3 \times 10^5$ kg/cm^2, $\mu = 0.15$, K = 6 kg/cm^3,
Pavement thickness, h = 18 cm, Radius of contact area = 15 cm. **(10 Marks)**

b. With sketches, describe the various types of joints and their requirements in rigid pavements. **(10 Marks)**

Module-5

9 a. Explain the factors affecting design and performance of CC pavement. **(10 Marks)**
b. Explain briefly the pavement evaluation. **(10 Marks)**

OR

10 a. List and explain the desirable properties of subgrade. **(08 Marks)**
b. Explain any three from following :
i) Pavement Roughness
ii) Falling Weight Deflectometer
iii) Warping stress
iii) Properties of concrete. **(12 Marks)**

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