CBCS SCHEME

USN

Eighth Semester B.E. Degree Examination, July/August 2022
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 IRC 37-2001 is allowed.
3. Missing data, if any may be assumed.

Module-1

1   a. Distinguish between Highway Pavement and Airfield pavement.   **(06 Marks)**
    b. Design the thickness of a flexible pavement by Burmister two layer analysis for a wheel load of 40 kN and a tyre pressure of 0.5 MN/m^2. The modulus of the elasticity of the pavement material is 150 MN/m^2 and that of the subgrade is 30 MN/m^2. The value of FW (displacement factor = 0.43) take.   **(07 Marks)**
    c. Explain the important design strategies of pavement.   **(07 Marks)**

OR

2   a. Distinguish between Flexible pavement and Rigid pavement.   **(06 Marks)**
    b. List the assumptions and limitations of Boussinesq's theory for stresses in homogeneous mass.   **(07 Marks)**
    c. Explain the desirable characteristics of the pavement.   **(07 Marks)**

Module-2

3   a. It is proposed to widen an existing two-lane NH section to four lane divided road. Design the pavement for new carriage way with the following data:
    (i)   Four lane divided carriage way.
    (ii)   Initial traffic in both directions in the year of completion of construction = 5600 CVPD.
    (iii) Design life = 10 year and 15 year.
    (iv)   Design CBR of subgrade soil = 5 percent.
    (v)   Traffic growth rate = 8%
    (vi)   Vehicle damage factor = 4.5 (Standard axles)   **(10 Marks)**
    b. With the help of neat sketch, explain the concept of Equivalent Single Wheel Load (ESWL).   **(10 Marks)**

OR

4   a. Calculate the design repetitions for 10 year period equivalent to 2268 kg wheel load if the mixed traffic in both directions is 1860 vehicles per day. The details of distribution of different wheel loads of commercial vehicles are given below.

Wheel load kg	2268	2722	3175	3629	4082	4536	4990
% Total Traffic volume	25	12	9	6	4	2	1

                                                                                      (10 Marks)
    b. Calculate the thickness of Bituminous surface by Kansas method.
        $E_s = 90$ kg/cm^2 $E_P = 900$ kg/cm^2 Wheel load = 5100 kg
        Tyre pressure = 7 kg/cm^2 Traffic coefficient, $x = 1.25$ Saturation coefficient, $y = 0.8$
        Assumed $\Delta = 0.25$ cm
        Design the thickness of pavement layer, base course, sub-base course are to be provided having 'E' values 400 kg/cm^2 and 200 kg/cm^2. Assuming the pavement consists of a single layer.   **(10 Marks)**

Module-3

5   a. What is the principle of Benkelman beam test? Explain the procedure of determining the deflection value at any point on a flexible pavement. **(10 Marks)**

  b. What are the various types of pavements distress? Mention the cause for each one of them and explain briefly. **(10 Marks)**

OR

6   a. Write a short note on Falling Weight Deflectometer. **(07 Marks)**

  b. Explain briefly the various design factors for run way pavements. **(07 Marks)**

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

Module-4

7   a. Explain design procedure for "Design of Tie Bars" **(10 Marks)**

  b. Calculate the stresses at interior, edge and corner regions of a CC pavement using Westergaards Analysis. Using the following data:

  Wheel load = 4100 kg $E_C = 2.1 \times 10^5 \, kg/cm^2$

  Pavement thickness = 20 cm   Poisson's ratio of concrete = 0.15

  Modulus of subgrade reaction K = 2.5 kg/cm^3 Radius of contact area, a = 8.91 cm

  (10 Marks)

OR

8   a. A C-C pavement has a thickness of 18 cm and has 2-lanes of 7.2 m with a longitudinal joint along the centre. Design the dimensions and spacing of the tie bar using the following data :

  (i)   Allowable working stress in tension, $S_s = 1400 \, kg/cm^2$

  (ii) Unit weight of concrete, $\omega = 2400 \, kg/m^3$

  (iii) Coefficient of friction, f = 1.5

  (iv) Allowable bond stress in deformed bars in concrete, $S_b = 1400 \, kg/cm^2$

  (08 Marks)

  b. Write the step by step procedure for the design of concrete slab thickness satisfying the fatigue criterion as per IRC : 58 – 2002. **(06 Marks)**

  c. What are the factors affecting the design of rigid pavements? **(06 Marks)**

Module-5

9   a. Determine the spacing between contraction joints for 3.5 m slab width having thickness of 20 cm and f = 1.5 for the following two cases:

  (i)   For plain C-C pavement allowable $S_C = 0.8 \, kg/cm^2$

  (ii) For reinforced CC, 1 cm dia bars at 0.3 m spacing. **(10 Marks)**

  b. Explain different types of joints in rigid pavements with the help of neat sketches. **(10 Marks)**

OR

10 a. With the help of neat sketches, explain Mud-Pumping in cement concrete pavements. **(10 Marks)**

  b. The maximum increase in temperature is expected to be 26°C after the construction of a CC pavement. If the expansion joint gap is 2.2 cm, design the spacing between expansion and contraction joint. Assume plain cement concrete construction with thermal co-efficient equal to $10 \times 10^{-6} / °C$, unit weight of concrete = 2400 kg/m^3. Allowable stress in tension during initial period of curing = 0.8 kg/cm^2 and coefficient of friction = 1.4 **(10 Marks)**

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