G 1018 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Eighth Semester

Branch : Civil Engineering

CE 010 804 L05—HIGHWAY AND AIRFIELD PAVEMENTS—Elective III (CE)

(New Scheme—Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries **3** *marks.*

1. Explain ESWL and the concept in the determination of equivalent wheel load.
2. Enumerate the various methods of flexible pavement design. Briefly indicate the basis of design in each case.
3. Explain the critical locations of loading as regards wheel load stresses in cement concrete pavement.
4. Explain various types of joints in rigid pavement.
5. Write short notes on Alligator cracking and Reflection cracking.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. With neat sketch enumerate the differences between Flexible pavement and Rigid pavement.
7. Explain group index method of pavement design.
8. Explain the following terms :
   (a) Modulus of subgrade reaction.
   (b) Radius of relative stiffness.
   (c) Radius of resisting section.
9. Explain temperature stresses in rigid pavement.
10. Write a note on pavement evaluation.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 marks.

11. What is frost action ? Discuss the effect and factors on which the intensity of frost action depends ? Suggest measures to prevent or reduce the adverse effects.

Or

12. Calculate the design repetitions for ten 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	*Percentage in total traffic volume*
2268	25
2722	12
3175	9
3629	6
4082	4
4536	2
4990	1

13. 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 carried out on subgrade soil using 30 cm diameter plate yielded a pressure of 2.5 kg/cm^2 after 10 repetitions of load at 0.5 cm deflection.

Or

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

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

The different pavement materials available near the construction site are as follows :

(a) Compacted sandy soil with CBR value = 10%

(b) Poorly graded gravel with CBR value = 20%

(c) Well graded gravel with CBR value = 95 %

(d) Minimum thickness of bituminous concrete surfacing may be taken as 5 cm. The traffic survey revealed the present ADT of commercial vehicles as 1100. The annual rate of growth of traffic is found to be 8 percent. The pavement construction is to be completed in 2 years after the last count.

Design the pavement section by CBR method as recommended by IRC, using all the four pavement materials.

15. Calculate the warping stresses at interior, edge and corner for a concrete pavement of thickness 20 cm with transverse joints at 4.5 m spacing. The width of slab is 3.5 m. For concrete $E = 3 \times 10^5$ kg/cm^2 and $\mu = 0.15$, K value for subgrade = 5 kg/cm^3. Temperature differential is 0.9 C per cm. Assume thermal coefficient for concrete as 10×10^{-6} per° C.

Or

16. 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 = 5100 kg

E = 3.0×10^5 kg/ cm^2

Pavement thickness, h = 18 cm

Poisson's ratio for concrete = 0.15

Modulus of subgrade reaction K = 6 kg/cm^2

Radius of contact area, a = 15 cm.

17. A concrete pavement of thickness 20 cm is constructed over a granular sub-base having modulus of reaction 30 kg/cm^2. The maximum temperature difference between the top and bottom of the slab during summer day and night is found to be 16° C. The spacing between the transverse contraction joint is 4.5 m and that between longitudinal joint is 3.5 m. The design wheel load is 5100 kg, radius of contact area is 15 cm, E value of CC is 3×10^5 kg/cm^2, Poisson's ratio is 0.15, and the coefficient of thermal expansion of CC 10×10^{-6} per °C and friction coefficient is 1.5. Using the edge and corner load stress charts given by the IRC and the chart for the warping stress coefficient, find the worst combination of stresses at edge.

Or

18. A cement concrete pavement 20 cm thick and 7.5 m width has a longitudinal joint along the centre line. Design the diameter, length and spacing of the tie bars, if the allowable working stress in steel is 1400 kg/cm^2 in tension, allowable bond strength of deformed bars in concrete is 24.6 kg/cm^2 and coefficient of friction is 1.2. Assume unit weight of concrete as 2400 kg/cm^3.

19. Explain the principle and procedure of Benkelman Beam test.

Or

20. Explain with neat sketch the various types of distresses in cement concrete pavement and their causes.

(5 × 12 = 60 marks)