Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40272

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Seventh Semester

Civil Engineering

CE 8006 – PAVEMENT ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. On what basis are pavements classified as flexible and rigid pavements.

2. What is the significance of resilient modulus as a material property for a pavement material?

3. Define equivalent wheel load.

4. What are the two failure criteria used for mechanistic empirical method?

5. Compute the change in relative stiffness of 15 cm thick concrete pavement whose modulus of elasticity is 2,15,000 kg/cm^2 and Poisson's ratio is 0.15 if the modulus of subgrade reaction changes from 5 kg/cm^3 to 7.5 kg/cm^3.

6. Why are joints provided in cement concrete pavements?

7. Write the two basic reasons for the failure of subgrade?

8. When does sideway skidding occur on curves?

9. Can granular soil be stabilized with cement? Justify your answer.

10. List any two applications of geosynthetics in roads and pavements.

PART B — (5 × 13 = 65 marks)

11. (a) Write in detail the strength characteristics of pavement materials considering the fact that pavement is a layered structure.

Or

(b) Discuss in detail the various wheel load factors that are required to be considered for the design of pavement.

12. (a) Design the pavement section using triaxial method, with the following data,

E value of subgrade soil – 85 kg/cm^2

E value of paving materials – 950 kg/cm^2

E value of base course – 400 kg/cm^2

E value of sub-base course – 200 kg/cm^2

Wheel Load – 5100 kg

Tyre pressure – 7.5 kg/cm^2

Traffic coefficient – 1.25

Saturation coefficient – 0.8

Or

(b) Plate bearing test conducted with 30 cm diameter plate on a subgrade sustained a load of 1600 kg at 0.25 cm deflection. The test when carried out on a base course of thickness 18 cm sustained a load of 5500 kg at 0.25 cm deflection. Design the pavement section for a wheel load of 5500 kg with tyre pressure of 7.5 kg/cm^2 using Burmister's approach.

13. (a) Discuss in detail the design of the dowel bar system as per IRC recommendations and write on the advantages of Bradbury's stress coefficient.

Or

(b) 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 = 5100 kg, Pavement thickness = 20 cm, Modulus of elasticity of concrete = 3.0 × 10^5 kg/cm^2, Poisson's ratio of concrete = 0.15, Modulus of subgrade reaction of concrete = 8 kg/cm^3, radius of contact area = 15 cm.

14. (a) Enumerate the various types of typical failures that occur in flexiable pavements. Supplement with neat sketches to illustrate the different failures wherever possible.

Or

(b) Explain in detail the different methods of pavement evaluation.

15. (a) Write in detail the factors affecting the properties of soil – bitumen and outline the design of soil-bitumen mix.

Or

(b) What are the problems associated with the choice of black cotton soil as a subgrade material. Write on any two methods that can successfully stabilize black cotton soil.

PART C — (1 × 15 = 15 marks)

16. (a) Soil subgrade sample was obtained from the project site and the CBR tests was conducted are field density. The following were the results :

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

It is desired to use compacted sandy soil with 7% CBR, poorly graded gravel with 20% CBR and well graded gravel with 95% CBR for different pavement layers. A minimum thickness of bituminous concrete surfacing may be taken as 5 cm. The traffic survey revealed the present ADT of commercial vehicle as 1300. The annual rate of growth of traffic is found to be 9%. The pavement construction is to be completed in three years after last traffic count. Design with illustration, the pavement section by CBR method as recommended by IRC, using all the four pavement materials.

Or

(b) A CC pavement slab of thickness 20 cm is constructed over a granular sub-base having modulus of reaction 16 kg/cm^2. The maximum temperature difference 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 longitudinal joint is 3.5 m. The design wheel load is 5100 kg, radius of contact area is 15 cm, Modulus of elasticity of concrete = 3.0×10^5 kg/cm^2, Poisson's ratio is 0.15 and the coefficient of thermal expansion if cement concrete is 10×10^{-6}/°C and the coefficient of friction is 0.15. Using the edge and corner load stress charts given by IRC and the chart for wrapping stress coefficient, find the worst combination of stresses at the edge.

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