

## SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE

## EXAMINATION, DECEMBER 2009

CE 04 705 (D)—PAVEMENT DESIGN

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

*Answer all the questions.*

1. (a) Explain the functions of components of Flexible and rigid pavement with neat sketch.
  - (b) Write in detail about the effect of frost action towards the performance of pavement.
  - (c) Explain the steps Involved in the design of Flexible pavements by GI method.
  - (d) Give the Baussinesq's and Burmister's equation for modulus of Elasticity of subgrade with flexible and Rigid bearing plate.
  - (e) How the warping stresses are accounted in the design of Rigid pavement ?
  - (f) Calculate the stresses at Interior edge and the corner region of a cement concrete pavement using Westergaurd's analysis. Use following data : —
    - (i) Wheel load= 4100 kg,  $E_c = 2.1 \times 10^5 \text{ kg/cm}^2$ .
    - (ii) Pavement thickness = 20 cm.
    - (iii) Poisson's ratio of concrete = 0.15.
    - (iv) Modulus of subgrade reaction  $k = 2.5 \text{ kg/cm}^3$ .
    - (v) Radius of contact area (or) Radius of Wheel load distribution  $a = 8.91 \text{ cm}$ .
  - (g) What is the object of pavement evaluation ? Explain how the pavement evaluation can be conducted.
  - (h) List the various structural requirements of both flexible and Rigid pavements
- (8 × 5 = 40 marks)
2. (a) (i) Compare the flexible pavement with rigid pavement among various Issues. (6 marks)
  - (ii) Explain the method of design of Bituminous mix by Marshall method. (9 marks)

*Or***Turn over**

- (b) (i) What is the criteria is designing pavement for vehicles having dual wheels at both ends of rear axle ?

(6 marks)

- (ii) Explain any *one* method with sketch to evaluate the subgrade soil strength.

(9 marks)

3. (a) (i) Discuss the effect of repetition of loads on road pavement and also how to find the equivalent load factor.

(6 marks)

- (ii) Using following daily traffic data, determine design repetition for 25 years for various wheel loads equivalent to 2268 kg wheel loads. Roads in two lane and traffic counted in a day was 10,000. : —

Wheel load in kg	% of total traffic volume
2268	25
2722	15
3175	11
4082	15
4536	9
4993	5

Other Minor Type                      Rest Percentage

Assume that relevant data.

(9 marks)

Or

- (b) (i) C.B.R. value of sub-grade is 4%. Calculate the Total thickness of pavement. Also calculate the thickness of sub-base, base, weaning layer having C.B.R. value of 15%, 80%, 90% respectively. Use IRC accepted C.B.R Curve D.

(7 marks)

- (ii) Using tri-axial method, and following data, calculate pavement thickness. Wheel load 5443 kg, radius of bearing plate 15 cm. Traffic Intensity is 1000 and rainfall 40 cm. Deflection limit is 0.25 cm. Values of Modulli of Subgrade, base and bituminous concrete are 125, 375 and 1125 kg/cm<sup>2</sup>. Assume missing data.

(8 marks)

4. (a) (i) Explain the various types of Joints and their functions in cement concrete pavements. (6 marks)
- (ii) Give the design criteria of the same. (9 marks)

Or

- (b) Design the pavement of a plain cement concrete 7 m wide. Use IRC recommendation wherever applicable. Adopt expansion joint gap 20 mm and maximum variation in temperature between summer and winter is  $40^{\circ}\text{C}$ . Present traffic Intensity is 1050 veh/day of weight more than 3 ton. Modulus of reaction of sub-base is  $7\text{kg/cm}^3$ .  $E$  for concrete  $3 \times 10^5 \text{ kg/cm}^2$ ,  $\mu = 0.15$  and  $\alpha = 15 \text{ cm}$  and design wheel load is 4100 kg. Temperature differential in slab in the region is 17.3, 19.0 and 20.3 for thickness is of 15, 20 and 25 cm respectively. (15 marks)
5. (a) (i) Write a brief note on pavement distress. (6 marks)
- (ii) How the surface condition of pavement can be evaluated? (9 marks)

Or

- (b) (i) What are the various functions of overlay and list the possible combinations of overlay? (6 marks)
- (ii) Deflection studies were carried out on 12 points on a section of flexible pavement by Benkelman beam apparatus during summer using a dual wheel load of 4084 kg and tyre pressure of  $5.6 \text{ kg/cm}^2$  with a temperature of  $37^{\circ}\text{C}$  and the correction factor for subsequent increase in subgrade in  $C$  is 1.2. If the present traffic consists of 1000 commercial veh/day, calculate the thickness of bituminous overlay required for the following deflection values in mm after making necessary leg correction. Use IRC guideline 1.57, 1.50, 1.40, 1.60, 1.70, 1.65, 1.71, 1.55, 1.45, 1.35, 1.52, 1.60 mm. (9 marks)
- [4 × 15 = 60 marks]