53 (CE 502) TREN

2013

(December)

TRANSPORTATION ENGG.

Paper : CE 502

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What are the 3E's of Traffic Engineering ? Explain briefly the various factors which affect the road user characteristic. 5

   (b) Differentiate between Rigid and Flexible pavement. 6

   (c) What is cutback bitumen ? Explain the term M.C and R.C. 4

(d) In a braking test, a vehicle travelling at a speed of 30*kmph* was stopped by applying brakes fully and the skid marks were 5.8*m* in length. Determine the average skid resistance of the pavement surface. 5

2. (a) Discuss concept and derive expression for spacing of expansion and contraction joint in rigid pavement. 10

(b) Explain with sketches how the subsurface drainage system is provided to lower the water table and control seepage flow. Discuss the importance of Highway Drainage system. 10

3. (a) What are the various methods of Road Construction ? Explain the construction procedure for water bound macadam (WBM) Road. 6

(b) Compute the radius of relative stiffness of 15*cm* thick cement concrete slab from the following data. 4

$E = 2{,}10{,}000 kg/cm^2$, Poisson's ratio for concrete = 0.15, Modulus of subgrade reaction = $7.5 kg/cm^3$.

(c) Explain briefly, with sketch, the function and types of construction of : 10

(i) traffic separator

(ii) off road parking facilities.

4. (a) Discuss the relationship between following traffic stream flow characteristic : 5

(i) Speed

(ii) Travel time

(iii) Volume

(iv) Density

(v) Capacity

(b) Why it is essential to study the behaviour of the soil. Briefly explain the properties of Subgrade Soil. 5

(c) Calculate the stresses at interior, edge and corner region of a cement concrete pavement using westergaard's stress equation. Given data are Wheel load = 5100kg, $E = 3\times10^5\ kg/cm^2$ pavement thickness = 18cm, Poisson's ratio = 0.15, Modulus of subgrade reaction $K = 6.0\ kg/cm^3$, Radius of contact area = 15cm. 10

5. *(a)* Explain origin and destination study. What are the various uses of O and D studies ? 6

(b) What is grade separation ? Explain a clover leaf grade separation indicating the flow of traffic with neat sketch. 6

(c) Explain the method of carrying out impact test and abrasion test for stone aggregates. 8

6. *(a)* What are the various types of traffic marking commonly used ? What are the factors on which PCU value depends. 6

(b) A vehicle moving at 45*kmph* speed was stopped by applying the brake and the length of Skid Mark was 14*m*. If the Average skid resistance of the pavement is known to be 70% determine the brake efficiency of the test vehicle. 4

(c) Explain the following terms : 5

(i) Bitumen

(ii) Asphalt

(iii) Tar

(iv) Flakiness index

(v) Elongation Index.

(d) Determine the spacing between contraction joint for $3.5m$ slab width having thickness of $20cm$ and $f = 1.5$ for the plain cement concrete, allowable $S_C = 0.8 kg/cm^2$. 5

7. (a) Determine the warping stress at interior edge and corner region in a $25cm$ thick concrete pavement with transverse joint at $11m$ intervals, and longitudinal joint at $3.6m$ intervals the modulus of subgrade reaction K is $6.9 kg/cm^3$. Assume temperature differential for day condition to be $0.6°C$ per cm slab thickness, assume radius of loaded area as $15cm$ for computing warping stress at the corner, thermal coefficient $= 10 \times 10^{-6}$ per $°C$, modulus of elasticity $= 3 \times 10^5 kg/cm^2$. Poisson's ratio $= 0.15$. 10

(b) The gap of expansion joint in a cement concrete pavement is $2cm$. If the laying temperature is $14°C$ and the maximum slab temperature in summer is $44°C$ calculate the spacing between expansion joint. Assume coefficient of thermal expansion of concrete as 10×10^{-6}. 4

(c) What is traffic rotary ? Calculate the theoretical maximum traffic capacity for a traffic lane with the traffic flow at a stream speed of $40kmph$. Assume $t=0.7$. Average length of vehicle $=5.0m$. 6