HIGHWAY & TRAFFIC ENGINEERING
(CIVL 3103)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) The method of design of flexible pavement as recommended by IRC is
(a) Group Index Method (b) CBR Method
(c) Water Guard Method (d) Benkelman Beam Method.

(ii) As per IRC recommendations, the maximum limit of superelevation for mixed traffic in plain terrain is
(a) 1 in 15 (b) 1 in 12.5
(c) 1 in 10 (d) equal to camber.

(iii) If the brakes of vehicles are effective, the vehicle running at 30km/hr comes to a stop in
(a) 10 metres (b) 12 metres
(c) 15 metres (d) 18 metres.

(iv) The terrain may be classified as rolling terrain if the cross slope of land is
(a) up to 10% (b) between 10% and 20%
(c) between 25% and 60% (d) more than 60%.

(v) The best example of rigid pavement is
(a) Concrete Road
(b) Bituminous Road
(c) Gravel Road
(d) Water Bound Macadam Road.

(vi) For water bound macadam road, in localities of heavy rainfall, the recommended camber is
(a) 2.5% (b) 3%
(c) 4% (d) 2%.

(vii) The result of ring and ball softening point test on asphalt is given in terms of
(a) viscosity (b) time
(c) flow (d) temperature.

(viii) The most suitable equipment for compacting clayey soils is
(a) Smooth wheel roller (b) Pneumatic tired roller
(c) Sheep foot roller (d) Vibrator.

(ix) Which of the following is indicated by a warning sign?
(a) Level crossing (b) No parking
(c) End of speed limit (d) Overtaking prohibited.

(x) In CBR test the value of CBR is calculated at
(a) 2.5 mm penetration only
(b) 5 mm penetration only
(c) 7.5 mm penetration only
(d) both 2.5 mm and 5 mm penetration.

Group – B

2. (a) Discuss the factors on which the construction of camber depends upon.

(b) Calculate the minimum sight distance required to avoid head on collision of two cars approaching from opposite directions at 90 kmph and 60 kmph. Assume reaction time of 2.5 seconds, co-efficient of friction as 0.70 and brake efficiency of 50% in both the cases.

4 + 8 = 12

3. (a) A valley curve is formed by a descending gradient of 1 in 25 meeting an ascending gradient of 1 in 30. Calculate the length of the curve to fulfill both comfort condition and head light sight distance requirements for a design speed of 80 kmph. Assume allowable rate of change of centrifugal acceleration C = 0.6 m/sec^3.

(b) Write a short note on PIEV theory.

8 + 4 = 12

Group – C

4. (a) Using the data given below, calculate the wheel load stresses at (i) interior (ii) edge and (iii) corner regions of a cement concrete pavement using Westergaard's stress equations. Also determine the probable location where the crack is likely to develop due to corner loading.

Wheel load P = 5100 kg
Modulus of elasticity of cement concrete E = 3.0×10^5 kg/cm^2
Pavement thickness h = 18 cm
Poisson's ratio of concrete μ = 0.15
Modulus of subgrade reaction K = 6.0 kg/cm^3
Radius of contact area a = 15 cm

(b) Write short note on vehicle damage factor.

8 + 4 = 12

5. (a) Write short notes on flexible pavement and rigid pavement.

(b) What is Equivalent Single Wheel Load (ESWL)? Describe with a neat sketch.

8 + 4 = 12

Group – D

6. (a) Write a short note on the different type of excavation equipments that are commonly used in highway projects.

(b) Mention the significance and the requirements of highway drainage system.

6 + 6 = 12

7. (a) Write a short note on "Road Safety Audit".

(b) The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is 0.7 m^3/s. Design the cross-section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 2 m and cross slope to be 1 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.5 m/s and Manning's roughness co-efficient is 0.02.

4 + 8 = 12

Group – E

8. (a) What do you mean by passenger car unit (PCU)? What are the factors affecting the PCU values?

(b) Draw a neat sketch of rotary intersection. What are the design factors that are taken into consideration while designing a rotary intersection?

(2 + 4) + (3 + 3) = 12

9. (a) Write short notes on "On-Street" Parking. What are the advantages and disadvantages of traffic signal?

(b) Describe the various measures that are used to decrease the rate of accidents.

(5 + 3) + 4 = 12