HIGHWAY AND TRAFFIC ENGINEERING
(CIVL 2204)

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) Nagpur road plan formulae were prepared by assuming
(a) rectangular or block road pattern
(b) radial or star and block road pattern
(c) radial or star and circular road pattern
(d) radial or star and grid road pattern.

(ii) Camber in the road is provided for
(a) effective drainage (b) counteracting the centrifugal force
(c) having proper sight distance (d) increasing the superelevation.

(iii) The maximum allowable width of any vehicles as per IRC is taken as
(a) 3.5 m (b) 3.75 m (c) 2.44 m (d) 3.80 m.

(iv) For WBM (Water Bound Macadam) roads, in localities of heavy rainfall, the recommended value of camber to be provided is
(a) 1 in 50 or 2.0% (b) 1 in 60 or 1.7%
(c) 1 in 33 or 3.0% (d) 1 in 25 or 4.0%.

(v) A vehicle has a wheel base of 6.5 m. What is the off tracking while negotiating a curved path with a mean radius of 32m?
(a) 0.72 m (b) 0.6 m (c) 0.87 m (d) 0.66 m.

(vi) For circular curve of radius 200 m, the coefficient of lateral friction is 0.15 and design speed is 40 kmph. The equilibrium super-elevation (for equal pressure on inner and outer wheel) would be:
(a) 21.3 (b) 7 (c) 6.3 (d) 4.6.

(vii) Roadway width for National Highway and State Highway (two lanes) as per IRC is
(a) 7.5 m (b) 10 m (c) 12 m (d) 15 m.

(viii) The angularity number of aggregates suitable for road construction lies in the range between
(a) 2-18 (b) 0-6 (c) 5-10 (d) 0-11.

(ix) 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.

(x) Dead slow is
(a) regulatory sign (b) warning sign
(c) informatory sign (d) slope sign.

Group - B

2. (a) Explain camber. What are the objectives of provision of camber in the cross-section of highway geometric design? *[(CO1)(Understand/IOCQ)]*
(b) Calculate the stopping sight distance on a highway at a descending gradient of 2% for a design speed of 80kmph. Assume, coefficient of longitudinal friction (f)= 0.35 and reaction time (t)= 2.5s. *[(CO1)(Analyse/HOCQ)]*
(c) Derive an expression for finding the super-elevation required if the design coefficient of lateral friction is 'f'. *[(CO1)(Analyse/IOCQ)]*

(2 + 2) + 4 + 4 = 12

3. (a) Briefly explain the purpose of providing shoulders in highway geometric design. Provide neat sketches for the same. *[(CO1)(Remember/LOCQ)]*
(b) Mention any three cross-section elements. *[(CO1)(Remember/LOCQ)]*
(c) Explain the importance of friction coefficient/skid resistance in geometric design of highways. Also, state the factors affecting friction between pavements and tyres of vehicles. *[(CO1)(Analyse/IOCQ)]*

(3 + 2) + 3 + 4 = 12

Group - C

4. (a) Explain the following tests on aggregates and also mention their respective IRC recommended values:
(i) Impact test
(ii) Abrasion test. *[(CO2)(Remember/LOCQ)]*
(b) A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standard plate.

Mean settlement values (mm)	0.0	0.26	0.52	0.76	1.02	1.26	1.53	1.76
Load values (kg)	0.0	540	1010	1290	1510	1600	1720	1840

[(CO2)(Analyze/HOCQ)]

(3 + 3) + 6 = 12

5. (a) Write short notes on the following tests of bitumen:
   (i) Penetration test
   (ii) Ductility test
   (iii) Softening point test. *[(CO2)(Remember/LOCQ)]*
   (b) Explain the various components of a flexible pavement with a neat sketch. *[(CO3)(Remember/LOCQ)]*

(2 × 3) + 6 = 12

Group - D

6. (a) Write short note on:
   (i) Earth roads
   (ii) WBM roads. *[(CO2)(Remember/LOCQ)]*
   (b) Illustrate the different types of rigid pavement failures. *[(CO3)(Understand/IOCQ)]*
   (c) What are the requirements of highway drainage? *[(CO3)(Understand/IOCQ)]*

(3 × 2) + 4 + 2 = 12

7. (a) Write a short note on sub-surface drainage. *[(CO4)(Remember/LOCQ)]*
   (b) Describe the different types of flexible pavement failures. *[(CO4)(Remember/LOCQ)]*
   (c) Describe the different types of Transverse joint. *[(CO4)(Remember/LOCQ)]*

4 + 4 + 4 = 12

Group - E

8. (a) What are differences between “Rotary Intersections” and “Roundabouts”? *[(CO5)(Understand/IOCQ)]*
   (b) Draw a neat sketch of rotary indicating all it’s details. *[(CO5)(Remember/LOCQ)]*
   (c) Write a short note on “Passenger Car Unit”. What are the factors affecting “Passenger Car Unit”? *[(CO5)(Remember/LOCQ)]*

3 + 4 + (3 + 2) = 12

9. (a) Write a short note on:
   (i) Origin and Destination study
   (ii) Parking study. *[(CO5)(Remember/LOCQ)]*
   (b) What do you mean by “Level of Service”? *[(CO5)(Remember/LOCQ)]*
   (c) Define “Headway” and “Spacing”. *[(CO5)(Remember/LOCQ)]*

(3 × 2) + 4 + 2 = 12

Cognition Level	*LOCQ*	*IOCQ*	*HOCQ*
Percentage distribution	*67.71*	*21.87*	*10.42*

Course Outcome (CO):

After the completion of the course students will be able to

CIVL 2204.1: Provide the knowledge of Highway Network Planning, Highway alignment and Highway Geometric Design.

CIVL 2204.2: Study different pavement materials and design different types of pavements.
CIVL 2204.3: Building and idea about Highway Construction including the drainage and its maintenance and safety.
CIVL 2204.4: Develop and idea of Traffic engineering, Traffic Signal Design and Design of at grade Intersections:
CIVL 2204.5: Analyse Parking and Accident in Transport System.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*