HIGHWAY AND TRAFFIC ENGINEERING
(CIVL 2204)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) The critical stress is considered in
(a) Surface (b) Sub base layer
(c) Sub grade (d) Both sub grade and surface.

(ii) The development of different statistical measures of various accident related factors gives insight into which of the following factors
(a) Causes of accidents
(b) Location of points at which unusually high number of accidents take place
(c) Identification of hazards
(d) Driver profiles.

(iii) Which of the following is not a type of on-street parking?
(a) Parallel parking (b) Right-angle parking
(c) 30 degree parking (d) Metered parking.

(iv) The main objective of providing a camber is
(a) to make the road impervious
(b) to make the road surface durable
(c) to drain off rain water from road surface, as quickly as possible
(d) all of the above.

(v) The vertical alignment does not influence
(a) sight distance (b) vehicle operation cost
(c) accidents (d) vehicle speed.

(vi) The extra widening of pavement is the sum of
(a) mechanical widening and psychological widening
(b) two times of mechanical widening
(c) two times of psychological widening
(d) mechanical widening and physical widening.

(vii) The most preferred type of transition curve by IRC for highway is
(a) Spiral (b) Cubic parabola
(c) Parabola (d) Leminiscate.

(viii) The best type of interchange can be provided with
(a) Rotary (b) Diamond
(c) Partial cloverleaf (d) Full cloverleaf.

(ix) The time lost by traffic due to traffic friction and traffic control devices is called
(a) Delay (b) Green Time
(c) Red Time (d) Setback Time.

(x) Which of the following is not a factor affecting PCU?
(a) Vehicle characteristics (b) Traffic stream characteristics
(c) Roadway characteristics (d) Design characteristics.

Fill in the blanks with the correct word

(xi) The most raised portion of the pavement is called _____

(xii) Parking accumulation is defined by _____.

(xiii) The survey in which details are covered roughly but not accurately is called _____.

(xiv) The clearance time in a traffic signal is indicated by _____.

(xv) The total shift of a transition curve is given by _____.

Group - B

2. (a) What are the significant recommendations of Jayakar Committee Report? *[(CO1)(Remember/LOCQ)]*

(b) What are the various requirements of an ideal highway alignment? *[(CO2)(Remember/LOCQ)]*

(c) What are the special considerations that are considered for aligning roads on hilly areas? *[(CO1)(Remember/LOCQ)]*

4 + 4 + 4 = 12

3. (a) Explain briefly the factors on which overtaking sight distance depends. *[(CO1)(Understand/LOCQ)]*

(b) Write a short note on stopping sight distance. *[(CO2)(Remember/LOCQ)]*

(c) While aligning a hill road with a ruling gradient of 6%, a horizontal curve of radius 60m is encountered. Find the compensated gradient at the curve. *[(CO1)(Apply/IOCQ)]*

3 + 3 + 6 = 12

Group - C

4. (a) Write a short note on Equivalent single wheel load (ESWL). *[(CO2)(Understand/LOCQ)]*

(b) Compute the radius of relative stiffness of 15cm thick cement concrete slab from the following data:
Modulus of elasticity of concrete = 210000kg/cm^2

Poisson's ratio of concrete = 0.13
Modulus of subgrade reaction, k = (i) 3kg/cm^2, (ii) 7.5kg/cm^2. *[(CO3)(Evaluate/HOCQ)]*

(c) What are the various factors to be considered in pavement design? *[(CO3)(Remember/LOCQ)]*

4 + 5 + 3 = 12

5. (a) Design a flexible pavement by IRC method with the following data:
   (i) Two lane single carriage way
   (ii) Initial traffic in the year of construction = 400 CVPD (sum of both directions)
   (iii) Traffic growth of 7.5%
   (iv) Design life = 15 years
   (v) Vehicle damage factor = 2.5 standard axle per commercial vehicle
   (vi) Design CBR of subgrade soil = 5%. *[(CO3)(Analyse/HOCQ)]*

   (b) What are the differences between a flexible pavement and rigid pavement? *[(CO3)(Apply/IOCQ)]*

10 + 2 = 12

Group - D

6. (a) Explain the various types of failures in rigid pavements and their causes. *[(CO4)(Remember/LOCQ)]*

   (b) Write a short note on Hydrologic analysis which is used for the design of surface drainage system in a highway. *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

7. (a) Explain briefly the construction procedure of earth roads. *[(CO4)(Understand/LOCQ)]*
   (b) Write short note on Transverse joints in cement concrete pavement. *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

Group - E

8. (a) The 15 minute traffic count on cross roads 1 and 2 during peak hour are observed as 178 and 142 vehicles per lane respectively approaching the intersection in the direction of heavier traffic flow. If the amber times required are 3 and 2 seconds respectively for two roads based on approach speeds, design the signal timings by trial-cycle method. Assume an average time headway of 2.5 seconds during green phase. *[(CO6)(Evaluate/HOCQ)]*

   (b) Write short notes on: (i) Origin and destination study, (ii) Traffic volume study. *[(CO5)(Remember/LOCQ)]*

6 + (3 + 3) = 12

9. (a) Draw a neat sketch of a Rotary Intersection. *[(CO5)/Understand/LOCQ)]*
   (b) Explain briefly the various design factors that are to be considered in rotary intersection design. *[(CO5)(Remember/LOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	69.79	8.33	21.88

Course Outcome (CO):

After the completion of the course students will be able to

1. Plan highway networks and Design highway geometrics.
2. Characterize the properties of soil, aggregate, bitumen, and bituminous mixes.
3. Analyze and design rigid and flexible pavement (IRC Method).
4. Understand the principles of construction, maintenance and safety of highways.
5. Conduct traffic studies, analyze traffic data and design intersections.
6. Design traffic signal and analyze parking &accidents.

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