

**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) In water bound macadam roads, binding material, is
    - (a) cement
    - (b) sand
    - (c) aggregates
    - (d) stone dust.
  - (ii) As per IRC specification, the height of the driver's eye above the pavement surface is
    - (a) 0.12m
    - (b) 0.15m
    - (c) 1.2m
    - (d) 1.0m.
  - (iii) Design speed on roads is decided on the basis of the cumulative frequency of
    - (a) 98<sup>th</sup> percentile
    - (b) 85<sup>th</sup> percentile
    - (c) 60<sup>th</sup> percentile
    - (d) 30<sup>th</sup> percentile.
  - (iv) The standard load considered for CBR test of soil for 2.5 mm penetration:
    - (a) 1270 kg
    - (b) 1370 kg
    - (c) 2055 kg
    - (d) 2155 kg.
  - (v) Penetration grade of bitumen like 20/30 is preferred in
    - (a) cold climate
    - (b) hot climate
    - (c) arctic climate
    - (d) mild climate
  - (vi) If cross slope of a country is 10% to 25%, the terrain is classified as
    - (a) plain
    - (b) rolling
    - (c) steep
    - (d) hilly.
  - (vii) If  $ISD=110m$  then the SSD will be:
    - (a) 55 m
    - (b) 60 m
    - (c) 220 m
    - (d) 225 m.

- (viii) Hardness property of road aggregates can be determined by  
(a) impact test (b) abrasion test  
(c) crushing test (d) shape test.
- (ix) The Nagpur road plan in India was started in the year  
(a) 1941 (b)1942 (c)1943 (d)1944.
- (x) Which is the best level of service (LOS) of a roadway among the followings?  
(a) LOS 'A' (b)LOS 'D' (c) LOS 'F' (d) LOS 'E'

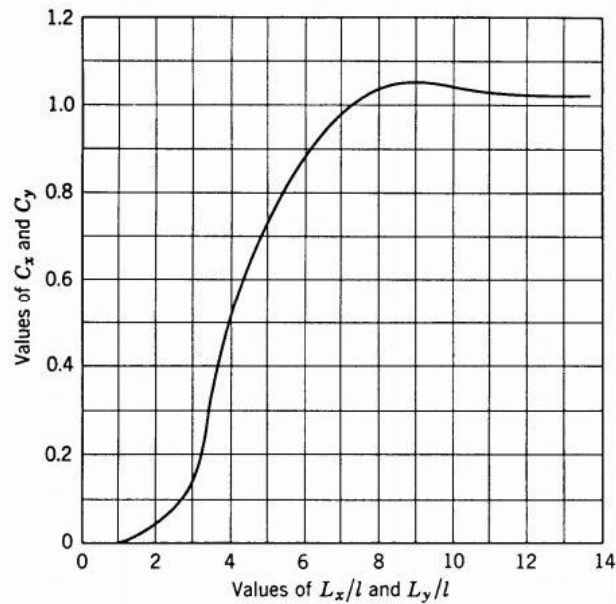
### **Group - B**

2. (a) Write down the difference between : Slip and Skid.  
(b) Write a short note on 'PIEV' theory and superelevation.  
(c) Define camber. In a district where the rainfall is light, rigid pavement is to be constructed of width 7.5 m. What should be the height of the crown with respect to the edges assuming straight line camber?
- 3 + (3 + 3) +(1 +2) = 12**
3. (a) A vertical summit curve is formed at the intersection of two gradients, +3.0 and -6.0 percent. Design the length of summit curve to provide a SSD for a design speed of 100 kmph. Assume the necessary data.  
(b) Write a short note on Bombay road plan.  
(c) What are the factors controlling the highway alignment.  
(d) While aligning a hill road with a ruling gradient of 6 percent, a horizontal curve of 60 m is encountered. Find the compensated gradient at the curve.

$$4 + 3 + 2 + 3 = 12$$

### **Group - C**

4. (a) Determine the warping stresses at interior, edge and corner regions in a 25 cm thick concrete pavement with transverse joints at 11 m interval and longitudinal joints at 3.6 m intervals. The modulus of subgrade reaction (K) is 6.9 kg/cm<sup>3</sup>. Assume temperature differential for day condition to be 0.6 degree per cm slab thickness. Assume radius of loaded area as 15 cm for computing warping stress at corner. Additional data are given as:  $e = 10 \times 10^{-6}$  per °C,  $E = 3 \times 10^5$  kg/cm<sup>2</sup>,  $\mu = 0.15$ .



(b) Write down the desirable properties of aggregate and briefly discuss about one of the relevant laboratory tests of aggregate in the context of road construction.

**6 + 6 = 12**

5. (a) Design a new flexible pavement as per IRC:37-2012 for two-lane undivided carriageway using the data given below:  
 Design CBR value of subgrade = 7.0%, initial traffic on completion of construction = 4500 CV per day, average growth rate = 7.5% per year, design life = 18 years, VDF value = 2.5.

Design table as per IRC 37-2012

CBR	CSA, msa	Total Pavement Thickness, mm	Granular sub-base course, mm	Granular Base course, mm	DBM, mm	BC/SDBC (upto 5 msa), mm
7%	2	470	175	225	50	20
	5	535	210	250	50	25
	10	615	260	250	65	40
	20	640	260	250	90	40
	30	655	260	250	105	40
	50	660	260	250	110	40
	100	685	260	250	125	50
	150	700	260	250	140	50

(b) Write short notes on  
 (I) Tar  
 (II) Bitumen Emulsion

**6 + (3 + 3) = 12**

**Group – D**

6. (a) What are the general types of distresses in bituminous pavement? Discuss about the remedial measures for at least three types of distress.
- (b) What is road safety audit (RSA)? Why is road safety audit needed to be done and for what type of projects?

**6 + (3 + 3) = 12**

- 7.(a) Briefly discuss about the cross-drainage structures and works.
- (b) Write short notes on  
(i) WBM road  
(ii) Mud pumping

**6 + (3+3) = 12**

**Group – E**

8. (a) Explain time-mean speed and space-mean speed with the help of a suitable example.
- (b) Explain the speed-flow-density relation with the help of proper diagrams.
- (c) Discuss the advantages and disadvantages of traffic rotary particularly in the context of traffic condition in India.

**4 + 4 + 4 = 12**

9. (a) Explain the concept of PCU.
- (b) The average normal flow of traffic on cross roads A and B during design period are 550 and 300 PCU per hour, the saturation flow on these roads are estimated as 1340 and 1100 PCU per hour respectively. The all red time required for pedestrian crossing is 12 sec. Design two phase traffic signal with pedestrian crossing by Webster's method.
- (c) Write about the advantage and disadvantage of traffic signals.

**2 + 6 + 4 = 12**

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