

**B.TECH/CE/5<sup>TH</sup> SEM/CIVL 3103/2016**  
**HIGHWAY AND 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) Nagpur road plan formula was prepared by assuming  
(a) rectangular or block road pattern  
(b) radial or star and grid road pattern  
(c) radial or star and block road pattern  
(d) circular road pattern.
- (ii) The shape of the camber, best suited for cement concrete pavements is  
(a) 1 in 60  
(b) 1 in 30  
(c) 1 in 36  
(d) 1 in 48.
- (iii) The function of expansion joint in rigid pavements is to  
(a) relieve warping stresses  
(b) relieve shrinkage stresses  
(c) resist stresses due to expansion  
(d) allow free expansion
- (iv) The most suitable equipment for compacting clayey soils is a  
(a) smooth wheeled roller  
(b) pneumatic tyred roller  
(c) sheep foot roller  
(d) vibrator.
- (v) The stopping sight distance depend upon  
(a) total reaction time of driver  
(b) efficiency of brakes  
(c) speed of vehicle  
(d) all of the above.
- (vi) Which of the following is indicated by a "warning sign"?  
(a) Level crossing  
(b) No parking  
(c) End of speed limit  
(d) Overtaking prohibited.

**B.TECH/CE/5<sup>TH</sup> SEM/CIVL 3103/2016**

- (vii) If the stopping distance is 60m, then the minimum stopping sight distance for two lane, two way traffic is  
(a) 30m (b) 60m (c) 120m (d) 180m.
- (viii) The maximum design gradient for vertical profile of a road is  
(a) ruling gradient (b) limiting gradient  
(c) exceptional gradient (d) minimum gradient.
- (ix) The Maximum width of a vehicle as recommended by IRC is;  
(a) 1.85 m (b) 2.44 m (c) 3.85 m (d) 4.72 m.
- (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) 5.5 mm penetrations.

**Group - B**

2. (a) What is super-elevation? Derive an equation for finding the super-elevation required if the design coefficient of lateral friction is 'f'.  
(b) The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200 m on a certain locality. Calculate the super-elevation needed to maintain this speed. If the maximum super-elevation of 0.07 is not to be exceeded, calculate the maximum allowable speed on this horizontal curve as it is not possible to increase the radius. Safe limit of transverse coefficient of friction is 0.15.  
**(2 + 4) + 6 = 12**
3. (a) Define gradient. What is compensation gradient on horizontal curves? While aligning a hill road with a ruling gradient of 6 %, a horizontal curve of radius 60 m is encountered. Find the compensated gradient at the curve.  
(b) There is a horizontal highway curve of radius 400 m and length 200 m on this highway. Compute the set- back distance required from the centre line on the inner side of the curve so as to provide for  
(i) stopping sight distance of 90 m.  
(ii) safe overtaking sight distance of 300m  
The distance between the centre lines of the road and inner lane is 1.9 m.  
**(1 + 2 + 3) + 6 = 12**

**Group - C**

4. (a) What do you understand by group index? Write down the empirical formula for group index and state the limiting values of each parameter involved in it.
- (b) Calculate thickness of bituminous material using triaxial method.  
 Wheel load = 5100 kg  
 Tyre pressure = 7 kg/cm<sup>2</sup>  
 Traffic co-efficient = 1.25  
 Saturation co-efficient = 0.8  
 E- value of subgrade soil = 90 kg/cm<sup>2</sup>  
 E- value of sub base course = 200 kg/cm<sup>2</sup>  
 E- value of base course = 400 kg/cm<sup>2</sup>  
 E- value of Paving material = 900 kg/cm<sup>2</sup>  
 Assume any other suitable data if required.

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

5. (a) Discuss different types of joints in cement concrete pavement with neat sketches.
- (b) Design a system of dowel bars for a cement concrete slab with the following data:  
 Design wheel load = 4100 kg  
 Load transfer desired = 45%  
 Slab thickness (h) = 220 mm  
 Joint width = 2 cm  
 Permissible flexural stress in dowel bar = 1400 kg/cm<sup>2</sup>  
 Permissible shear stress = 1000 kg/cm<sup>2</sup>  
 Permissible bearing stress on concrete = 100 kg/cm<sup>2</sup>  
 k- value of subgrade = 7.5 kg/cm<sup>3</sup>  
 E - value of concrete = 3 × 10<sup>5</sup> kg/cm<sup>2</sup>  
 Poisson's ratio of concrete = 0.15.

**6 + 6 = 12**

**Group - D**

6. (a) Write a short note on the different types of rollers that are being used for soil compaction.
- (b) Briefly describe the construction procedure of WBM roads.

**6 + 6 = 12**

7. (a) Describe the different types of failures in rigid pavement.  
 (b) Write a short note on the maintenance of a bituminous surface.

**6 + 6 = 12**

**Group - E**

8. (a) Mention the different factors that affect the Passenger Car Unit (PCU) values.  
 (b) Describe the various advantages and limitations of traffic rotary.
9. (a) Write short notes on regulatory signs, informatory signs and warning signs.  
 (b) The consolidated data collected from speed and delay studies by floating car method on a stretch of urban road of length 3.5 kms, running North-South are given below. Determine the average values of volume, journey speed and running speed of the traffic stream along either direction.

**6 + 6 = 12**

Trip No.	Direction of trip	Journey time Min. Sec.	Total stopped delay Min. Sec.	No. of vehicles overtaking	No. of vehicles overtaken	No. of vehicles from opposite direction
1	N-S	6-32	1-40	4	7	268
2	S-N	7-14	1-50	5	3	186
3	N-S	6-50	1-30	5	3	280
4	S-N	7-40	2-00	2	1	200
5	N-S	6-10	1-10	3	5	250
6	S-N	8-00	2-22	2	2	170
7	N-S	6-28	1-40	2	5	290
8	S-N	7-30	1-40	3	2	160

**4 + 8 = 12**