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10CV755

**Seventh Semester B.E. Degree Examination, June/July 2016**  
**Highway Geometric Design**

Time: 3 hrs.

Max. Marks: 100

*Note: Answer FIVE full questions, selecting at least TWO questions from each part.*

**PART – A**

- 1 a. What is PCU? What are factors affecting PCU values? (08 Marks)
- b. The following data were obtained from the spot speed studies carried out at stretch of highway during a certain period of time. Suggest
  - i) Speed limit for regulation of traffic.
  - ii) Lower speed group causing congestion.
  - iii) Speed for design of geometric elements.

Speed range Kmph	No. of vehicles observed	Speed Range kmph	No. of vehicles observed
0 to 10	12	50 to 60	225
10 to 20	18	60 to 70	119
20 to 30	68	70 to 80	43
30 to 40	29	80 to 90	33
40 to 50	204	90 to 100	09

- 2 a. List the pavement surface characteristics and explain briefly. (10 Marks)
- b. Write a note and mention IRC standards:
  - i) Width of formation
  - ii) Right of way-IRC only for open areas. (10 Marks)
- 3 a. Derive an expression for overtaking sight distance. (08 Marks)
- b. Find the minimum sight distance to avoid head-on collision of 2-cars approaching at 90 kmph and 60 kmph. Given :  $t = 2.5$  secs,  $f = 0.7$  and Brake efficiency of 50% in either case. (06 Marks)
- c. The speed of overtaking and overtaken vehicles are at 70 kmph and 40 kmph respectively. Determine overtaking sight distance. Take  $a = 0.99$  m/sec<sup>2</sup>. (06 Marks)
- 4 a. Write a design procedure of evaluating super elevation as per IRC. (06 Marks)
- b. A state highway passing through a rolling terrain has a horizontal curve of radius equal to ruling minimum radius. Design all the geometric features of the curves. Assume :  $V = 80$  kmph, No. of lane = 2 and  $l = 6$  m (14 Marks)

**PART – B**

- 5 a. Define Gradient and its types. (06 Marks)
- b. A vertical summit curve is formed at the intersection of two gradients, +3.0 and -5.0 percent. Design the length of summit curve to provide a stopping sight distance for a design speed of 80 kmph. Assume data as per IRC. (06 Marks)
- c. A valley curve is formed by a descending grade of 1 in 25 meeting an ascending grade of 1 in 30. Design the length of valley curve to fulfil both comfort 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<sup>3</sup>. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42-8 = 50, will be treated as malpractice.

- 6 a. Define unchannelised and channelized intersections. Write a neat sketch, of typical unchannelised and channelized intersections. (10 Marks)  
b. What is intersection at grade? Explain the basic requirements of intersection at grade. (10 Marks)
- 7 a. What are grade separated intersection? Explain their advantages. (08 Marks)  
b. What is rotary intersection? Explain the design factors of rotary. (12 Marks)
- 8 a. What is highway drainage? Explain its requirements. (08 Marks)  
b. The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is  $0.9 \text{ m}^3/\text{sec}$ . Design the cross section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 1.0 m and cross slope to be 1.0 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2 m/sec and Manning's roughness co-efficient is 0.02. (12 Marks)

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