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P.E.S. College of Engineering, Mandya - 571 401
(An Autonomous Institution affiliated to VTU, Belgaum)
Seventh Semester, B.E. - Civil Engineering
Semester End Examination; Dec - 2016/Jan - 2017
Highway Geometric Design

Time: 3 hrs   *Max. Marks: 100*

Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

UNIT - I

1 a. What are the objectives of highway geometric design? Discuss in brief the various geometric elements to be considered in highway design. **10**

b. Explain the term traffic volume. Enumerate the different factors affecting PCO for different design purpose. **10**

2 a. Distinguish between at grade and grade separated junctions. Briefly discuss the basic requirements of intersection at grade. **10**

b. Explain un-channelized and channelized intersections with the help of neat sketches. List the advantages and limitations of un-channelized and channelized intersections. **10**

UNIT - II

3 a. Explain the role of pavement surface characteristics in highway geometric design. Discuss the factors affecting friction between pavements and tyres of vehicles. **10**

b. Define camber. What are the objectives of providing camber? Discuss the factors on which the amount of camber to be provided depends. Specify the recommended ranges of camber for different types of pavement surfaces. **10**

4 a. Draw the cross-section details of a road in embankment. State the IRC specifications for width of carriage way for various classes of roads. **10**

b. Write short notes on :

i) Cycle tracks   ii) Drive ways   iii) Right of way   iv) Road humps. **10**

UNIT - III

5 a. Define 'total reaction time' of driver. List the factors affecting it. **4**

b. Calculate the SSD for a design speed of 60 kmph. What is the SSD, if a rising gradient of 1 in 40 is encountered? Assume $f = 0.35$ and $t = 2.5$ seconds. **8**

c. The speeds of overtaking and overtaken vehicles are 70 and 40 kmph respectively on a two way traffic road. If the acceleration of overtaking vehicle is 0.99 m/s^2, calculate safe OSD. **8**

6 a. Discuss the importance of highway drainage. List the requirements of a good highway drainage system. **10**

b. The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is 0.9 m^3/s. Design the cross-section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 1.0 m cross slope to be 1.0 V to 1.5 H. The allowable velocity of flow in the drain is 1.2 m/s and Manning's roughness coefficient, $n = 0.02$.   10

UNIT - IV

7 a. Explain super elevation. What are the factors on which the design of super elevation depends?   4

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 super elevation should not exceed 7%, calculate the maximum allowable speed on this horizontal curve as it is not possible to increase the radius. Take $f = 0.15$.   8

c. What is 'off-tracking'? Explain with a sketch. Calculate the off-tracking of a vehicle with wheel base 7.0 m, while negotiating a horizontal curve of radius 100 m.   8

8 a. What is a transition curve? What are the objectives of providing a transition curve?   6

b. List the various types of transition curves used in highways. What is an ideal transition curve? Explain.   6

c. Calculate the length of transition curve and the shift using the following data :

Design speed: 65 kmph

Radius of circular curve: 220 m

Use IRC formulae for computations.   8

UNIT - V

9 a. Explain ruling, limiting and exceptional gradients. Specify the values recommended by IRC.   6

b. 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.   6

c. A vertical summit curve is formed at the intersection of two gradients, +3% and -5%. Design the length of summit curve to provide a SSD for a design speed of 80 kmph. Assume any other data missing.   8

10 a. What is traffic rotary? What are its advantages and limitations, in particular reference to traffic conditions in India?   10

b. Briefly explain a grade separated intersection. State the advantages and disadvantages of a grade separated intersection.   10

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