U.S.N ⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)
Seventh Semester, B.E. - Civil Engineering
Semester End Examination; Dec - 2017/Jan - 2018
Highway Geometric Design

Time: 3 hrs   Max. Marks: 100

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.
       ii) Missing data, if any, may be assumed suitably mentioning the same.

UNIT - I

1 a. What are the objectives of highway geometric design? Discuss the various design factors on which the design of highways depends. **10**

 b. Explain the concept of PCU. Enumerate the different factors affecting PCU for different design purpose. **10**

2 a. What are the various types of intersections and bring out the basic principles? **10**

 b. With neat sketches, show few typical patterns of un-channelized and channelized intersections. What are the advantages and limitations of un-channelized and channelized intersections? **10**

UNIT - II

3 a. Explain the importance of friction coefficient in geometric design of highways. State the factors affecting friction between pavements and tyres of vehicles. **10**

 b. Enumerate the factors governing the width of carriage way. Sate the IRC specifications for width of carriage way for various classes of roads. **10**

4 a. Write short notes on :
   i) Traffic separators   ii) Pavement unevenness
   iii) Shoulders   iv) Kerbs. **10**

 b. Draw a typical cross section details of National highway :
   i) In embankment   ii) In cutting. **10**

UNIT - III

5 a. Calculate the minimum sight distance required to avoid head-on collision of two cars approaching from the opposite directions at 90 and 60 kmph. Assume a reaction time of 2.5 s, coefficient of friction of 0.7 and a brake efficiency of 50% in both the cases. **10**

 b. Calculate the safe overtaking sight distance for a design speed of 96 kmph. The average acceleration during overtaking may be assumed as 2.5 kmph/s. Assume all other data as per IRC. **10**

6 a. Discuss the objectives of surface drainage system and subsurface drainage system of roads. **10**

b. The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is 0.9 m³/s. 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 V to 1.5 H. The allowable velocity of flow in the drain is 1.2 m/s and Manning's roughness coefficient is 0.02.   10

UNIT - IV

7. A state highway passing through a rolling terrain has a horizontal curve of radius 230 m with a design speed of 80 kmph. Design the geometric elements superelevation, extra width and transition curve length for the horizontal curve. Assume all other data as per IRC.   20

8 a. With the aid of neat sketches, explain the methods of eliminating camber and introduction of super elevation.   10

b. The radius of a horizontal curve on a roadway is 400 m and length is 200 m. The distance between the centre lines of the road and inner lane is 1.9 m. Compute the set back distances required to provide,   10

  i) Stopping sight distance of 90 m   ii) Safe overtaking sight distance of 300 m.

UNIT - V

9 a. What are the types of longitudinal gradients on roads? Discuss the objectives of each.   10

b. A vertical summit curve is to be designed when two grades, +1/50 and -1/80 meet on a highway. The stopping sight distance and overtaking sight distance required are 180 m and 640 m respectively. But due to site conditions the length of vertical curve has to be restricted to a maximum value of 500 m. Calculate the length of summit curve needed to fulfil the requirements of stopping sight distance, overtaking sight distance and intermediate sight distance and discuss the results.   10

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

b. What are interchange ramps? With sketches, show different types of interchanges.   10

✳ ✳ ✳