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10CV755

**Seventh Semester B.E. Degree Examination, Dec.2018/Jan. 2019**  
**Highway Geometric Design**

Time: 3 hrs.

Max. Marks:100

**Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**  
**2. Assume missing data as per IRC.**

**PART – A**

- 1
  - a. What do you understand by the term design vehicle? How does it affect geometric design? (05 Marks)
  - b. State the IRC values of various design control elements for roads—wherever applicable. (05 Marks)
  - c. Enumerate the concept of PCU in geometric design along with the list of factors affecting PCU. Also present the typical IRC values recommended for rural road in plain terrain. (10 Marks)
  
- 2
  - a. How does the pavement surface characteristics affect the performance of a highway. (06 Marks)
  - b. In a district, where the rainfalls is heavy, state highway (SH) of bituminous concrete pavement and water bound macadam of 7m wide are to be constructed. Calculate the height of the crown with respect to the edges in these two cases. (04 Marks)
  - c. Explain : i) traffic separators and kerbs  
ii) Requirements of ideal road humps. (10 Marks)
  
- 3
  - a. Define SSD and with neat sketches present the requirements of sight distance at curves and intersections. (08 Marks)
  - b. The speed of overtaking vehicle passing in national highway is 100kmph with overtaking acceleration 1.92kmph/sec.
    - i) Calculate the safe OSD
    - ii) Draw neat sketches of overtaking zone
    - iii) Check whether adequate length for OSD is available within 500m where an obstruction exists and if there is no oncoming vehicle. Assume suitable data as per IRC. (12 Marks)
  
- 4
  - a. Explain briefly the effect of centrifugal force on horizontal curve having no super elevation. (06 Marks)
  - b. List the reasons why extra widening is required at horizontal curve. (04 Marks)
  - c. Design all the geometric features of a horizontal curve for a national highway passing through rolling terrain in heavy rainfall area. Assume all the data as per IRC for a ruling minimum radius. Also assume pavement is rotated about the inner edge. (10 Marks)

**PART – B**

- 5
  - a. Explain various types of gradients and grade compensation (10 Marks)
  - b. A vertical curve is formed by a descending gradient of 1 in 50 which meets an ascending gradient of 1 in 30. Design the length of curve to fulfill both comfort condition and head light sight distance requirements for a design speed of 80kmph. Assume  $c = 0.6\text{m/sec}^2$ . Also determine the location of culvert from flatter grade. (10 Marks)



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- 6 a. With neat sketches channelizing island and gap in median at junction. (08 Marks)  
b. Write a note on atgrade junctions. (06 Marks)  
c. Explain the situations at which grade separated intersections and median openings are justified. (06 Marks)
- 7 a. Stating the advantages and disadvantages of a rotary intersection, explain the step by step methods involved in the design. (10 Marks)  
b. With neat sketches explain clover leaf and diamond intersections. (10 Marks)
- 8 a. Explain design procedure of filter material. (05 Marks)  
b. List the importance of good drainage system in highway. (05 Marks)  
c. 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 1.0m and cross slope to be 1V to 1.5H. The allowable velocity of flow in the drain is 1.2m/sec and Manning's coefficient  $n = 0.02$ . (10 Marks)

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