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Seventh Semester B.E. Degree Examination, June/July 2015

Highway Geometric Design

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, selecting
atleast TWO questions from each part.**

PART – A

1. a. Mention certain basic design controls and criteria which govern the geometric features of a highway and explain any two of them. (10 Marks)
- b. Enumerate the concept of PCU in mixed traffic flow on highways. Give PCU values for different classes of vehicles for urban roads. (06 Marks)
- c. Define capacity and write the theoretical formula to calculate capacity. (04 Marks)
2. a. Write short notes on : i) service roads ii) drive ways iii) right of way. (06 Marks)
- b. What is camber? State the objects of providing camber. Give IRC values for different types of roads in heavy and light rainfall areas. (06 Marks)
- c. Mention the factors affecting sleid resistance. (04 Marks)
- d. In a district where the rainfall is heavy major district road of WBM pavement 3.8 m wide and a state highway of bituminous concrete pavement 7.0 m wide are to be constructed, what should be the height of the crown with respect to the edges in these two cases? (04 Marks)
3. a. What is PIEV theory? Explain. (06 Marks)
- b. Mention the factors on which the minimum over taking sight distance required for the safe overtaking. (04 Marks)
- c. The speed 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/sec^2 :
 - i) Calculate safe overtaking sight distance
 - ii) Mention the minimum length of overtaking zone and show the positions of the sign posts. (10 Marks)
4. a. Write note on mechanical widening and psychological widening. (06 Marks)
- b. What is transition curve? Mention the different types? (04 Marks)
- c. Calculate super elevation to be provided for a horizontal curve with radius of 400 m for design speed of 100 kmph in plain terrain. Comment in the results. What is the co-efficient of lateral direction mobilized if super elevation is restricted to 0.07. (06 Marks)
- d. Calculate the values of ruling minimum and absolute minimum radius of horizontal curve of a nation highway in plan terrain. Assume ruling design speed and minimum design speed values as 100 and 80 kmph respectively. Take $e = 0.07$ and $f = 0.15$. (04 Marks)

PART – B

5. a. Explain the following with IRC specification : i) Ruling gradient ii) Minimum gradient iii) Exceptional gradient iv) Limiting gradient. (10 Marks)
- b. While aligning a hill road with a ruling gradient of 6 percent horizontal curve of 60 m is encountered. Find the compensating gradient of the curve. (04 Marks)
- c. A valley curve is formed by descending gradient of 1 in 25 meeting an ascending gradient of 1 in 30. Design the length of valley curve to full fill both comfort condition and head light distance requirement for a design speed of 80 kmph. Assume allowable rate of change of centrifugal acceleration $c = 0.6 \text{ m/sec}^2$. Assume $t = 2.5 \text{ sec}$ $f = 0.35$. (06 Marks)

- 6 a. Mention the principles to be considered in the good design of intersection. (05 Marks)
b. Differentiate between at-grade and grade separated junction. (04 Marks)
c. What is median? What are the functions of medians? (06 Marks)
d. Define channelization. Mention the purposes of channelization. (05 Marks)
- 7 a. Draw a neat diagram of rotary intersection (round about) and show the different elements? (10 Marks)
b. What is clover leaf interchange and what are its advantages? Draw a neat diagram of clover leaf. (06 Marks)
c. Explain the advantages and disadvantages of an over pass. (04 Marks)
- 8 a. Mention the importance of highway drainage. (05 Marks)
b. Draw the section of surface drainage system in urban roads and explain briefly. (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 trapezoidal section to be 1.0 m and cross slope to be 1.0 vertical and 1.5 horizontal. The allowable velocity of flow in the drain is 1.2 m/sec and mannings roughness co-efficient is 0.02. (10 Marks)
