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Seventh Semester B.E. Degree Examination, Dec.09/Jan.10

Highway Geometric Design

Time: 3 hrs.

Max. Marks:100

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

PART - A

- 1 a. Discuss briefly the various factors which affect the road user characteristics and their effects on traffic performance. (08 Marks)
- b. The following data were obtained from the spot-speed studies carried out at a sketch of highway during a certain period of time. Suggest :
 - i) Speed limit for regulation of traffic
 - ii) Lower speed group causing congestion, and
 - iii) Speed for design of geometric elements.

Speed range (kmph)	No. of vehicles	Speed range (kmph)	No. of vehicles
0- 10	08	60 - 70	155
10 - 20	15	70 - 80	120
20 - 30	60	80 - 90	93
30 - 40	95	90 - 100	27
40 - 50	210	100 - 110	11
50 - 60	270	110 - 120	03

(12 Marks)

- 2 a. List the pavement surface characteristics and explain briefly :
 - i) Friction and factors affecting friction (10 Marks)
 - ii) Camber and effects of providing steep camber.
- b. Write a note on the following and mention the IRC standards :
 - i) Width of carriageway (10 Marks)
 - ii) Traffic separators.
- 3 a. Define SSD, ISD and OSD. (03 Marks)
- b. Derive an expression for calculating the overtaking sight distance (OSD) on a highway. (09 Marks)
- c. Two vehicles A and B are moving in the same direction with speeds of 100 kmph and breaking efficiency of 70% and 50% respectively. An object is seen by both the drivers on the road approximately at a distance of 250 m. Find :
 - i) Which vehicle will meet with an accident and
 - ii) If the accident is to be avoided, what is the breaking efficiency required? (08 Marks)
- 4 a. Explain briefly the effect of centrifugal force on horizontal curve having no super elevation. (07 Marks)
- b. Calculate the extra widening required on single lane one way road having horizontal curve of radius 80 m, wheel base 6.1 m. (03 Marks)
- c. Calculate the setback distance on national highway having horizontal curve of radius 300 m and length 180m. Assume speed 80 kmph and coefficient of friction 0.35. (10 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.

PART – B

- 5 a. With neat sketches, explain summit and valley curves and the various cases when these are formed while two different gradients meet. (10 Marks)
- b. A valley curve is formed by a descending gradient of 1 in 50 which meets an ascending gradient of 1 in 40. Design the total length of the valley curve, if the design speed is 80 kmph. So as to fulfill both comfort condition and head light sight distance for night driving, after calculating SSD required. (10 Marks)
- 6 a. With neat sketches, explain :
i) Unchannelized intersections
ii) Channelized intersections. (10 Marks)
- b. Write short notes on any two :
i) Speed change lanes.
ii) Features of channelizing islands.
iii) Gap in medians at junctions. (10 Marks)
- 7 a. List the advantages and disadvantages of rotary intersections. (10 Marks)
- b. List the various types of four-leg interchanges and explain with neat sketches :
i) Diamond interchange
ii) Clover-leaf interchange. (10 Marks)
- 8 a. Explain with neat sketches, how the sub surface drainage system is provided to :
i) Lower the water table
ii) Control seepage flow. (10 Marks)
- b. The maximum quantity of water to be discharged by the two side drains on a highway section is $1.5 \text{ m}^3/\text{sec}$. Design the cross-section and side slope of trapezoidal drain assuming the bottom width of section to be 1.00 m and side slope 1 in 1.5. The allowable velocity of flow in the drain is 1.1 m/sec and Manning's roughness coefficient is 0.02. (10 Marks)
