USN

10CV755

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Highway Geometric Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. List and explain the geometric control factors which affect the design of highways. **(10 Marks)**

b. Spot speed studies were carried out at a certain stretch of highway and the consolidated data collected are given below.

Speed range	No. of vehicles
0 – 10	12
10 – 20	18
20 – 30	68
30 – 40	89
40 – 50	204
50 – 60	255
60 – 70	119
70 – 80	43
80 – 90	33
90 – 100	09

Determine (i) Upper speed and lower speed limit for regulation of traffic (ii) Design speed (iii) Median speed. **(10 Marks)**

2 a. Explain the role of pavement surface characteristics in highway geometric design. State the factors affecting friction between pavements and tyres of vehicles. **(10 Marks)**

b. With neat figure, explain the design of road humps as per IRC provisions. **(10 Marks)**

3 a. Define SSD. Derive an expression for finding Stopping Sight Distance at level and at grades. **(10 Marks)**

b. The speed of overtaking and overtaken vehicles are 70 kmph 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.
(iii) Draw a neat sketch of the overtaking zone and show the position of the sign posts. **(10 Marks)**

4 a. Explain briefly the effect of centrifugal force on horizontal curve having no super elevation. **(10 Marks)**

b. There is a horizontal highway curve of radius 400 m and length 200 m on the highway. Compute the set-back distance required from the centre line on the inner side of the curve so as to provide for,
(i) Stopping sight distance of 90 m.
(ii) Safe overtaking sight distance of 300 m.
The distance between the centre lines of the road and the inner lane is 1.9 m. **(10 Marks)**

PART – B

5 a. 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 grade of 1 in 25 meeting an ascending grade of 1 in 30. Design the length of the valley curve to fulfill both comfort condition and head light sight distance requirements for a design speed of 80 kmph. Assume allowable rate change of centrifugal acceleration C = 0.6 m/sec^2. **(10 Marks)**

6 a. List the advantages and disadvantages of ROB and RUB. **(10 Marks)**

b. With neat sketches, explain,

(i) Unchannelized island.

(ii) Channelized island. **(10 Marks)**

7 a. List the advantages and disadvantages of rotary intersection. **(10 Marks)**

b. The width of approaches for a rotary intersection is 12 m. The entry and exit width at the rotary is 10 m. Table below gives the traffic from the four approaches, traversing the intersection. Find the capacity of the rotary. **(10 Marks)**

Approach	Left turn	Straight	Right turn
North	400	700	300
South	350	370	420
East	200	450	550
West	350	500	520

8 a. What are the requirements of good drainage system? **(10 Marks)**

b. The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is 0.9 m^3/sec. 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 vertical to 1.5 horizontal. The allowable velocity of flow in the drains is 1.2 m/sec and Manning's roughness co-efficient is 0.02. **(10 Marks)**

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