CBCS SCHEME

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Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Highway Engineering

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing one full question from each module.*

Module-1

1 a. Explain various characteristics of Road Transport. **(05 Marks)**
   b. Explain briefly the salient features of third twenty year road development plan. **(05 Marks)**
   c. There are three alternate proposals of road plans for a district in Karnataka state. Suggest the order of priority for planning road based on the maximum utility approach. Assume utility units of 0.5, 1.0, 2.0 for the three population ranges and utility of 1.0 and 10.0 per 1000 tonnes of agricultural and industrial products served.

Proposal	Road length in km	Number of villages served pollution range			Productivity in 1000 tonnes	
		<2000	2001-5000	>5000	Agriculture	Industrial
A	200	80	40	10	90	12
B	250	75	45	12	105	22
C	300	85	50	18	110	26

(06 Marks)

OR

2 a. Explain the role of transportation in social and economic development of the country. **(05 Marks)**
   b. Explain briefly the following :
      (i) Jayakar Committee   (ii) Indian Road Congress (IRC)   (iii) Central Road Fund (CRF) **(05 Marks)**
   c. The area of a certain district in India is 13,400 sq.km and there are 12 towns as per 1981 census. Determine the lengths of different categories of roads to be provided in third twenty year road development plan. **(06 Marks)**

Module-2

3 a. What are the basic requirements of an ideal highway alignment? List and explain briefly. **(05 Marks)**
   b. Briefly explain the role of pavement surface characteristics in highway geometric design. **(05 Marks)**
   c. Calculate the safe stopping sight distance for design speed of 50 kmph. For (i) Two way traffic on two lane road (ii) Two way traffic on a single lane road. Assume f = 0.37 and reaction time, t = 2.5 sec. **(06 Marks)**

OR

4 a. Briefly explain how MAP study is helpful in the alignment of new highway. **(05 Marks)**
   b. Give the details of drawings to be prepared in highway project and discuss briefly. **(05 Marks)**
   c. The radius of a horizontal circular curve is 100 m. The design speed is 50 kmph and the design co-efficient of lateral friction is 0.15.
      (i) Calculate the super elevation required if full lateral friction is assumed to develop
      (ii) Calculate the co-efficient of friction needed if no super elevation is provided.
      (iii)Calculate the equilibrium super-elevation if the pressure on inner and outer wheels should be equal. **(06 Marks)**

Module-3

5 a. List and explain the desirable properties of subgrade soil. **(05 Marks)**
   b. List and explain the various design factors to be considered for pavements. **(05 Marks)**
   c. A load penetration values of CBR tests conducted on a specimen of a soil sample are given below. Determine the CBR value of soil, if 100 divisions of load represents 190 kg and in the calibration chart of proving ring. **(06 Marks)**

Penetration of plunger, in mm	0.0	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0	7.5	10.0	12.5
Load dial readings (Divisions)	0	8	15	23	29	34	37	43	48	57	63	67

OR

6 a. Explain the desirable properties of aggregates to be used in pavement construction. **(05 Marks)**
   b. Explain the significance of ESWL in pavement design. **(05 Marks)**
   c. Calculate the stresses at interior, edge and corner regions of a cement concrete pavement using Westergaard's stress equation. Use the following data; wheel load, $P = 5100$ kg, Modulus of elasticity, $E = 3 \times 10^5$ kg/cm^2, Pavement thickness, $h = 18$cm, Poisson's ratio of concrete, $\mu = 0.15$, Modulus of subgrade reaction, $k = 6$ kg/cm^3, Radius of contact area, $a = 15$cm. **(06 Marks)**

Module-4

7 a. Briefly explain the different types of pavement construction. **(08 Marks)**
   b. Explain the construction steps for cement concrete pavement slab. **(08 Marks)**

OR

8 a. Explain the construction steps for water bound macadam roads. **(08 Marks)**
   b. Write a short note on the following :
      (i) Bituminous macadam   (ii) Bituminous concrete   (iii) Prime coat   (iv) Seal coat
      (08 Marks)

Module-5

9 a. What are the requirements of highway drainage system? **(05 Marks)**
   b. Explain the various road user benefits of highway improvements. **(05 Marks)**
   c. The maximum quantity of water expected in one of the open longitudinal drain on clayey soil is 0.9 m^3/sec. Design the cross-section of trapezoidal drain, assuming the bottom width of the trapezoidal section to be 1 m and cross slope to be 1 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2 m/sec. **(06 Marks)**

OR

10 a. Briefly explain the types of cross drainage structures. **(05 Marks)**
   b. Describe the various methods of economic analysis of a highway. **(05 Marks)**
   c. Compare the annual costs of two types of pavement structures (i) WBM with thin bituminous surface at total cost of Rs.2.2 lakhs per km, life of 5 years, interest at 10%, salvage value of Rs.0.9 lakhs after 5 years; Annual average maintenance cost of Rs. 0.35 lakhs per km and (ii) Bituminous macadam base and bituminous concrete surface, total cost of Rs. 4.2 lakhs per km, life of 15 years, interest at 8%, salvage value of Rs. 2 lakhs at the end of 15 years ; Annual average maintenance cost Rs.0.25 lakhs per km. **(06 Marks)**

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