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**Sixth Semester B.E. Degree Examination, July/August 2022**  
**Highway Engineering**

Time: 3 hrs.

Max. Marks: 100

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

**Module-1**

- 1 a. Discuss the role of transportation in national development. (06 Marks)
- b. Compare road transportation with other modes of transportation. (06 Marks)
- c. The area of a certain backward district is 13400 km<sup>2</sup> and there are 12 towns as per 2020 census. Determine the length of different categories of roads by third road development plan overall density 82 km/100 sq.km. (08 Marks)

**OR**

- 2 a. With neat sketches, explain different road patterns. (06 Marks)
- b. List and explain briefly the recommendation of Jayakar Committee. (06 Marks)
- c. There are three alternate proposals of road plans for a district of Karnataka State. Identify 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, 5.0 per 1000 tonnes of agricultural and industrial products served.  
Industrial products served = 1000 t - 10.

Proposal	Road length km	Number of towns and villages served with population range			Productivity served in 1000 tonnes	
		< 2000	2001 - 5000	5001 - 10000	Agricultural	Industrial
A	500	100	150	40	150	20
B	700	270	350	82	300	35
C	900	290	430	96	430	45

(08 Marks)

**Module-2**

- 3 a. Explain the basic requirements of an ideal alignment of a road between two terminal stations. (06 Marks)
- b. Discuss the various steps in a new highway project. (06 Marks)
- c. Calculate the minimum sight distance required to avoid a head-on collision of two cars approaching from the opposite directions at 90 and 60 kmph. Assume a reaction time of 2.5 seconds, coefficient of friction of 0.7 and a brake efficiency of 50% in either case. (08 Marks)

**OR**

- 4 a. Discuss with sketches the different shapes of cross slope or camber. (06 Marks)
- b. Explain PIEV theory as applied to highway geometric design. (06 Marks)
- c. Calculate the extra widening required for a pavement of width 7m on a horizontal curve of radius of the longest base of wheel expected on the road is 7.0 m. Design speed is 70 kmph. (08 Marks)

**Module-3**

- 5 a. Explain the desirable properties of road aggregated in brief. (06 Marks)
- b. With a neat sketch, explain aggregate crushing test. (06 Marks)
- c. Differentiate between Tar and Bitumen. (08 Marks)

OR

- 6 a. What is ESWL? Explain the significance in road design. (06 Marks)  
 b. Draw the typical cross section of highway flexible pavement and explain the function of each one of these. (06 Marks)  
 c. A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to the mean settlement readings are given below. Determine the modulus of subgrade reaction for the standard plate.

Mean settlement values (mm)	0.0	0.24	0.52	0.76	1.02	1.23	1.53	1.76
Load values kg	0.0	460	900	1180	1360	1480	1590	1640

(08 Marks)

**Module-4**

- 7 a. Explain Rothfutch's method of proportioning of materials. (06 Marks)  
 b. List the factors to be considered for the selection of base course and surface course. (06 Marks)  
 c. Explain the construction of cement concrete pavement slab by cement grouted layer with its specifications. (08 Marks)

OR

- 8 a. With sketches explain: (i) Power shovel (ii) Dragline (06 Marks)  
 b. What is seal coat? What are its functions? (06 Marks)  
 c. Discuss the advantages and disadvantages of cement concrete pavements. (08 Marks)

**Module-5**

- 9 a. Discuss the importance of highway drainage. (08 Marks)  
 b. List the requirements of highway drainage system. (06 Marks)  
 c. The maximum quantity of water expected in one of the longitudinal drains on clayey soil is  $0.9 \text{ m}^3/\text{sec}$ . Design the cross section and the longitudinal slope of trapezoidal drain assuming the bottom width of trapezoidal section to be 1.0 m and the cross slope to be 1.0 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2 m/sec and Manning's roughness coefficient as 0.02. (06 Marks)

OR

- 10 a. Discuss the various components of quantifiable and non-quantifiable benefits to the road users due to highway development project. (06 Marks)  
 b. Discuss the benefit cost ratio method. (06 Marks)  
 c. Calculate the annual cost of stretch of highway from the following particulars.

Item	Total cost Rs. in lakhs	Estimated life years	Rate of Interest (%)	CRF
Land	12.0	100	6	0.06018
Earth work	9.0	40	8	0.08386
Bridges culverts	7.5	60	8	0.08080
Pavement	14.0	15	10	0.13147

The average cost of maintenance of the road is 1.5 lakhs per year.

(08 Marks)

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