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Fifth Semester B.E. Degree Examination, May 2017 Transportation Engineering - I

Time: 3 hrs.

Max. Marks:100

**Note: 1. Answer any FIVE full questions, selecting atleast TWO questions from each part.
2. Missing data, if any, may be assumed suitably.**

PART - A

1.
 - a. What are the advantages and disadvantages of different modes of transportation? (08 Marks)
 - b. Explain briefly the contributions of Indian Road Congress and Central Road Institute in the road development of India. (06 Marks)
 - c. Discuss the role of transportation in the development of a country. (06 Marks)

2.
 - a. Write a note on road pattern. (06 Marks)
 - b. Outline the essential features of Road development plan vision – 2021. (04 Marks)
 - c. There are five alternate proposals of road plans for a backward district. The details are given below. Justify with reasons which proposal is the best, assuming, utility units of 0.5, 1.0, 2, 4 and 8 for the five population ranges and utility units of 1.0 and 5 per 1000t of agricultural and industrial products served. (10 Marks)

Proposal	Total road length KM	No. of towns and villages served with population range					Productivity in thousand tonnes	
		<2000	2001-5000	5001-10000	10001-20000	>20000	Agri.	Industrial
P	500	100	150	40	20	3	150	20
Q	600	200	250	68	28	3	220	25
R	700	270	350	82	36	4	300	35
S	800	280	410	91	41	4	400	42
T	900	290	430	96	44	4	430	45

3.
 - a. Explain briefly the various factors governing the highway alignment. (08 Marks)
 - b. Explain the various factors governing geometric design of a highway. (06 Marks)
 - c. The speeds of overtaking and overtaken vehicles on a two way traffic road are 90 kmph and 65 kmph respectively. The acceleration of overtaking vehicle is 3.25 kmph/sec, calculate the safe overtaking sight distance. (06 Marks)

4.
 - a. List the objects of providing super elevation and extra widening of pavement on horizontal curves. (06 Marks)
 - b. A NH passing through a flat terrain has a horizontal curve of radius equal to the ruling minimum radius. If the design speed is 100 kmph, calculate the (i) Design super elevation (ii) Extra widening (iii) Length of transition curve by making suitable assumptions. (08 Marks)
 - c. 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 valley curve to fulfill both comfort condition and head light sight distance requirements for a design speed of 80 kmph. Assume allowable rate of change of centrifugal acceleration $C = 0.6 \text{ m/sec}^2$. (06 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. What are the desirable properties of subgrade soil? Explain. (06 Marks)
b. Explain CBR test conducted on soil specimen in laboratory. (08 Marks)
c. A plate load was conducted on a soaked subgrade during monsoon season using a plate dia of 30 cm. The load values corresponding to the mean settlement dial readings are given. Determine the modulus of subgrade reaction for the standard plate.

Mean settlement value, 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

(06 Marks)

- 6 a. What is ESWL? Explain its significance in pavement design. (06 Marks)
b. Explain the steps involved in the design of flexible pavement as per IRC:37-2001. (06 Marks)
c. Determine the warping stresses at interior, edge and corner of a 25 cm thick cement concrete pavement with transverse joints at 5.0 m interval and longitudinal joints at 3.6 m intervals. The modulus of subgrade reaction, k is 6.9 kg/cm^3 and the radius of loaded area is 15 cm. Assume max. temperature differential during day to be 0.6°C per cm slab thickness (for warping stresses at interior and edge) and max. temperature differential of 0.4°C per cm slab thickness during the night (for warping stress at the corner). Additional data are as under: $e = 10 \times 10^{-6}$ per $^\circ\text{C}$, $E = 3 \times 10^5 \text{ kg/cm}^2$, $\mu = 0.15$, $C_x = 0.88$, $C_y = 0.54$. (08 Marks)

- 7 a. Explain procedure for construction of wet mix macadam and bituminous concrete. (10 Marks)
b. Explain with neat sketch any two methods of surface drainage. (05 Marks)
c. Explain with sketches how the subsurface drainage system is provided to lower the water table and control the seepage flow. (05 Marks)

- 8 a. What are the factors which affect the vehicle operation cost? (06 Marks)
b. What are the various tangible and intangible benefits of highway improvements? (06 Marks)
c. Calculate the annual cost of stretch of highway from the following particulars:

Item	Total cost ₹ in lakhs	Estimated life, years	Rate of Interest %
Land	35.0	100	6
Earthwork	40.0	40	8
Bridges, Culverts and Drainage	50.0	60	8
Pavement	100.0	15	10
Traffic signs and road app.	15.0	5	10

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

(05 Marks)
