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10CV56

Fifth Semester B.E. Degree Examination, June/July 2015
Transportation Engineering - I

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART - A

1 a. What are the social effects of transportation? (06 Marks)
   b. What are the advantages and disadvantages of airways? (06 Marks)
   c. What are the objectives of IRC and Central Roads Research Institute? (08 Marks)

2 a. With sketches indicate different road patterns. (06 Marks)
   b. Indicate the details to be collected in : i) Traffic surveys   ii) Engineering surveys, while planning a highway. (06 Marks)
   c. The area of district is 8400km^2. There are 9 towns with population greater than 5000. Calculate the length of NH, SH, MDR, ODR + VR as par 3rd 20 year road plan. (08 Marks)

3 a. Briefly explain how map study is helpful in the alignment of new highway. (06 Marks)
   b. The width of pavement is 7.5m and parabolic camber of 1 in 40 is to be provided. Design the parabolic profile of the pavement surface. (06 Marks)
   c. A vehicle is moving at 55kmph on a single lane pavement of width 4mts on level surface. The reaction time is 2.3secs and coefficient of longitudinal friction is 0.39. Determine the intermediate sight distance. (08 Marks)

4 a. Design the length of transition curve for a speed of 65 kmph on a 2 – lane highway with a width of 7.0 mts. The radius of the curve is 220 mts. The super elevation is provided by raising the outer edge with respect to inner edge. The rate of raising the outer edge is 1 in 150 in open country. The wheel base is 6.1 mts. (12 Marks)
   b. An up gradient of 1 in 18 meets another up – gradient of 1 in 48. Design the length of the vertical curve to be provided for a SSD of 70 mts. Mention the type of curve provided. (08 Marks)

PART - B

5 a. The CBR test results are as follows :

Load in kgs	0	2	4	9	20	34	49	74	92	118	125
Penetration in mm	0	0.5	1	1.5	2	2.5	3	4	5	7.5	10

Apply correction and determine the CBR value of the soil. (08 Marks)
   b. The results of soil test is as follows :

Sieve size 0.074mm	% age passing is 45%
Liquid Limit	38 %
Plastic Limit	27 %

Determine the Group Index and classify the soil as per HRB system. Discuss its suitability as subgrade material. (08 Marks)
   c. Define cut back bitumen. What is SC, MC and RC cutback bitumen? (04 Marks)

6 a. Design the bituminous pavement with the following data :
      4 – lane divided carriageway.
      Traffic in each direction = 5600 CVD ;   Design life = 9 yrs ; CBR = 5% ;
      Traffic growth rate = 8% ; Vehicle damage factor = 4.5 ; Distribution factor = 0.75.
      Indicate pavement composition. Also, after 4 years determine the thickness of DBM and BC
      to be laid.   **(10 Marks)**

  b. Determine warping stress at interior, edge and corner region for the following data.
      Slab thickness = 25 cm ; Slab size = 3.6 × 11m ; Modulus of subgrade reaction
      = 6.9kg/cm^3 ; Temperature differential = 0.6^{0}C per cm ; Radius of area of contact,
      a = 15cm ; e = 10 × 10^{-6}/^{0}C ; E = 3 × 10^5 kg/cm^2 ; μ = 0.15.   **(10 Marks)**

7 a. Mention the specification of materials and construction procedure for Wet Mix Macadam.
        (08 Marks)

  b. What are the requirements of highway drainage system?   **(04 Marks)**

  c. The sieve analysis of subgrade soil is as follows :

Sieve size mm	4	2	1	600μm	300μm	150μm	75μm
% age passing	100	88	70	52	25	10	5

      Size of perforation in drain pipe = 2.5mm. Design the filter material for
      i) Permeability condition   ii) Prevent piping condition.   **(08 Marks)**

8 a. Mention factors affecting vehicle operation cost dependent on time.   **(04 Marks)**

  b. Analyse the economics by Benefit – Cost Ratio method for proposal A, B and C. **(06 Marks)**

	A	B	C
Highway cost	1, 76, 527	3, 81, 900	3, 75, 100
Road user cost	32, 57, 857	28, 73, 025	27, 52, 345

  c. Calculate the Annual cost of a stretch of highway

Particulars	Cost in lakhs	Life in years	Rate of S. int %
Right of way	140	100	7
Earth work	90	40	8
Bridges	85	70	8
Pavement	160	12	9

      Maintenance cost is Rs 12 lakhs per year.   **(10 Marks)**

Table 1 : Pavement design catalogue for traffic range 10 -150 msa

Cumulative Traffic msa	Total Pavement thickness mm	CBR 5%		
		Pavement composition		
		Bituminous surface		Granular base and sub base mm
		BC mm	DBM mm	
10	660	40	70	Base = 250
20	690	40	100	
30	710	40	120	Sub base = 300
50	730	40	140	
100	750	50	150	
150	770	50	170	

Table 2 : Values of coefficient C

$\frac{L_x}{\ell}$ or $\frac{L_y}{\ell}$	1	2	3	4	5	6	7	8	9	10	11	12 & > 12
C_x or C_y	0	0.04	0.175	0.44	0.72	0.92	1.03	1.075	1.08	1.075	1.05	1.03

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