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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Civil Engineering

Semester End Examination; May/June - 2019

Highway Engineering

Time: 3 hrs *Max. Marks: 100*

Note: *i) Answer FIVE full questions, selecting ONE full question from each unit.*

ii) Missing data, if any may suitably assumed. iii) Use of IRC-37-2001 is permitted.

UNIT - I

1 a. What are the advantages and disadvantages of different modes of transportation? 6

b. Explain briefly the following : 6

i) Indian Roads Congress (IRC) ii) Central Road Fund (CRF)

c. The area of district is 8400 m^2. There are 9 towns with population greater than 5000. Calculate the length of NH, SH, MDR and ODR + VR as per third twenty year road plan. 8

2 a. Define saturation system of road planning. 6

b. Outline the essential features of road development plan vision-2021. 6

c. There are four alternate proposals P, Q, R and S as given below. Suggest the order of priority for phasing based on the utility units 0.25, 0.5, 1 and 2.5 for the four population ranges and 1.00 per 1000 tonnes of agricultural and industrial products served. 8

Proposal	Total road length km	Number of villages served with population range				Total Agricultural and industrial production in 1000 tonnes
		1001 - 2000	2001 - 2000	5001-10000	>10000	
P	300	160	80	30	6	200
Q	400	200	90	60	8	270
R	500	240	110	70	10	315
S	550	248	112	73	12	335

UNIT - II

3 a. Explain the various factors governing geometric design of a highway. 10

b. The speeds of overtaking and over taken vehicles are 85 and 65 kmph respectively on a two way traffic road. The average acceleration during overtaking may be average assumed as 0.99 m/s^2; 10

i) Calculate safe overtaking sight distance

ii) What is the minimum length of overtaking zone?

iii) Draw a neat sketch of overtaking zone and show the positions of the sign posts

4 a. List the object of providing super elevation and extra widening of pavement on horizontal curves. 6

b. Design the super elevation at the highway curve having radius of 300 m. The design speed may be taken as 100 kmph. 6

Contd…2

c. Calculate the length of transition curve at the horizontal curve of radius 300 m. For a design speed of 80 kmph by three methods using following data : 8

i) Rate of introduction of super elevation = 1 in 150

ii) Total width of pavements at curve = 7.6 m

UNIT - III

5 a. Explain CBR test conducted on soil specimen in laboratory with neat sketch. 8

b. What are the tests conducted to judge the desirable properties and suitability of the following highway materials : 6

i) Road aggregates ii) Bitumen binder

c. A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponidng to the mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standrad plate. 6

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

6 a. Distinguish between bitumen and tar. 4

b. Explain procedure for construction of wet mix macadam. 8

c. Explain the construction step for cement concrete roach. 8

UNIT - IV

7 a. Differentiate between Flexible and Rigid pavement. 4

b. Explain the components of flexible pavement with typical cross section. 8

c. Design the flexible pavement for construction of a new highway (NH / TWO lane / Single carriageway) with the following data as per IRC:37-2001 :

i) Number of commercial vehicles as per last count = 1000 CVPD 8

ii) Period of construction = 3 years iii) Design life = 3 years

iv) Annual growth rate = 8% v) Design CBR of sub grade soil = 6%

8 a. Explain various joints provided in the cement concrete pavement with neat sketches. 10

b. Explain the factors that affect design and performance of highway pavements. 10

UNIT - V

9 a. List the requriment of an highway drainage system. 6

b. Explain the methods of sub-surface drainage to control the seepage flow and capliiary rise of water. 8

c. Write a brief note on the importance of highway maitenance works. 6

10 a. Brief out the causes of deferioration and damages to road pavements. 10

b. List and explain the types of highway maintenance works. 10

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