



# 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 - 2018 Highway Engineering

Time: 3 hrs

Max. Marks: 100

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

### UNIT - I

- 1a. Discuss the relative role, advantages and disadvantages of various modes of transportation. 10
- b. Explain briefly the various surveys to be carried out before planning a highway system for a given area. Mention the various plans to be prepared after planning surveys are carried out. 10
- 2a. Explain briefly how master plan is prepared and phased in road development program. 10
- b. With neat sketches, explain the various factors controlling the alignment of roads. 10

### UNIT - II

- 3 a. Explain the objectives of providing superelevation at horizontal curves. What are the factors on which the design of super elevation depends? Discuss the maximum and minimum superelevation. 10
- b. A horizontal curve on a national highway passing through a plain terrain is having a radius of 400 m. Design the geometric elements super elevation and length of transition curve for the following data : 10
- Design speed = 100 kmph, length of wheel base = 6 m, rate of introduction of super elevation = 1 in 150 pavement is rotated about the inner edge and width of pavement = 0.7 m.
- 4 a. A two-lane highway having a horizontal curve of radius 400 m and length 260 m. Calculate the set-back distance required to satisfy the SSD and OSD criteria. Assume, longitudinal friction coefficient = 0.35, maximum over taking acceleration = 1.92 kmph/s and total width of pavement = 7.62 m. 10
- b. Design a valley curve at the junction of a downward gradient of 1 in 30 and level stretch, if the design speed is 100 kmph. 10

### UNIT - III

- 5 a. Explain the desirable properties of road aggregates. List the various test on road aggregates and indicate the permissible values to be used in road construction. 10
- b. Explain the desirable properties of bitumen used in road construction. List the various tests on bitumen and indicate the permissible values to be used in road construction. 10
- 6 a. Explain the method of construction wet mix macadam base course. 10
- b. Enumerate the steps in the construction of cement concrete pavements. 10

### UNIT - IV

- 7 a. Give a sketch showing the various layers in pavement, generally adopted in India. What are the functions and importance of each of these layers? 8
- b. Explain Flexible and Rigid pavements and bring out the points of differences. 6
- c. Design a flexible pavement for a two lane undivided roadway for the following data : 6
- CBR of subgrade soil = 5%; Initial traffic = 4450 CVPD; Growth rate = 6%;  
Average VDF = 3.14; Design life = 15 years and construction; Period = 2 years

Contd...2

- 8 a. Discuss Westergaard’s concept of temperature stresses in concrete pavement. 10
- b. The following data is given for a cement concrete pavement :
- Spacing of transverse joint = 10 m; Width of pavement = 7 m; Wheel load = 4000 kg; Contact pressure = 5 kg/ cm<sup>2</sup>; Modulus of elasticity of concrete = 3x10<sup>5</sup> kg/cm<sup>2</sup>; Poisson’s ratio = 0.15; Thermal coefficient = 8 x 10<sup>-6</sup> per °C; Modulus of subgrade reaction = 4 kg/ cm<sup>3</sup>; Maximum difference of temperature = 20 °C; Coefficient of friction at interface = 1.5. Find the magnitude of wheel load stresses and temperature stresses, if the thickness of slab is 25 cm. 10

**UNIT - V**

- 9 a. What are the objectives of highway maintenance? Classify different types of Highway maintenance works and mention the functions of each. 10
- b. List the different causes of distress in flexible pavement and its maintenance measures. 10
- 10 a. With a neat sketch, explain how the subsurface drainage system is provided to lower the water table, control seepage flow and control of capillary rise. 10
- b. The maximum quantity of water to be discharged by a side drain on a highway is 0.7 m<sup>3</sup>/s. Design the side drains for the following conditions :
- Silty loam soil with maximum permissible velocity of flow = 0.8 m/s 10
- Roughness coefficient = 0.03
- Cross section - Trapezoidal section with a 1.0 m bottom width and cross slope of 1.0 V to 1.5 H.

Pavement Design Catalogue					
Cumulative Traffic (msa)	Total Pavement Thickness (mm)	PAVEMENT COMPOSITION (mm)			
		Bituminous Surfacing		Granular Base	Granular Sub-base
		Wearing Course	Binder Course		
CBR 5%					
1	430	20 PC	-----	225	205
2	490	20 PC	50 BM	225	215
3	530	20 PC	50 BM	250	230
5	580	25 SDBC	55 DBM	250	250
10	660	40 BC	70 DBM	250	300
20	690	40 BC	100 DBM		
30	710	40 BC	120 DBM		
50	730	40 BC	140 DBM		
100	750	50 BC	150 DBM		
150	770	50 BC	170 DBM		

