



## 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; June - 2017**

**Highway Engineering**

*Time: 3 hrs*

*Max. Marks: 100*

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

### UNIT - I

- |      |   |   |
|------|---|---|
| 1 a. | What are the various requirements of an ideal highway alignment? Discuss and explain with sketches the various factors controlling the alignment of roads.  | 8 |
| b.   | What are the various surveys to be carried out before planning a highway system for a given areas? Explain briefly.   | 6 |
| c.   | What are the major policies and objectives of third 20-year road development plan?  | 6 |
| 2 a. | Discuss the scope of Highway Engineering.   | 6 |
| b.   | Explain briefly the various stages of work in a new highway Project.  | 6 |
| c.   | The area of a certain district in India is 13,400 M.km and there are 12 towns as per 1981 census. Determine the length of different categories of roads to be provided in this district by the year 2001. | 8 |

### UNIT - II

- |      |   |   |
|------|---|---|
| 3 a. | Explain camber. What are the objects and recommended values for different types of road surfaces?   | 6 |
| b.   | Explain sight distance and factors causing restrictions to sight distance.  | 8 |
| c.   | Calculate the safe overtaking sight distance for a design speed of 96 kmph. Assume all other data suitably.   | 6 |
| 4 a. | Write a note on Off-tracking.   | 4 |
| b.   | While aligning a highway in a built up area, it was necessary to provide a horizontal circular curve of radius 325 m. The design speed is 65 kmph, length of wheel base of largest truck is 6.0 m and width of pavement is 10.5 m. Design the following geometric features:<br>i) Super elevation    ii) Extra widening of pavement    iii) Length of transition curve. | 8 |
| c.   | How do you determine the length of summit curve and valley curve?   | 8 |

### UNIT – III

- |      |   |   |
|------|---|---|
| 5 a. | What are the object of compaction and factors on which compaction depend? | 6 |
| b.   | Explain CBR and the test procedure in the laboratory.                     | 8 |

- c. Explain the functions of Stone aggregates as pavement materials and its desirable properties and tests. 6
- 6. a. Write down the construction steps for water bound macadam road. 10
- b. Enumerate the steps in the construction of cement concrete pavements. 10

**UNIT-IV**

- 7 a. Briefly outline the advantages and limitations of flexible pavements. 8
- b. What are the objects of highway pavement design? 6
- c. Design a new flexible pavement for a two lane undivided carriageway using the following data:
 

Design CBR value of sub grade	= 5.0%	
Initial traffic on completion of construction	= 300 cv per day	6
Average growth factor rate	= 6.0 % per year	
Design life	= 10 years	
VDF value	= 2.5	

- 8 a. Explain Flexible and Rigid pavements and bring out the point of difference. 10
- b. Using the data given below, calculate the wheel load stresses at,
  - i) Interior            ii) Edge            iii) Corner regions of CC Pavement using Westergaard's stress equations.

Also determine the probable location where the crack is likely to develop due to corner loading.

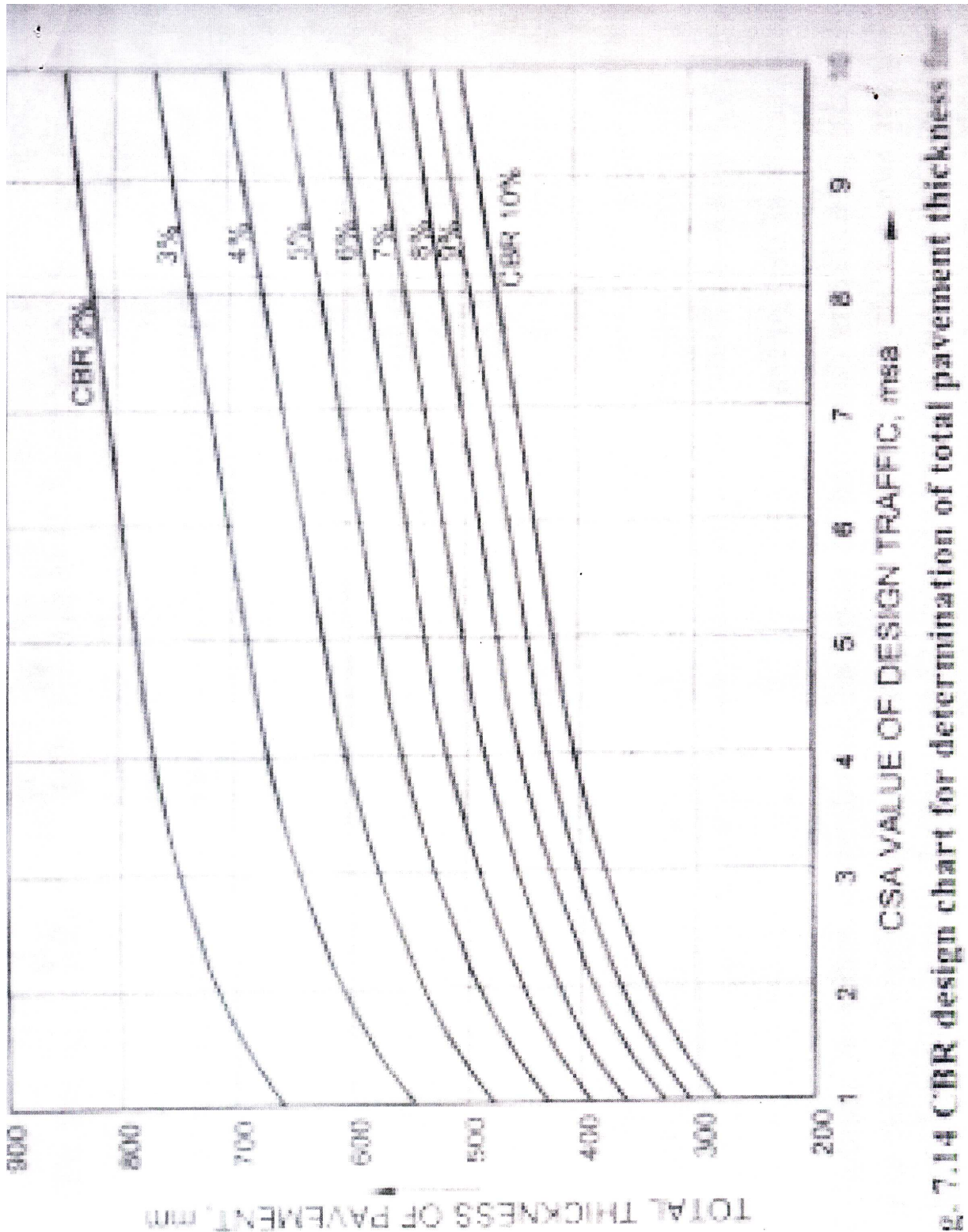
- |  |  |    |
|--|--|----|
| Wheel load                               | P = 5100 kg                                | 10 |
| Modulus of elasticity of cement concrete | E = 3.0x10 <sup>5</sup> kg/cm <sup>2</sup> |    |
| Pavement thickness                       | h = 18 cm                                  |    |
| Poisson's ratio of concrete              | μ = 0.15                                   |    |
| Modulus of sub-grade reaction            | K = 6.0 kg/cm <sup>3</sup>                 |    |
| Radius of contract area                  | a = 15 cm                                  |    |

**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. Discuss the importance of highway drainage. 6
- b. Explain with sketches how the subsurface drainage system is provided to lower the water table. 6

- c. The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is  $0.9 \text{ m}^3/\text{s}$ . Design the cross section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 1.0 m and cross-slope to be 1.0 V to 1.5 H. The allowable velocity of flow in the drain is 1.2 m/s and Manning's roughness coefficient is 0.02.

8



2. 7.14 CBR design chart for determination of total pavement thickness for

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