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

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Dec. - 2015

Highway Engineering

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*
ii) Assume missing data suitably.

UNIT - I

1 a. What are the various modes of transportation? Discuss their relative role, advantages and disadvantages. 10

b. Explain briefly how master plan is prepared and phased in road development program. 10

2 a. Explain with sketches the various factors controlling the alignment of roads. 10

b. Explain briefly the various stages of work in a new highway project. 10

UNIT - II

3 a. A state highway with a design speed of 80kmph is passing through a rolling terrain. Calculate the radius of curve, absolute minimum sight distance and length of transition curve for the following data:
Longitudinal friction coefficient = 0.35
Rate of introduction of super-elevation = 1 in 150
Pavement is rotated about the inner edge
All other data may suitably assume as per IRC guidelines. 10

b. The design speed of a two-lane single carriage way is 65 kmph. The radius and length of a horizontal curve is 400 m and 200 m respectively. Calculate the set-back distance for the requirements of stopping sight distance and overtaking sight distance. Assume total width including ultra width as 7.6 m. 10

4 a. A vertical curve is to be designed when two grades +2.0% and -1.25% meet on a highway with a design speed of 100 kmph. Due to site conditions, the length of vertical curve has to be registered to maximum of 500 m. Calculate the length of curve needed to fulfill the requirements of stopping sight distance and overtaking sight distance or at least intermediate sight distance and hence comment on the results. 10

b. Explain summit and valley curves and the various cases when these are formed while two different gradients meet. Discuss the design requirements of summit and valley curves. 10

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UNIT - III

5 a. Explain the desirable properties of road aggregates. List the various tests on road aggregates and indicate the permissible values to be used in road construction. 10

b. Explain CBR and laboratory test procedure to obtain CBR. How are the results of the test obtained and interpreted? 10

6 a. Mention the method of configuration and quality control for a granular sub-base layer. 10

b. Mention the configuration steps and quality control tests for the configuration of CC pavements slab. 10

UNIT - IV

7 a. What are the various factors to be considered in pavement design? Discuss the significance of each. 10

b. Give a sketch showing the various layers in pavement, generally adopted in India. What are the functions and importance of each of these layers? 10

8 a. Discuss Westergaard's concept of temperature stresses in concrete pavement. 10

b. Calculate the wheel load stresses at interior, edge and corner regions of a cement pavement using Westergaard's stress equations for the following data:

Wheel load = 5100 kg, pavement thickness = 18 cm, Radius of contact = 15 cm modulus of elasticity of cement concrete = $3x10^5$ kg/cm^2, Poisson's ratio of concrete = 0.15, modulus of subgrade reaction = 6 kg/cm^3. 10

UNIT - V

9 a. What are the different types of localised distresses in bituminous pavements? Mention the general causes. 10

b. List various types of structural distresses that develop in cement concrete pavements. Mention the features and causes of these distresses. 10

10 a Discuss the importance of highway drainage. What are the requirements of a good highway drainage system? 10

b. Explain with sketches how the subsurface drainage system is provided to lower the water table and control seepage flow. 10

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