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ANNA UNIVERSITY
COLLEGE OF ENGINEERING, GUINDY
B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATION, NOV/DEC 2013
CIVIL ENGINEERING BRANCH
FIFTH SEMESTER
CE 9305 - HIGHWAY ENGINEERING

Time : 3 Hours

Max Marks : 100

The relevant catalogue of the IRC Code 37-2001 shall only be given on demand. The entire Code should not be permitted.

PART -A

10 x 2 = 20 Marks)

1. What is the prime role of the Indian Roads Congress?
2. State any four recommendations of the Jayakar Committee for road development in India.
3. What is the lag distance for a design speed of 100 km/h?
4. A vertical summit curve is formed at the intersection of two gradients +3.0 and - 5.0. Calculate the deviation angle.
5. State the concept of California Bearing Ratio in the design of flexible pavements.
6. What is the main point of difference in the structural behavior of the rigid pavement as compared to the flexible pavement?
7. What do you mean by 80/100 grade bitumen?
8. Why are joints provided in cement concrete roads?
9. What is the concept of pavement serviceability?
10. What is mud pumping in rigid pavements? Name any one factor which causes it.

PART-B (5 X 16 = 80 Marks)

11. i) Explain any three obligatory points and illustrate with neat sketches how they control highway alignments. (10)
- ii) Calculate the Head Light Sight Distance and Intermediate Sight Distance for a highway with a design speed of 65 km/h. Assume $f = 0.36$, $t = 2.5$ sec. (6)

12.a.i) Derive an equation for finding the super-elevation at a curved alignment. (8)

ii) The radius of a horizontal circular curve is 240 m. The design speed is 80 km/h. The design coefficient of lateral friction is 0.15.

- Calculate the super-elevation required if full lateral friction is assumed to develop
- Calculate the coefficient of friction needed if no super-elevation is provided
- Calculate the equilibrium super-elevation if the pressure on inner and outer wheels be equal. (8)

(Or)

12.b.i) Derive an expression for calculating overtaking sight distance on a highway. (8)

ii) Find out the length of a transition curve for a two-lane pavement with an extra widening on a horizontal curve with a radius of 200m. The allowable rate of change of centrifugal acceleration is 0.6 m / sec^3 ; design speed: 65 km / h; allowable rate of introduction of super-elevation: 1 in 100. (8)

13.a.i) Explain the following concepts with reference to the design of flexible pavements :

- Lane distribution factor
- Vehicle damage factor (6)

ii) Design the flexible pavement for the construction of a new highway with the following data:

- Category of road - Four Lane Dual Carriageway
- Number of commercial vehicles in the year of completion of construction - 5600 commercial vehicles per day per direction
- Annual growth rate of commercial vehicles - 8%
- Design life - 15 years
- Design CBR of sub-grade soil - 5% (10)

(Or)

13.b. i) Explain the method stipulated by the Indian Roads Congress (I.R.C) to compute design traffic for rigid pavements. (4)

ii) Briefly outline the methodology suggested by the I.R.C., for the design of rigid pavement. (12)

14.a. Explain any four properties of good aggregates used for bituminous construction and describe any one test to evaluate its suitability. How do aggregate properties affect the service behavior of bituminous surfacing?

(Or)

14.b. Discuss requirements of materials and construction steps for the following methods of bituminous construction.

- i) Penetration Macadam
- ii) Bitumen Bound Macadam
- iii) Bituminous Carpet
- iv) Bituminous Concrete

15.a. Write in a tabular statement and explain with neat sketches symptoms, causes and treatment for the following types of defects in bituminous roads.

- i) Alligator Cracks
- ii) Rutting
- iii) Corrugations
- iv) Potholes

(Or)

15.b. Illustrate with neat sketches the method of pavement evaluation using Benkelman Beam.
