
B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS

NOVEMBER / DECEMBER 2012

16

CIVIL ENGINEERING BRANCH

FIFTH SEMESTER – (REGULATIONS 2008)

CE 9305 – HIGHWAY ENGINEERING

(Copies of relevant Design Chart and Pavement Design Catalogue of the IRC : 37 – 2001 alone need to be given. The entire Code Book should not be permitted)

Time: 3 Hours **Max. Marks: 100**

Instructions

1. **Answer ALL Questions**
2. **Draw neat sketches wherever required**

PART – A (10 x 2 = 20 Marks)

1. Why is Macadam's method of road construction considered better and scientific?
2. State any two observations you would make while on reconnaissance survey in respect of a proposed highway.
3. State the classification of urban roads as per the Indian Roads Congress and draw a typical cross section of any one urban class.
4. What is meant by super-elevation and why is it considered essential for modern traffic?
5. What is California Bearing Ratio? State its use in pavement design.
6. Draw the cross section of a rigid pavement and enumerate the function of each component.
7. What do you understand by 80/100 bitumen?
8. What is the necessity of hair-pin bends in hill roads? Specify any two of their geometric design standards.
9. List any four factors on which skid resistance offered by a pavement depends.
10. Name any two methods of pavement evaluation and state the concept of any one of them.

PART – B (5 x 16 = 80 Marks)

11. Illustrate with neat sketches any four factors, which influence highway alignment.

12.a.i) Derive an expression to calculate the overtaking sight distance at a highway.

ii) The design speed of a particular road with a gradient of 1 in 40 is 65 km/h. Find the stopping sight distance for the ascending and descending gradient. Assume the reaction time as 2.5 sec. and the design coefficient of friction as 0.35.

(Or)

12.b.i) Derive an equation for finding the super-elevation required, if the design coefficient of lateral friction is f.

ii) The design speed of a highway is 80 km/h. The radius of a horizontal curve is 200m. Calculate the super-elevation needed to maintain this speed. Calculate the maximum allowable speed on this horizontal curve as it is not possible to increase the radius, if the maximum super-elevation of 0.07 is not to be exceeded. Safe limit of transverse coefficient of friction is 0.15.

13.a.i) Briefly explain the IRC recommendations in respect of Vehicle Damage Factor (VDF) and lane distribution of commercial traffic over the carriage way in the design of flexible pavement. (6)

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

- Two-lane single carriageway
- Number of commercial vehicles as per last count = 1000 / day
- Period of construction = 3 years
- Traffic growth rate per annum = 8%
- Design life = 15 years
- VDF = 3.5 (Standard axles per commercial vehicle)
- Design CBR of sub-grade soil = 10%
- Lane Distribution Factor = 75% (10)

(Or)

13.b.i) Explain the following terms in the design of rigid pavements.

- Wheel load
- Design Traffic (6)

ii) Describe the construction process of rigid pavements. (10)

14.a. Briefly explain any four desirable properties each of road aggregates and bitumen and enumerate corresponding tests to judge their suitability. Specify acceptable values of test results.

(Or)

14.b.i) Calculate the length of a transition curve and the shift using the following data:

- Design Speed = 65 km/h
- Radius of circular curve = 220m
- Allowable rate of introduction of super-elevation (pavement rotated about centre line) = 1 in 150
- Pavement width including extra widening = 7.5 m (6)

ii) Explain with neat sketches how the surface water is collected and disposed off in urban roads. (5)

iii) Explain the process for the construction of bituminous concrete roads. (5)

15.a. Explain with neat sketches, causes and treatment of the following defects of bituminous pavement.

i) Alligator and reflection cracks
ii) Rutting and Corrugations
iii) Potholes and raveling
iv) Fatty surface and hungry surface
v)

(Or)

15.b. Describe with a neat sketch the principle, procedures and uses of Benkelman Beam.