

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]  
(2125)

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**B. Tech 6th Semester Examination**

**Highway Engineering (OS)**

CE-6004

**Time : 3 Hours**

**Max. Marks : 100**

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all select one question from each sections A, B, C and D and all the sub-parts of questions in section E are compulsory.

**SECTION - A**

1. (a) Briefly outline the main features of various road patterns commonly in use. Explain the star and grid pattern with the help of sketches. (10)
- (b) Compare the Nagpur road plan and twenty year road plan; discuss merits of each. (10)
2. (a) What are the different stages of planning and construction of new highway project? (10)
- (b) Write short notes on:
  - (i) Obligatory points.
  - (ii) Reconnaissance survey. (5×2=10)

**SECTION - B**

3. (a) Discuss the objective of providing a transition in horizontal alignment. What are the different types of transition curves commonly adopted in horizontal alignment of road? (7+3=10)

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- (b) A valley curve is formed by a descending grade 1 in 22.5 meeting a rising grade of 1 in 25. Design the length of valley curve to be comfortable as well as to leave adequate head light sight distance at a speed limit of 60kmph. The reaction time is 2.5 sec,  $f=0.38$ , height of head light above ground as 0.8 m and beam angle  $1.5^\circ$  upward. (10)

4. (a) Discuss with the help of diagram the highway cross-section elements. (10)
- (b) Determine the total width of a pavement on a horizontal curve on a new state highway to be aligned along plane terrain with ruling minimum radius for following data:
  - (i) ruling design speed is 100kmph
  - (ii) max value of super elevation is 0.07 and skid resistance is 0.15.Assume other data suitably. (3+7=10)

**SECTION - C**

5. (a) Explain the level of service concept while deciding the design capacity of a road. (10)
- (b) Estimate the basic capacity of a traffic lane at a speed of 60kmph and assume following data:

All vehicles are of average length of 6.1m

Average reaction time is 2.5 sec.

Coefficient of longitudinal friction is 0.35.

No gradient. (10)

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6. (a) Show the conflict points at the intersection of following types :
- (i) Cross roads, both two way.
  - (ii) Cross roads, one way.
  - (iii) T-intersection, both two way.
  - (iv) Y-intersection, one one way. (4×4=16)
- (b) Compare angle parking with parallel parking. (4)

**SECTION - D**

7. (a) Explain the desirable properties and tests of aggregates to be used in different types of pavement construction. (10)
- (b) Explain the test procedure of Marshall's method of bituminous mix design. (10)
8. (a) Explain CBR and the test procedure for lab and field tests. How are the tests results obtained and interpreted?(14)
- (b) What are bitumen emulsions? Discuss the relative advantages of emulsions over cutback. (4+2=6)

**SECTION - E**

9. (a) Compare:
- (i) Channelized and un-channelized intersections. (2)
  - (ii) Polymer modified bitumen (PMB) and crumb rubber modified bitumen (CRMB). (2)
- (b) Explain in brief the relevance of PIEV theory of reaction time. (2)

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- (c) What is off tracking and curve resistance for turning vehicles on a horizontal curve? (2)
- (d) What is the relevance of equivalent wheel load? (2)
- (e) State the classification of roads as per Nagpur Road plan. (2)
- (f) The radius of horizontal circular curve is 80m. The design speed is 45kmph and the design coefficient of lateral friction is 0.15. Determine superelevation required if full lateral friction is assumed to develop. (2)
- (g) What is setback distance? (2)
- (h) List any three methods of designing fixed isolated signals. (2)
- (i) Discuss the relevance and method of measuring pavement surface unevenness. (2)