

Reg No : ..... Name : .....



**MAR ATHANASIOUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech Degree Examination, May 2026

Course Code: B24CE2T06

Course Name: HIGHWAY AND PAVEMENT ENGINEERING

Use of IRC -37 and IRC -38 permitted

Max. Marks: 100

Duration:3 Hours

**PART - A: 30 Marks (10 Qns x 3 Marks)**

**Answer all questions**

1. What is road roughness? How does it affect riding quality?
2. Explain the following terms in a highway section. (i) Shoulder (ii) Right of way.
3. What is the purpose of providing transition curves on the horizontal alignment of highways?
4. Explain the term deviation angle in vertical alignment of highways.
5. Define the term space headway and state its mathematical relationship with density.
6. Explain the following terms in traffic signal design. (i) Cycle (ii) Interval
7. Differentiate Maximum Wheel Load and Contact Pressure . Identify the pavement design aspects controlled by maximum wheel load and tyre pressure.
8. List out the reliability levels provided in IRC:37-2018 performance models. When is 90% reliability used?
9. Evaluate the functional difference between a Prime Coat and a Tack Coat in terms of their placement and bonding objectives.
10. Explain the importance of providing tie bars in longitudinal joints.

**PART - B: 70 Marks (5 Qns x 14 Marks)**

**Answer any One full question from each module.**

**Module 1**

11. Discuss the detrimental effect of highway systems on environment.

OR

12. (a) What are the economic, operational and environmental implications of alignment in a highway project?

(6 marks)

(b) What are the guiding principles to be considered while designing the highway alignment? (8 marks)

### Module 2

13. Derive the expression for computing superelevation on a curve of radius  $R$ , velocity  $v$  and coefficient of transverse friction  $f$ .

OR

14. The speed of overtaking and overtaken vehicles in a two-way traffic road are 75 and 40 kmph respectively.
- i) Calculate safe overtaking sight distance for given data. Assume acceleration of overtaking vehicle as  $1.0 \text{ m/s}^2$  (6 marks)
- ii) Draw a neat sketch indicating the positions of required sign posts for the above designed overtaking zone. (3 marks)
- iii) Assuming this OSD needs to be provided on a summit curve formed by an ascending grade of 3% and descending grade of 5%, compute the length of curve required. (5 marks)

### Module 3

15. (a) Explain the following types of grade separated intersections using a neat sketch illustrating the traffic flow. Indicate the potential conflict locations in them. (i) Trumpet (ii) Full cloverleaf (7 marks)
- (b) What are the different design factors to be considered while rotary intersection design. (7 marks)

OR

16. a) Distinguish between the following types of traffic signs. Provide examples for each (i) regulatory signs (ii) warning signs (iii) informatory signs (9 marks)
- b) Explain different types of pavement markings and their purposes (5 marks)

### Module 4

17. a) Explain Desirable properties of bitumen binder. (7 marks)
- b) Explain a test to assess the elastic property of bitumen. (7 marks)

OR

18. a) Explain the Viscoelastic Property of Bitumen under different loading conditions. (6 marks)
- b) Explain the different types of bitumen grading systems with their significance in pavement construction. (8 marks)

### Module 5

19. a) Explain the parameters in Westergarrds analysis. (6 marks)
- b) Compute the radius of relative stiffness of 25cm thick concrete slab using following data: Modulus

of elasticity of cement concrete =  $3 \times 10^5 \text{ kg/cm}^2$ , Poisson's Ratio for concrete = 0.15, Modulus of Subgrade Reaction.  $K = 20 \text{ kg/cm}^3$  (8 marks)

OR

20. Explain the mechanism, causes, identification, and prevention of the following flexible pavement failures: (a) Alligator cracking (b) Rutting (c) Shear failure cracking

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