Code No: R2021015 **R20** SET - 1

II B. Tech I Semester Supplementry Examinations, July - 2023
HIGHWAY ENGINEERING
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Explain the necessity and objective of highway planning and list the methods of road classification. [7M]

b) Define highway alignment. Explain the essential requirements considered as guiding principles for an ideal highway alignment. [7M]

Or

2 a) Outline the main features of various road patterns in common use. Explain with sketch the radial or star and grid pattern. [7M]

b) Discuss the special considerations which must be observed for hill-road alignment? [7M]

UNIT-II

3 a) Determine the minimum stopping sight distance that should be provided to a vehicle coming down 6% gradient for the following given data: [7M]
   i. Design speed = 55 kmph
   ii. Reaction time of driver = 2.1 sec
   iii. Coefficient of friction between tire and road surface = 0.5.

b) Calculate the length of overtaking sight distance (OSD) for the two-lane straight level road for a design speed of 60 kmph. Assume other necessary data. [7M]

Or

4 a) The radius of a circular curve is 120 m, and the design speed is 60 kmph. Taking the design coefficient of lateral friction as 0.015, calculate the following: [7M]
   i. The superelevation required if full lateral friction is assumed to develop.
   ii. The coefficient of friction is needed if no superelevation is provided.
   iii. The equilibrium super elevation is if the pressure on the inner and outer wheels is equal.

b) What do you mean by 'Geometric design of highway'? List various geometric elements considered in highway design with a neat sketch. [7M]

UNIT-III

5 a) Explain the total reaction time of the driver and factors on which it depends? Explain PIEV theory. [7M]

b) Discuss why it is necessary to provide a transition curve and a circular curve? Recall the merits and demerits of the transition curve. [7M]

Or
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6 a) Assume that two vehicles P and Q of weights 3 tonnes and 5 tonnes, respectively, approaching each other collide at right angles, P from West and Q from South. After the collision, A skids in the direction N 40° W and B in the direction N 60° E. The skid distances of P and Q before collision are 36m and 22m, respectively, and after collision 16m and 35m, respectively. If the average skid resistance of the pavement is 0.52, calculate the original speeds of the vehicles. [7M]

b) What are the details collected in O & D survey? Describe the most commonly adopted methods of the OD survey. [7M]

UNIT-IV

7 a) While discussing the importance of traffic studies, describe how the traffic volume data is presented and the results are used in traffic engineering. [7M]

b) Discuss the use of traffic signals? What are their advantages and disadvantages. [7M]

Or

8 a) Discuss the recommendations of the IRC 37-2018 for the CBR method of flexible pavement design? Discuss briefly. [7M]

b) List out the types of pavements with neat cross-section details, functions and requirements of different components of pavements. [7M]

UNIT-V

9 a) List various tests for judging the suitability of road aggregates. Discuss the objects of carrying out these tests and their advantages and limitations. [7M]

b) Explain the following: Roller compacted Concrete, Distresses in the flexible pavement, Resilient Modulus and Modulus of Subgrade Reaction. [7M]

Or

10 a A highway concrete pavement is 25 cm thick with transverse joints at 12 m and longitudinal joints at 3.6 m intervals. The modulus of subgrade reaction is 2.8 kg/cm^3. Determine the warping stresses at the interior, edge and corner regions taking the following data: [7M]

- Temperature differential for day conditions = 0.5° C/cm slab thickness
- Radius of loaded area = 15 cm
- Thermal coefficient of concrete = 10 × 10–6/° C
- Modulus of elasticity of concrete = 3 × 105 kg/cm^2
- Poisson's ratio of concrete = 0.15

b Using Westergaard's equations, calculate the stresses at the interior, edge, and corner regions of a cement concrete pavement for the following data: [7M]

- Wheel load = 4000 kg
- Slab thickness = 15 cm
- The radius of wheel load distribution = 15 cm
- Modulus of elasticity of concrete = 2.1 × 105 kg/cm^2
- Poisson's ratio of concrete = 0.15
- Modulus of subgrade reaction = 2.8 kg/cm^3