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

II B. Tech I Semester Regular Examinations, Feb/March - 2022
HIGHWAY ENGINEERING
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions Carry **Equal** Marks

1 a) Discuss how the roads help in the growth of economic prosperity and the overall development of a country. [7M]
b) Define alignment and list out eh factors affecting the same and list out the engineering survey e required for the finalization of 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) List the objects and factors affecting highway geometric design? List various geometric elements considered in highway design. Discuss any two in detail. [7M]

3 a) Calculate the maximum allowable speed on a horizontal curve of radius 360 m if the maximum permissible value of the lateral coefficient of friction is 0.15 and the rate of superelevation is 0.067. [7M]
b) Design the superelevation required at a horizontal curve of radius 320 m for a speed of 65 kmph. Assume suitable 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 .015, calculate the following: [7M]
- The superelevation required if full lateral friction is assumed to develop.
- The coefficient of friction is needed if no superelevation is provided.
- The equilibrium superelevation is if the pressure on the inner and outer wheels is equal.

b) State the factors that affect the length of summit curves. Discuss. [7M]

5 a) Recall why overtaking zones are provided? What is the basis of deciding its length? Draw a neat sketch of overtaking zone and show the signs to be installed and their positions. [7M]
b) Calculate the stopping sight distance for a design speed of 100 kmph. Take total reaction time as 2.5 sec and the safe coefficient of friction as 0.15. [7M]

Or

6 a) Identify the vertical curve and design the length of the curve for headlight sight distance and comfort requirements. Take the design speed as 80 kmph and the allowable rate of change of centrifugal acceleration as 0.65 m/sec3. A descending grade of 1 in 30 meets an ascending grade of 1 in 35. [7M]
b) What are the details collected in O & D survey? Describe the most commonly adopted methods of the OD survey. [7M]

7 a) What factors are considered to determine the PCU value for a particular class of vehicle? [7M]
b) Discuss how the accident survey is carried out and what data are collected through this survey. [7M]

Or

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

b) Define OBC. Discuss in detail the Marshall method of bituminous mix design. [7M]

9 a) List different types of bituminous materials used in road construction? Explain under what circumstances each of these materials is preferred. [7M]

b) Design the size and spacing of dowel bars provided at the expansion joints of a cement concrete pavement of thickness 25 cm with a radius of relative stiffness 80 cm, for a design wheel load of4500 kg. Assume load capacity of the dowel system as 50 % of the design wheel load. Joint width is 2.0 impermissible shear, and flexural stresses in dowel bar are 1000 kg/cm^2 and 1500 kg/cm^2, respectively, and allowable bearing stress in cement concrete is 100 kg/cm^2. [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/cm3. 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) Discuss the salient features of the IRC recommendations for the design of concrete pavements for high volume roads. [7M]