Dr. Rama Parh 24/11/2023

(8) (128)

Department of Civil Engineering, NIT Hamirpur
B. Tech Examination 2023, V^{th} Semester Civil
Highway Engineering (CE - 314)

M. Marks: 50 **Time allowed: 3 Hrs.**

Note: Attempt all questions. Draw suitable diagrams, wherever necessary.

Q. No. 1: (a) Explain Maximum Utility System. Why it is considered a rational method to decide the final road network? Illustrate it with an example.

(b) What are the various requirements of ideal highway alignment? Explain obligatory points. With sketches, discuss how these points control the alignment. (5+5 =10)

Q. No. 2: (a) Derive an equation for finding the superelevation required if the design coefficient of lateral friction is "f".

(b) What do you understand by Traffic Volume study? What are its various uses? Briefly explain how its data can be presented and the results used for traffic studies. (5+5=10)

Q. No.3: (a) The average normal flow of traffic on cross-roads A and B during design period are 450 and 300 PCU per hour, the saturation flow values on these roads are estimated as 1500 and 1250 PCU per hour respectively. The all-red time required for pedestrian crossing is 12 Secs. Design a two-phase traffic signal by Webster's method.

(b) Assuming a linear speed-density relationship, the mean free speed is observed to be 60 Kmph near zero density, and the corresponding jam density is 140 veh/km.

(i) Write down the speed – density and volume – density equations.

(ii) Draw the speed-density, speed-volume and volume-density diagrams indicating critical values. (5+5=10)

Q.No.4: (a) Define California Bearing Ratio. Briefly describe the procedure for determining the CBR value of a subgrade. Discuss how the flexible pavement is designed knowing the value of CBR of various pavement materials.

(b) Calculate the stresses at interior, edge and corner regions of a cement concrete pavement using Westergaard's stress equations with the following data.

Wheel load = 4100 Kg, Modulus of elasticity of concrete = 3.0×10^5 Kg/cm^2

Pavement thickness = 15 cm, Poisson's ratio of concrete = 0.15

Modulus of subgrade reaction = 3.0 Kg/cm^3

Radius of contact area = 15 cm. (5+5 =10)

Q. No.5: (a) Briefly explain along with diagrams the various types of failures in flexible pavements.

(b) What do you understand by Strengthening of existing roads? Briefly explain the procedure of Benkleman Beam method for overlay design of pavements. (5+5=10)