

Bihar Engineering University, Patna
End Semester Examination - 2022

Course: B.Tech.
Code: 101507

Semester: V
Subject: Transportation Engineering

Time: 03 Hours
Full Marks: 70

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are NINE questions in this paper.
- (iii) Attempt FIVE questions in all.
- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct option/answer of the following (Any seven question only): [2 x 7 = 14]

- (a) The star and grid pattern of road network was adopted in
 - (i) Nagpur road plan
 - (ii) Lucknow road plan
 - (iii) Bombay road plan
 - (iv) Delhi road plan
- (b) The desirable camber for straight roads with water bound macadam or gravel surface, is
 - (i) 1 in 33 to 1 in 25
 - (ii) 1 in 40 to 1 in 33
 - (iii) 1 in 150 to 1 in 140
 - (iv) 1 in 160 to 1 in 140
- (c) IRC recommends the use of _____ curve as transition curve
 - (i) Spiral
 - (ii) Lemniscate
 - (iii) Cubic parabola
 - (iv) Square parabola
- (d) The weaving length of a roadway is the distance
 - (i) between the channelizing islands
 - (ii) equal to half circumference
 - (iii) equal to total width of adjoining radial roads
 - (iv) equal to diameter of rotary
- (e) Total parking demand is determined by which traffic study?
 - (i) Accident studies
 - (ii) Traffic volume study
 - (iii) Travel time studies
 - (iv) Parking studies
- (f) Regulatory signs are generally circular in shape, identify a regulatory sign which is NOT circular in shape
 - (i) Restriction end sign
 - (ii) Speed limit sign
 - (iii) Stop sign
 - (iv) No parking sign
- (g) The speed and delay studies on a defined section of highway are conducted by
 - (i) radar gun
 - (ii) traffic counters
 - (iii) moving car method
 - (iv) enoscope
- (h) The penetration test for bitumen is conducted at a temperature of
 - (i) 60° C
 - (ii) 37° C
 - (iii) 25° C
 - (iv) 50° C
- (i) The dowels bars are used in rigid pavements for
 - (i) Resisting bending stresses in all the portions
 - (ii) Transferring load from one portion to another
 - (iii) Resisting shear stresses in all the portions
 - (iv) Resisting Tensile stresses in all the portions
- (j) Bitumen of grade 80/100
 - (i) Its penetration value is 10 cm
 - (ii) Its penetration value is 8 to 10 mm
 - (iii) Its penetration value is 8 to 10 cm
 - (iv) Its penetration value of 8 mm

P.T.O.

- Q.2 (a) Differentiate between flexible and rigid pavement. [5]
(b) Using the data given below, calculate the wheel load stresses at (a) interior (b) edge and (c) corner regions of a cement concrete pavement using Westergaard's stress equations. Also determine the probable location where the crack is likely to develop due to corner loading. [9]

Wheel load, $P = 5100 \text{ Kg}$

Modulus of elasticity of cement concrete, $E = 3.1 \times 10^5 \text{ kg/cm}^2$

Pavement thickness, $h = 18 \text{ cm}$

Poisson's ratio of concrete, $\mu = 0.15$

Modulus of subgrade reaction, $K = 6.0 \text{ kg/cm}^3$

Radius of contact area, $a = 15 \text{ cm}$

- Q.3 (a) On a two-way traffic road, the speeds of overtaking vehicles are 65 km/hr and 40 km/hr. If the average acceleration is 0.92 m/s^2 . Determine the overtaking sight distance indicating the details of overtaking operations. Show the minimum length of overtaking zone and details of overtaking zone by a neat sketch. [7]
- (b) A valley curve of a state highway is formed by a descending gradient of 1 in 20 meeting an ascending gradient of 1 in 30. Design the length of a valley curve to fulfil both comfort condition and headlight sight distance required for a design speed of 80 km/hr. Assume allowance rate of change of centrifugal acceleration $C = 0.60 \text{ m/s}^3$. Suggest the best suitable shape of the valley curve. Consider reaction time $t = 2.5 \text{ sec}$ and coefficient of friction = 0.35 [7]

- Q.4 (a) Explain the factors affecting sight distances. [5]
(b) The driver of a vehicle travelling 60 km/hr up a gradient requires 9 m less to stop after he applies brakes, as compared to a driver travelling at same speed, down the same gradient. Given, $f = 0.40$. What is the present gradient? [9]

Q.5 Explain various road patterns in detail with neat sketches. [14]

- Q.6 (a) Explain total reaction of driver and the factors on which it depends. [3]
(b) Explain PIEV theory. [6]
(c) Write a note on factors affecting friction offered by Pavement surface. [5]

- Q.7 (a) Compare tar and bitumen. [3]
(b) List the various tests carried out on bitumen [4]
(c) Explain the desirable properties of aggregate to be used in different types of pavement construction. [7]

- Q.8 (a) Discuss the advantages and limitations of CBR method of design for flexible pavement. [7]
(b) Discuss the critical combination of stresses due to wheel load and temperature effects. [7]

Q.9 Write short notes on any four of the following: [3.5x4=14]

- (i) Kerb Parking
(ii) Design factors of highway lighting
(iii) ESWL
(iv) Traffic islands
(v) Off Tracking
(vi) Super elevation