

**4<sup>TH</sup> SEM. /CIVIL ./ 2024(S)**

**Th-4 Highway Engineering**

**Full Marks: 80**

**Time- 3 Hrs**

**Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks**

1. Answer **All** questions 2 x 10
  - a. Name various factors that control highway alignment.
  - b. Differentiate between formation width and formation level.
  - c. Mention the width of carriageway recommended by IRC for
    - i) Single lane road, ii) Two lanes without raised kerbs.
  - d. What are the different types of sight distance considered in highway design?
  - e. Write down the mathematical expressions of i)Lag distance, ii)Braking distance.
  - f. What do you mean by transition curve? What are its types?
  - g. List the types of bituminous binders used in flexible pavement construction.
  - h. What are the tests to evaluate the properties of bitumen binders?
  - i. What do you mean by breast wall?
  - j. Draw traffic regulatory sign of i)U-turn, ii)No-Parking.
2. Answer **Any Six** Questions 6 x 5
  - a. Explain briefly about "PIEV" theory.
  - b. Draw typical cross section showing all details of a hill road of partly in cutting and partly in filling.
  - c. What do you mean by soil stabilization? Explain its necessity and purpose.
  - d. Write different types of road failures. Mention its causes and remedies.
  - e. What are the objectives of traffic signs? State the different types of traffic signals used at road crossing.
  - f. Explain the penetration test carried out for bituminous material.
  - g. Discuss briefly the working of bulldozer.

- 3 Calculate the safe stopping sight distance on a level road for design speed of 96kmph for i)Two-way traffic on a two lane road ii)Two-way traffic on a single lane road. Assume co-efficient of friction as 0.37 and reaction time of driver as 2.5 sec. 10
- 4 What do you mean by flexible pavement and rigid pavement? Explain the various steps involved in the preparation of sub-grade of flexible pavement. 10
- 5 What is super-elevation? Why super-elevation is provided to the road pavement. Estimate the super-elevation required at a horizontal curve of radius 300m for a design speed of 80kmph. Assume co-efficient of lateral friction as 0.15. 10
- 6 What is the necessity of cross-drainage? Give details of different works provided in i) Surface drainage ii) Sub-surface drainage 10
- 7 Write short notes on 2.5\*4
- Hot mix plant
  - Water Bound Macadam road
  - Surface drainage
  - Camber



**4<sup>TH</sup> SEM /CIVIL /2023 (S)**  
**TH-4 HIGHWAY ENGINEERING**

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. When Indian road congress formed and what was its objective?
  - b. What is RoW and formation width in Highway?
  - c. What is Emulsion and write its types.
  - d. What are Pneumatic tyre and sheep's foot rollers?
  - e. Draw any two traffic control signals and write their meaning.
  - f. Write at least four causes of pavement failure.
  - g. How landslide can be controlled in hilly roads?
  - h. What is Kerb? Write two functions of it.
  - i. Calculate the values of ruling minimum radius assuming design speed as 80km. Assume  $e=0.07$  and  $f=0.15$ .
  - j. What is necessity of providing cross-drainage works?
2. Answer **Any Six** Questions 6 x 5
  - a. Calculate the safe stopping distance for design speed of 60kmph for (a) two way traffic in two lane road, (b) two way traffic in a single lane road. Assume coefficient of friction as 0.4 and reaction of driver as 3.0 secs.
  - b. Write briefly, the necessity of providing curves in highway.
  - c. Elaborate Penetration test of Bitumen with figure.
  - d. Differentiate between Rigid pavement and Flexible pavement.
  - e. What is surface drainage and what are the methods for providing it?
  - f. What is corrugations and discuss its remedial measures.
  - g. Write a short note on Hot-Mix plant.
3. What are the requirements of a good aggregate? Why and how abrasion test is performed in aggregate? 10
4. What are the methods of providing super elevation? If the design speed of a highway is 100kmph and horizontal curve of radius 180m on a certain area, calculate super elevation required to maintain this speed. Take coefficient of friction as 0.18. 10
5. What is the purpose of Stabilization? Explain how lime stabilization is carried out in pavements. 10
6. Draw a neat sketch of flexible pavement showing different layers and give a brief idea about Sub-Grade preparation. 10
7. Describe failures in Rigid pavement and its maintenance. 10



# Previous Year Questions with Answers

**IV-SEM/CIVIL ENGG./2022(S)**

**(Theory - 4)**

**Time - 3 Hours**

**Full Marks - 80**

Answer any **five** Questions including Q. No. 1 & 2.

Figures in the right-hand margin indicate marks.

Answer **All** the Questions :

[2 × 10]

1. (a) What is camber ?
- (b) Differentiate between bitumen and tar.
- (c) What are the objectives of highway planning ?
- (d) Define traffic density ?
- (e) What do you mean by seal coat ?
- (f) Define base course and wearing course.
- (g) What is highway alignment ?
- (h) What is function of surface drainage and sub-surface drainage ?
- (i) Define transition curve.
- (j) Define WBm.

[6 × 5]

2. Answer any **Six** Questions.
- (a) Calculate the safe stopping sight distance for design speed of 50 kmph for -
  - (i) Two way traffic on a two lane road, (ii) Two way traffic on a single lane road. Assume coefficient of friction = 0.35 and reaction time = 2.5 second.
- (b) Write the objectives of providing transition curve in roads.
- (c) Explain the necessity of road drainage work.
- (d) Describe the different types of bends in hill roads.
- (e) Write short notes on CBR test.
- (f) Differentiate flexible and rigid pavement.
- (g) Calculate the allowable speed on a horizontal curve of radius 180m. Assume the coefficient of lateral friction as 0.15 and maximum super elevation of 1 in 15.
3. What is soil stabilization, briefly explain cement stabilization ? [10]
4. (a) What is highway drainage ? [2]

- (b) Explain surface drainage and sub-surface drainage systems in road. [8]
5. Explain the typical flexible pavement failures in details. [10]
6. Explain the total reaction time for a driver. [10]
7. Write short notes on : [10]
  - (a) Mud pumping
  - (b) Super elevation
  - (c) National Highways
  - (d) Kerbs

## ANSWERS TO 2022(S)

1. (a) What is camber ?

Ans.

- It's mostly found in the highways the median part of the road surface is elevated with regards to the edges. This slope from the diagonal direction is known as the Camber.
- Camber is the slope provided to the road surface at the transverse direction to drain off the rainwater out of the road surface. It is also known as the cross slope of the road.
- It is 3 types i. Parabolic camber ii. Straight camber iii. Combined camber

(b) Differentiate between bitumen and tar.

Ans.

### BITUMEN

- Bitumen is a solid or semisolid, black, sticky, ductile substance, obtained as an important by-product from the distillation of crude petroleum.
- It has a low degree of toxicity.
- It consists of a moderate percentage of carbon.
- It is more resistive to water and acid.

### TAR

- Tar is a black solid mass that is formed during the destructive distillation of coal, peat, wood, or other organic material. It contains 75 to 95% of bituminous contents. It contains a higher percentage of carbon.
- It has a high degree of toxicity.



**V- SEM/ CIVIL/2021(W) OLD**  
**CET-502 HIGHWAY ENGINEERING**

Full Marks: 80

Time : 3 Hours

Answer any **Five** Questions including Q No. 1& 2

Figures in the right hand margin indicates marks

1. Answer ALL the question in brief : 2×10
  - (a) What is IRC ?
  - (b) Define transition curve .
  - (c) What is a cut back bitumen?
  - (d) Differentiate between sub-grade and sub- base.
  - (e) Name the common binders.
  - (f) Define traffic rotary.
  - (g) What do you mean by pruning a tree?
  - (h) What do you mean by super elevation ? Specify the recommended values of super elevation for plain and rolling terrain by IRC.
  - (i) What is OSD ?
  - (j) What do you mean by tack coat ?
2. Answer any SIX questions 5×6
  - (a) Define camber. What are the objectives of providing camber ? Specify the recommended ranges of camber for different types of pavement surfaces ?
  - (b) Calculate the safe stopping sight distance for a design speed of 60 kmph for
    - (i) Two way traffic on a two lane road
    - (ii) Two way traffic on a single lane roadAssume coefficient of friction as 0.40 and reaction time of driver as 3 secs.
  - (c) Describe the Los angles abrasion test for road aggregates and explain its significance.
  - (d) Explain PIEV theory.
  - (e) Discuss briefly the types of traffic signals .
  - (f) Explain the purposes of providing breast-walls and retaining walls on hill roads.
  - (g) What are the significant recommendation of Jayakar committee report ?
3.
  - (a) What do you mean by highway alignment? 2
  - (b) Design the rate of super elevation for a horizontal highway curve radius 450m and speed 90 kmph. Assume all other data. 8
4.
  - (a) Differentiate between bitumen and tar. 3
  - (b) The speed of overtaking and overtaken vehicles are 70 & 40 kmph respectively on a two way traffic road. If the acceleration of overtaking vehicle is  $0.99 \text{ m/sec}^2$ . Assume all other data. 7
    - (i) Calculate safe overtaking sight distance ?
    - (ii) Mention the minimum length of overtaking zone.
5.
  - (a) Define arboriculture. 2
  - (b) What are the steps involved in maintenance of concrete roads . 8
6. Write Short notes on the followings. 2.5x4
  - (a) Water Bound Macadam (WBM)
  - (b) Premix carpet
  - (C) Bulldozer
  - (d) Grader
7. What is soil stabilization? Briefly explain about cement stabilization. 10

## HIGHWAY ENGINEERING

(Code : CET-502)

Full Marks : 70

Time : 3 hours

Answer any five questions

*Figures in the right-hand margin indicate marks*

1. (a) Differentiate between bitumen and tar 2  
(b) Draw a typical cross-section of a rigid pavement road and mention the layers of road. 5  
(c) Explain briefly CBR test with neat sketch. 7
2. (a) Define formation width. 2  
(b) Calculate the superelevation required for a concrete road 7.5 m wide on a curve of 800m radius of a design speed of 50 kmph. 5  
(c) Explain briefly surface drainage system in highways with sketches. 7
3. (a) What is the purpose of providing retaining walls on hill road ? 2  
(b) Describe cement stabilization in detail with factors affecting soil cement properties. 5  
(c) Define stopping sight distance. Calculate the minimum non-passing sight distance on a highway at a descending gradient of 6%. Given the following data :  
(i) Design speed = 80 kmph  
(ii) Reaction time of driver = 2.5 seconds  
(iii) Coefficient of friction between tyre and road surface = 0.4. 7
4. (a) Draw the general shapes of different types of transition curves. 2  
(b) Explain traffic signals with sketch. 5  
(c) What do you mean by overtaking sight distance ? Give a detail analysis. 7
5. (a) Define water bound macadam. 2  
(b) Describe the crushing strength test of aggregates. 5  
(c) Enumerate different types of traffic signs. Explain any one of them with sketches. 7
6. (a) Define sub-surface drainage. 2

(Turn Over)



( 2 )

- (b) Calculate the extra widening required for a pavement of width 7m on a horizontal curve of radius 250m if the longest wheel base of vehicle expected on the road is 7.0 m . Design speed is 70Kmph. 5
- (c) Explain the causes of failure of flexible pavements. 7
7. (a) Define landscaping and arboriculture. 2
- (b) Write short notes on any two : 5
- (i) Bituminous Concrete (BC)
  - (ii) D.B.M
  - (iii) Fly ash stabilization
  - (iv) Lime stabilization.
- (c) Calculate the length of transition curve using the following data :  
Design speed = 65 Kmph  
Radius of circular curve = 220 m  
Allowable rate of introduction of superelevation (Pavement rotated about the centre line) = 1 in 150  
Pavement width including extra widening = 7.5 m. 7