CE313 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2024

Semester V [Third Year] (Regular & Supplementary)

HIGHWAY ENGINEERING

Time: Three hours   Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) What is CRRI?   CO1
   (b) List different types of road patterns.   CO1
   (c) Write the basic requirements of an ideal alignment.   CO1
   (d) What is super elevation and its importance?   CO2
   (e) Define kerb and right of way.   CO2
   (f) List various types of curves provided on Hill Roads.   CO2
   (g) Define Flakiness Index and Elongation Index.   CO3
   (h) What is overlay needed in pavements?   CO3
   (i) Draw the cross-section of a rigid pavement and mark salient features.   CO3
   (j) What is pavement evaluation?   CO4
   (k) What are the components of traffic engineering?   CO4
   (l) List the driver characteristics.   CO4
   (m) What is road intersection?   CO4
   (n) Mention the objectives of spot speed studies.   CO4

UNIT – I

2. (a) Explain in brief different road development plans in India.   (7M) CO1
   (b) Discuss about various factors affecting highway alignment in detail.   (7M) CO1

(OR)

3. (a) Explain Nagpur Road Plan in detail. (7M) CO1
   (b) What are the objectives of highway planning? Explain various engineering surveys for highway alignment in brief. (7M) CO1

UNIT – II

4. (a) Define gradient and classify gradients. (7M) CO2
   (b) Calculate the safe stopping sight distance for design speed of 50 kmph for (i) two-way traffic on two lane road (ii) two-way traffic on single lane road (Assume coefficient of friction as 0.37, $g = 9.81$ m/s^2, and $t = 2.5$ s). (7M) CO2

(OR)

5. (a) List and explain the necessary tests to be conducted on road aggregate in brief. (7M) CO3
   (b) While aligning a highway in a built-up area, it was necessary to provide a horizontal curve of radius 325 m. The design speed = 65 kmph, length of wheel base of largest truck = 6, pavement width = 10.5 m. Design the following geometric features: (7M) CO2
   (i) Super elevation
   (ii) Extra widening of pavement
   (iii) Length of transition curve

UNIT – III

6. (a) Discuss the causes of failure in flexible and rigid pavement. (7M) CO3
   (b) A two-lane road at present carrying a traffic of 1200 CVPD. It is to be strengthened for growing traffic needs, Vehicle damage factor (VDF) = 2.75, rate of growth of traffic 7.5% per annum, period of construction is 5 years. The pavement is to be designed for a life of 15 years after completion. Calculate the cumulative standard axles used for design. (7M) CO3

(OR)

7. (a) Describe stepwise construction procedure of cement concrete road by continuous bay method. (7M) CO3
   (b) Design the pavement for construction of a new two-lane carriageway for design life 15 years using IRC method. The initial traffic in the year of completion in each direction is 150 CVPD and growth rate is 5%. Vehicle damage factor based on axle load survey = 2.5 standard axle per commercial vehicle. Design CBR of subgrade soil = 4%. (7M) CO3

UNIT – IV

8. (a) What is highway drainage? Discuss the importance, requirements and types of highway drainage, in detail. (7M) CO4
   (b) Calculate the theoretical capacity (C) of a traffic lane with one-way traffic flow for the given data:
   Traffic flow at a stream speed = 40 km/h;
   Average center to center spacing of vehicles = 12.8 m. (7M) CO4

(OR)

9. (a) Write a short note on road user characteristics. (7M) CO4
   (b) A vehicle moving at 40 kmph speed was stopped by applying the brake and the length of the skid mark was 12.2 m. If the average skid resistance of the pavement is known to be 0.70, determine the brake efficiency of the test vehicle. (7M) CO4

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B.TECH. DEGREE EXAMINATION, APRIL-2024

Semester V [Third Year] (Supplementary)

HIGHWAY ENGINEERING

Time: Three hours   Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Define IRC.   CO1
   (b) Explain classification of various road
       according to Nagpur road plan.   CO1
   (c) Enumerate various factors controlling
       alignment.   CO1
   (d) Define super elevation.   CO2
   (e) Define skidding and slipping.   CO2
   (f) Define stopping sight distance.   CO2
   (g) Define toughness of aggregate.   CO3
   (h) Define ESWL.   CO3
   (i) Define CBR.   CO3
   (j) Define Rotary.   CO4
   (k) State advantages of grade separated
       intersections.   CO4
   (l) Sketch no right turn marking on road.   CO4
   (m) Define traffic mean speed and space mean
       speed.   CO4
   (n) Draw a neat sketch of cloverleaf junction.   CO4

UNIT – I

2. (a) Explain the salient features of lucknow
       road development plan.   (7M) CO1
   (b) What are various road patterns explain
       with neat sketch.   (7M) CO1

(OR)

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3. (a) Explain the Bombay road development plan. (7M) CO1
   (b) What are the engineering surveys to be conducted to finalize highway alignment? (7M) CO1

UNIT – II

4. (a) What are the various design control and criteria for geometric design? (7M) CO2
   (b) Derive an equation for overtaking sight distance. (7M) CO2

(OR)

5. (a) Design the length of the transition curve and shift using the following data: (7M) CO2
   Design speed = 80 kmph;
   Radius of circular curve= 270 m;
   Allowable rate of super elevation = 1 in 150;
   Pavement rotated about inner edge of the pavement;
   Pavement width including extra widening = 7.5 m;
   (b) Discuss crushing test conducted on aggregate with neat sketch. (7M) CO3

UNIT – III

6. (a) Calculate the stress at interior, edge and corner regions of a cement concrete pavement using Westergaard's equation. Use the following data: (7M) CO3
   Wheel load P = 5200 kg;
   Modulus of elasticity of concrete E = 3.0 x 10^5 kg/cm²;
   Pavement thickness h = 20 cm,
   Poisson's ratio = 0.15;
   Modulus of subgrade reaction = 8 kg/cm³;
   Radius of contact area = 15 cm

   (b) Discuss the differences between flexible and rigid pavements (7M) CO3

(OR)

7. (a) Discuss in detail various steps involved in the construction of water bound macadam pavements. (7M) CO3
   (b) Discuss various failures of flexible pavement with neat sketch. (7M) CO3

UNIT – IV

8. (a) Discuss the scope and importance origin and destination studies. (7M) CO4
   (b) Discuss in detail Webster method of signal design with relevant equations. (7M) CO4

(OR)

9. (a) Discuss various road user characteristics that effect traffic engineering. (7M) CO4
   (b) Discuss various methods of conducting traffic volume studies. (7M) CO4

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B.TECH. DEGREE EXAMINATION, DECEMBER-2023

Semester V [Third Year] (Regular & Supplementary)

HIGHWAY ENGINEERING

Time: Three hours   Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Expand MORTH.   CO1
   (b) Write the classification of various road according to
       Lucknow plan.   CO1
   (c) Define overtaking sight distance.   CO1
   (d) Define design speed.   CO2
   (e) Define elongation index.   CO2
   (f) Compare Asphalt and Bitumen.   CO2
   (g) Mention the test used to determine the impact value of
       aggregate.   CO3
   (h) State any two differences between bitumen emulsion
       and CRMB.   CO3
   (i) Write the formula of abrasion value of aggregate.   CO3
   (j) Draw a neat sketch of mandatory road signs any two.   CO4
   (k) Define traffic volume and traffic capacity.   CO4
   (l) Write a short notes on advantages of providing
       islands.   CO4
   (m) Draw a neat sketch of grade separated.   CO4
   (n) Draw a neat sketch of road in cutting.   CO4

UNIT – I

2. (a) Discuss various salient features of road
       development in India as per the growth rate.   (7M) CO1
   (b) Write a detailed note on alignment and its
       selection.   (7M) CO1

3. (a) Discuss in detail various engineering surveys
required for road (7M) CO1
(i) Planning survey
(ii) Preliminary survey
(iii) Location survey
(b) Discuss in detail current road projects in India. (7M) CO1

UNIT – II

4. (a) Design the rate of super elevation for horizontal
highway curve of 400 m and speed of 90 kmph. (7M) CO2
(b) Discuss various factor affecting horizontal
alignment of highway. (7M) CO2

(OR)

5. (a) Explain penetration test on bitumen with neat
stretch. (7M) CO2
(b) Derive an expression for PIEV theory. (7M) CO2

UNIT – III

6. (a) Explain contribution of IRC 58-2015 in
pavement design. (7M) CO3
(b) Discuss in detail design of bituminous
pavement. (7M) CO3

(OR)

7. (a) Discuss the maintenance of highway. (7M) CO3
(b) Discuss in detail various steps involved in the
construction of rigid pavements. (7M) CO3

UNIT – IV

8. (a) Discuss the scope and importance of traffic
flow and capacities studies. (7M) CO4
(b) Briefly discuss various islands constructions. (7M) CO4

(OR)

9. (a) Discuss in detail highway lighting studies. (7M) CO4
(b) Discuss various vehicular characteristics that
effect parking of vehicles. (7M) CO4

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B.TECH. DEGREE EXAMINATION, JUNE-2023
Semester V [Third Year] (Supplementary)

HIGHWAY ENGINEERING

Time: Three hours   Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Expand NHAI.   CO1
   (b) Write the classification of various road according to Bombay plan.   CO1
   (c) Define intermediate sight distance.   CO1
   (d) Define PIEV theory.   CO2
   (e) Define flakiness index.   CO2
   (f) Compare Tar and cutback Bitumen.   CO2
   (g) Mention the test used to determine crushing value of aggregate.   CO3
   (h) State any two differences between CRMB and foamed bitumen.   CO3
   (i) Write the formula of specific gravity of aggregate.   CO3
   (j) Draw a neat sketch of cautionary road sign any two.   CO4
   (k) Define traffic flow and traffic capacity.   CO4
   (l) Write a short note on advantages of providing intersections.   CO4
   (m) Draw a neat sketch of road on embankment.   CO4
   (n) Draw a neat sketch of various camber shapes.   CO4

UNIT – I

2. (a) Discuss various factors affecting the alignment. (7M) CO1
   (b) Write a detailed note on Jaykar committee and its recommendations. (7M) CO1

3. (a) Discuss in detail various engineering surveys, drawing and reports required for road establishment. (7M) CO1

   (b) Discuss in detail various points considered for rural road development vision 2025. (7M) CO1

UNIT – II

4. (a) Design the rate of super elevation for horizontal highway curve of 400 m and speed of 90 kmph. (7M) CO2

   (b) Discuss various factors affecting vertical alignment of highway. (7M) CO2

(OR)

5. (a) Explain flash and fire point test on bitumen with neat sketch. (7M) CO2

   (b) Derive an expression for super elevation with a neat sketch. (7M) CO2

UNIT – III

6. (a) Explain contribution of IRC 37-2018 in pavement design. (7M) CO3

   (b) Discuss in detail design of WBM roads. (7M) CO3

(OR)

7. (a) Discuss the construction joints in cement concrete pavement. (7M) CO3

   (b) Discuss in detail various steps involved in the construction of flexible pavements. (7M) CO3

UNIT – IV

8. (a) Discuss the scope and importance of traffic engineering studies. (7M) CO4

   (b) Briefly discuss various methods of road markings. (7M) CO4

(OR)

9. (a) Discuss in detail accident studies. (7M) CO4

   (b) Discuss parking study that effect traffic engineering. (7M) CO4

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9. (a) Explain vehicles characteristics, in detail. (7M) CO4
   (b) If the velocity of moving vehicles on a road is 50 km/per hour, stopping distance is 19 metres and average length of vehicles is 4.5 metres, estimate the basic capacity of traffic lane. (7M) CO4

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CE313 (R20)

B.TECH. DEGREE EXAMINATION, MARCH-2023

Semester V [Third Year] (Regular)

HIGHWAY ENGINEERING

Time: Three hours   Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) List different road development plans in India. CO1
   (b) What is IRC? CO1
   (c) Write the types of highway alignment? CO1
   (d) What is width of carriage way for a two lane road, without raised kerbs, as per IRC? CO2
   (e) Distinguish camber and super elevation. CO2
   (f) What are the factors affecting stopping sight distance? CO2
   (g) List the desirable properties of bitumen in pavement construction. CO3
   (h) What is CBR? CO3
   (i) Draw the cross-section of a flexible pavement and mark salient features. CO3
   (j) Differentiate flexible pavement and rigid pavement. CO3
   (k) List the advantages of signalized intersections CO4
   (l) What are the factors affecting skid resistance? CO4
   (m) Mention the purpose of road markings. CO4
   (n) What are the objectives of accident studies? CO4

UNIT – I

2. (a) Discuss the characteristics of road transport in comparison with other systems? (7M) CO1
   (b) Explain different road patterns with neat sketches in detail. (7M) CO1

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(OR)

3. (a) Define alignment and state the requirement of an ideal road alignment. (7M) CO1

   (b) Discuss briefly about the objectives of highway planning. What is meant by reconnaissance survey? Discuss. (7M) CO1

UNIT – II

4. (a) Explain the objectives of highway geometric design. List the various geometric elements to be considered in the highway design. (7M) CO2

   (b) The speeds of the overtaking and overtaken vehicle are 70 and 40 kmph, respectively on a two way traffic road. If the acceleration of overtaking vehicle is 0.99 m/sec^2 (7M) CO2

   (i) Calculate safe overtaking sight distance

   (ii) Calculate the minimum and desirable length of overtaking zone

   (iii) Draw the neat-sketch of the overtaking zone and show the position of the sign post.

(OR)

5. (a) Discuss different tests on bitumen, in brief. (7M) CO2

   (b) Calculate the extra widening required for a pavement of within 7 m on a horizontal curve of radius 250 m if the longest wheel base of vehicle expected on the road is 7.0 m. Design speed 70 kmph. Compare the value obtained with IRC recommendations. (7M) CO2

UNIT – III

6. (a) Discuss in detail the design of expansion and contraction joints in cement concrete pavements. (7M) CO3

(b) Find CWL at depths of 5 cm, 20 cm and 40 cm for a dual wheel carrying 2044 kg each. The center to center tyre spacing is 20 cm and distance between the walls of the two tyres is 10 cm. (7M) CO3

(OR)

7. (a) Explain the Water Bound Macadam Road construction with the help of neat sketch. (7M) CO3

   (b) Calculate the stress at interior, edge and corner regions of a cement concrete pavement using Westergaard's equation. Use the following data Wheel load, P = 5000 kg; Modulus of elasticity of concrete, E = 3.0×10^5 kg/cm^2; Pavement thickness, h = 20 cm, Poisson's ratio = 0.15; Modulus of subgrade reaction = 6.0 kg/cm^3; Radius of contact area = 15 cm. (7M) CO3

UNIT – IV

8. (a) What is the need of Origin and Destinations Studies? Discuss in brief. (7M) CO4

   (b) For designing a 2-phase fixed type signal at an intersection having North-South and East-West road where only straight ahead traffic permitted, the following data are available.

Parameter Design Hour	North	South	East	West
Flow (PCU/hr)	1000	700	900	550
Saturation Flow (PCU/hr)	2500	2500	3000	3000

Total time lost per cycle is 12 seconds. Calculate the cycle length (seconds) as per Webster's approach? (7M) CO4

(OR)