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Question Paper Code : 57177

03/06/16  
AN

**B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016**

**Fifth Semester**

**Civil Engineering**

**CE 6504 – HIGHWAY ENGINEERING**

**(Regulations 2013)**

**Time : Three Hours**

**Maximum : 100 Marks**

**(Relevant IRC codes are allowed)**

**Answer ALL questions.**

**PART – A (10 × 2 = 20 Marks)**

1. Write short notes on Highway Research Board.
2. What are Shoulders ?
3. What are the elements involved in Highway Geometric design ?
4. What is meant by extra widening at curves ?
5. What are the factors in Pavement Design ?
6. Define Critical load positions.
7. What is significance of static immersion test ?
8. Define flakiness index.
9. Differentiate delamination and depression.
10. What are the causes of cracks ?

**PART - B (5 × 16 = 80 Marks)**

11. (a) Explain the Bombay road congress 1961.

**OR**

- (b) Explain in detail the reconnaissance survey for Highway location in rural area.

12. (a) What are the factors affecting Sight distance ?

**OR**

- (b) The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200 m on this road. If maximum super elevation of 1 in 15 is not to be exceeded calculate the maximum allowable speed on the curve. Also determine the extra widening required and length of the spiral transition curve using the following data. Length of the wheel base=6.1 m, Pavement width = 7.2 m and number of lanes = 2. Rate of introduction of super elevation is 1 in 200.

13. (a) Design the pavement for construction of a new bypass with the following data:

1. Two lane carriage way
2. Initial traffic in the year of completion of construction = 400 CVPD (sum of both directions)
3. Traffic growth rate = 7.5 %
4. Design life = 15 years
5. Vehicle damage factor based on axle load survey = 2.5 standard axle per commercial vehicle
6. Design CBR of subgrade soil = 4%.

**OR**

- (b) Explain the Design of joints.

14. (a) What are the Desirable properties of aggregates ?

**OR**

- (b) Explain the Ductility test and Softening point test.

15. (a) Explain in detail the possible causes and remedial measures for joint failure.

**OR**

- (b) Explain the possible causes and remedial measures for joint spalling.

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19/05/17 AN

**Question Paper Code : 71576**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fifth Semester

Civil Engineering

CE 6504 — HIGHWAY ENGINEERING

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Use Relevant Tables and Charts of IRC 37-2001/IRC 58-2002.

Answer ALL questions.

PART A — ( $10 \times 2 = 20$  marks)

1. What are classified roads in Nagpur plan?
2. What are the recommendations of Jayakar Committee?
3. What is the maximum and minimum super-elevation?
4. What are overtaking zones?
5. What are the types of Rigid Pavements?
6. Differentiate tack coat and prime coat.
7. What is the purpose of conducting abrasion test?
8. Define flakiness index.
9. What are the parameters that should be observed for evaluating a rigid pavement?
10. What are the causes of cracks?

PART B — ( $5 \times 16 = 80$  marks)

11. (a) What are the various classifications of roads?

Or

- (b) Explain in detail the reconnaissance survey for highway location in rural area.

12. (a) What are the factors affecting geometric design? Explain.

Or

- (b) The speed of overtaking and overtaken vehicles is 80 and 50 kmph respectively. On a two way traffic load, the acceleration of overtaking vehicles is  $0.99 \text{ m/sec}^2$ . Calculate OSD, mention the minimum length of overtaking zone and draw the sketch of the overtaking zone with all details.

13. (a) (i) Design the pavement for construction of a new bypass with the following data : Two lane carriage way, Initial traffic in the year of completion of construction = 400 CVPD (sum of both directions), Traffic growth rate = 7.5%. Design life = 15 years, Vehicle damage factor based on axle load survey = 2.5 standard axle per commercial vehicle and Design CBR of subgrade soil = 4%.

- (ii) What are the most important factor in the pavement design?

Or

- (b) Explain the design of joints in rigid pavements.

14. (a) Explain the California Bearing Ratio Test.

Or

- (b) What are the modern construction materials used for the construction of pavements? Explain their characteristics and usage in detail.

15. (a) Explain in detail the possible causes and remedial measures for joint failure.

Or

- (b) Explain the methods employed for evaluation of pavements and explain the evaluation of pavement by Benkelman Beam method and deflection measurements.





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**Question Paper Code : 40803**

14/05/18  
AN

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fifth Semester

Civil Engineering

CE 6504 – HIGHWAY ENGINEERING

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

(Relevant IRC codes are allowed)

Answer ALL questions.

PART – A

(10×2=20 Marks)

1. Mention any two recommendations of Jayakar Committee.
2. What are the objectives of the highway planning ?
3. What is meant by widening of pavement on horizontal curves ?
4. Define camber.
5. What are dowel bars ?
6. Define modulus of subgrade reaction.
7. Define Elongation Index.
8. Differentiate between cut-back bitumen and bitumen emulsions.
9. Differentiate between Spalling and traverse crack.
10. What is meant by mud pumping ?

PART – B

(5×13=65 Marks)

11. a) Explain the requirements of ideal highway alignment and the factors controlling the alignment. (13)
- (OR)
- b) i) Describe the classification of Highways based on location and function. (4)
- ii) Write short notes on i) Indian Road Congress ii) Central Road Research Institute (CRRI) and iii) Highway Research Board. (3+3+3=9)

40803

-2-



-3-

40803

12. a) i) Describe briefly about gradients and its types. (7)  
 ii) Explain the factors influencing the geometric design of hill roads. (6)

(OR)

- b) i) Find the rate of super elevation on a horizontal curve having a radius of curvature of 90 m. The design speed is 50 kmph and assume  $f = 0.15$ . (4)  
 ii) Explain in detail about sight distance and its types. (9)
13. a) i) Compare flexible and Rigid pavements. (5)  
 ii) Explain the CBR method of design of flexible pavements. (8)

(OR)

- b) i) Describe about Equivalent single wheel load. (5)  
 ii) Calculate the stresses at corner, edge and interior regions of a cement concrete pavement by applying Westergaard's equations with the following particulars :  
 $P = \text{Wheel load} = 4100 \text{ kg}$   
 $h = \text{Slab thickness} = 15 \text{ cm}$   
 $a = \text{Radius of wheel load distribution} = 15 \text{ cm.}$   
 $E = \text{Modulus of elasticity of concrete} = 2.1 \times 10^5 \text{ kg/cm}^2.$   
 $\mu = \text{Poisson's ratio for concrete} = 0.15.$   
 $K = \text{Modulus of subgrade reaction} = 3 \text{ kg/cm}^3.$  (8)
14. a) i) What is Geotextiles ? Describe the functions of geotextiles in road construction. (7)  
 ii) Discuss the requirements of good highway drainage system. (6)

(OR)

- b) Explain the penetration test, viscosity test, ductility test and softening point test for bitumen. (13)
15. a) i) Describe about Mud jacking. (3)  
 ii) Explain the different types of failure encountered in flexible pavements. (10)

(OR)

- b) i) Describe the objectives of pavement evaluation. (4)  
 ii) Discuss briefly the different types of failures in rigid pavement. (9)

PART – C

(1×15=15 Marks)

16. a) Describe the objectives of the engineering surveys and explain the engineering surveys conducted for highway alignment.

(OR)

- b) Explain in detail about the Crushing test, Abrasion test, Impact test and Soundness test on the aggregates used for highway road construction.

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**Question Paper Code : 52772**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Civil Engineering

CE 6504 — HIGHWAY ENGINEERING

(Regulation 2013)

(Common to PTCE 6504 – Highway Engineering for B.E.(Part-Time) Third Semester  
– Civil Engineering – Regulation – 2014)

Time : Three hours

Maximum : 100 marks

Use Relevant tables and charts of IRC 37-2001 /IRC 58-2002.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How are roads classified in Nagpur plan?
2. What are the recommendations of Jayakar Committee?
3. What are the fundamental principles of alignment?
4. What are the types of sight distance?
5. Differentiate between rigid and flexible pavements in pavement design.
6. Draw a typical rigid pavement with its vital components.
7. How Geotextiles improve safety and stability of highway embankments?
8. How adding up the waste plastics help in the improvement of bituminous pavements?
9. Differentiate delamination and depression.
10. What are the causes of cracks?

PART B — ( $5 \times 13 = 65$  marks)

11. (a) Write shortly the significance of 'soil suitability analysis and road Ecology' in highway planning.

Or

- (b) Write in brief the history of road development in India after independence.

12. (a) Explain the factors affecting sight distance.

Or

- (b) The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200 m on this road. If maximum super elevation of 1 in 15 is not to be exceeded, calculate the maximum allowable speed on the curve. Also determine the extra widening required and length of the spiral transition curve using the following data. Length of the wheel base = 6.1 m, Pavement width = 7.2 m and number of lanes = 2. Rate of introduction of super elevation is 1 in 200.

13. (a) 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 CPVD and growth rate is 5%. Vehicle damage factor based on axle load survey = 2.5 std axle per commercial vehicle. Design CBR of subgrade soil = 4%.

Or

- (b) Explain the IRC design procedure for rigid pavements.

14. (a) Explain the California bearing ratio test.

Or

- (b) What are the modern construction materials used for the construction of pavements? Explain their characteristics and usage in detail.

15. (a) List any Eight cracks and defects in flexible pavements and describe their respective symptoms, possible causes and the treatment/repair for each defect.

Or

- (b) Define Overlay and the procedure for design and construction of overlays.

PART C — ( $1 \times 15 = 15$  marks)

16. (a) Explain in brief the modern methods of laying highway alignment being adopted at present with its merits and demerits.

Or

- (b) Write in detail the present status of highway drainage in Chennai city roads and list out the measures to be taken for effective removal of water from the pavement.



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**Question Paper Code : 80212**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Civil Engineering

CE 6504 — HIGHWAY ENGINEERING

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define central road fund.
2. What are classified roads in Nagpur plan?
3. What are the fundamental principles of alignment?
4. What are the types of sight distance?
5. What are the Requirements of an ideal pavement?
6. Define Equivalent radius of resisting section
7. What is the significance of CBR test?
8. Define elongation index.
9. Define Bleeding.
10. Differentiate Pumping and Ravelling.

PART B — (5 × 16 = 80 marks)

11. (a) Explain Jayakar committee recommendations.

Or

- (b) Explain in detail the various factors affecting the design of highway location.

12. (a) Explain the Types of gradient.

Or

- (b) A road has a total width of 7.5 m including extra widening on curve and design speed of 60 kmph. Calculate the length of transition curve and its shift on this curve of 200 m radius. Allowable super – elevation is 1 in 150 and pavement is rotated about centerline.

13. (a) 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 std axle per commercial vehicle. Design CBR of subgrade soil=4%.

Or

- (b) Explain the design procedure for rigid pavements.

14. (a) What are the Different forms of bitumen.

Or

- (b) Explain the California Bearing Ratio Test.

15. (a) What are the possible causes for longitudinal cracking?

Or

- (b) Explain in detail about any four methods of strengthening of pavements.



Reg. No. :

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**Question Paper Code : 50285**

**B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017**

**Fifth Semester**

**Civil Engineering**

**CE 6504 – HIGHWAY ENGINEERING**

**(Regulations 2013)**

**Time : Three Hours**

**Maximum : 100 Marks**

**Answer ALL questions.**

**Use Table and Chart.**

**PART – A**

**(10×2=20 Marks)**

1. What are the objectives of highway planning ?
2. Write the classification of roads.
3. State the merit and demerit of parabolic camber.
4. Find the super elevation on a horizontal circular curve of 150 m radius for design speed of 65Kmph with a coefficient of friction 0.15.
5. What are the various factors considered for the design of pavements ?
6. Define : Rigidity Factor.
7. Define 'Flakiness index'.
8. What are the desirable properties of soil as highway material ?
9. 'Write down the works under routine repairs.
10. What is meant by Mud pumping ?

**PART – B**

**(5×13=65 Marks)**

11. a) Explain the classification of Urban roads with neat sketches.

**(OR)**

- b) Elaborate the factors affecting the geometric design of highway.

50285



12. a) Calculate the safe OSD for a design speed of 90 Kmph. Take reaction time of driver as 2.5 seconds and acceleration of overtaking vehicle as 2.5 kmph/sec. Draw OSD zone.

(OR)

- b) Calculate the length of the transition curve with the following data  
Design Speed = 70 Kmph, Radius of circular curve = 250m  
Allowable rate of introduction of super elevation = 1 in 150.  
Pavement width including extrawidth = 7.5m.

13. a) Explain any two methods of flexible pavement design.

(OR)

- b) Calculate the stresses at interior, edge and corner region of cement concrete pavement using Westergaard's equation. Use the following data.

Wheel Load = 5200 kg

Pavement Thickness = 20cm

Poisson's ratio of concrete = 0.15

Subgrade Modulus = 6kg/cm<sup>3</sup>

Young's Modulus of cement concrete = 3×10<sup>5</sup> kg/cm<sup>2</sup>

Radius of contact area = 15cm

14. a) Explain any two tests on road aggregates.

(OR)

- b) Explain any two tests on bitumen.

15. a) Discuss briefly the different types of failures of rigid pavements.

(OR)

- b) Evaluate any three non destructive testing methods of pavement deflection.

PART – C

(1×15=15 Marks)

16. a) A cement concrete pavement has a thickness of 18 cm and has two lanes of 7.2m with a longitudinal joint along the centre. Design the dimension and spacing of tie bar using the following details.

Allowable working stress in tension = 1400 kg/cm<sup>2</sup>

Unit weight of concrete = 2400 kg/m<sup>3</sup>

Coefficient of friction = 1.5

Allowable bending stress in deformed bars in concrete = 2.5 kg/cm<sup>2</sup>.

(OR)

- b) Explain the application of geotextiles and geomembrane in road construction.



**Reg. No. :**



**Question Paper Code : 20273**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

### Fifth Semester

## Civil Engineering

CE 6504 — HIGHWAY ENGINEERING

(Regulations 2013)

(Common to PTCE 6504 – Highway Engineering for B.E.(Part-Time)

Third Semester – Civil Engineering – Regulations 2014)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out both the Urban and Rural classification of Highways.
2. Write any four modal limitations of highway mode towards sustainability.
3. What are the types of curves in highway geometric design and write any two salient features of any one curve?
4. With neat sketches show the typical cross section of any one urban roads as per Indian Roads Congress (IRC) standards.
5. Differentiate between Rigid and Flexible pavements in pavement design.
6. Draw a typical Rigid Pavement with its vital components.
7. Differentiate between 'Geo-Textiles and Geo-Membrane' in highway construction.
8. List out the major construction machineries normally used at present in highway construction.
9. Define the term 'Pavement Serviceability Index' with its importance.
10. What do you mean by the term 'Highway Project Formulation'?

PART B — ( $5 \times 13 = 65$  marks)

11. (a) Write shortly the significance of 'Soil Suitability Analysis and Road Ecology' in highway Planning.

Or

- (b) Write in brief the history of road development in India after independence.

12. (a) Explain in brief the various classifications of rural roads with its salient components as per IRC standards with neat sketches.

Or

- (b) Explain shortly various special considerations to be given in design and construction of Hilly roads in highway design.

13. (a) Explain in brief various design principles to be adopted in flexible pavement design.

Or

- (b) Explain in detail the various design practices normally adopted in rigid pavement design as per IRC standards.

14. (a) Write in detail the different types of tests to be conducted to check the suitability of 'Aggregate Material' in highway materials.

Or

- (b) Discuss in brief the construction practice with modern material and methods to be adopted for a high type of bituminous pavement as per IRC standards.

15. (a) Explain in detail the pavement management system (PMS) with its effectiveness in pavement maintenance.

Or

- (b) Illustrate with neat sketches any four different types of pavement distress normally occur in flexible pavement with its preventive measures.

PART C — ( $1 \times 15 = 15$  marks)

16. (a) Explain in brief the modern methods of laying highway alignment being adopted at present with its merits and demerits.

Or

- (b) Write in detail the present status of highway drainage in Chennai city roads and list out the measures to be taken for effective removal of water from the pavement.



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**Question Paper Code : 91307**

**B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019**

**Fifth Semester**

**Civil Engineering**

**CE 6504 – HIGHWAY ENGINEERING**

**(Regulations 2013)**

**Time : Three Hours**

**Maximum : 100 Marks**

**Specific chart may be issued.  
Answer ALL questions.**

**PART – A**

**(10×2=20 Marks)**

1. Write short notes on Highway Research Board.
2. Write the functions of Indian Road Congress.
3. Differentiate between Right of Way and Carriage Way.
4. Draw a typical Transition Curve and mark all its zones.
5. What are the requirements of an ideal pavement ?
6. What is Equivalent single wheel load ?
7. Differentiate between 'Geo-Textiles and Geo-Membrane' in highway construction.
8. Write short note on Highway Drainage.
9. List any 4 types of failures observed in flexible pavement.
10. What are the causes of cracks in Pavement ?

**PART – B**

**(5×13=65 Marks)**

11. a) i) List out all the types of Highways as classified in the Indian Context starting from the Expressways upto Village/Rural Roads ; for each type, briefly state its specifications.  
ii) List the effects on Environment and Ecology of the Surroundings due to a highway project.

**(OR)**

- b) Illustrate with neat sketches and explain, how obligatory points control a highway alignment.



91307

12. a) Explain the types of gradient.

(OR)

b) A road has a total width of 7.5 m including extra widening on curve and design speed of 65 kmph. Calculate the length of transition curve and its shift on this curve of 200 m radius. Allowable super elevation is 1 in 150 and pavement is rotated about center line.

13. a) Design the pavement for construction of a new bypass with the following data :

1) Two lane carriage way.

2) Initial traffic in the year of completion of construction = 400 CVPD (sum of both directions)

3) Traffic growth rate = 7.5%

4) Design life = 15 years.

5) Vehicle damage factor based on axle load survey = 2.5 standard axle per commercial vehicle.

6) Design CBR of subgrade soil = 4%

(OR)

b) Explain in sequence the steps followed in design of cement concrete pavement.

14. a) Discuss the following test procedures for testing the quality of aggregate and Bitumen.

i) Aggregate Impact Test.

ii) Softening Point Test.

(OR)

b) Discuss the construction practice adopted for flexible pavement.

15. a) Explain in detail the possible causes and remedial measures of Rigid Pavement failure.

(OR)

b) Explain the methods employed for evaluation of pavements and explain the evaluation of pavement by Benkelman Beam method and deflection measurements.

PART – C

(1×15=15 Marks).

16. a) Explain the process of engineering survey for a highway alignment through conventional method.

(OR)

b) i) Explain PIEV Theory with neat sketch.

ii) Compare two modes of Transportation – Railways and Highways.