

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3150613

Date: 30/05/2026

Subject Name: Pavement Design and Highway construction

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a) Enumerate the chemical constituents of bituminous binders used in pavements. **03**
 - (b) Discuss the essential properties of subgrade soil for highway pavement. **04**
 - (c) Explain the purpose and method of the Los Angeles abrasion test on aggregates. **07**
- Q.2**
- (a) Explain the main functions of the surface, base, and subbase layers in a pavement structure. **03**
 - (b) Describe the major factors that influence the selection of pavement materials for different layers. **04**
 - (c) Explain the concept of volume stability in subgrade soils and its effect on pavement integrity. **07**
- OR**
- Q.2**
- (c) Describe Boussinesq's theory for stress distribution in pavements. **07**
- Q.3**
- (a) Differentiate between flexible pavement and rigid pavement. **03**
 - (b) Explain the difference between subgrade rutting criteria and fatigue cracking criteria in flexible pavement design. **04**
 - (c) Describe the design method as per IRC 58 for plain jointed rigid pavements. **07**
- OR**
- Q.3**
- (a) How does the modulus of resilience of subgrade influence pavement thickness design? **03**
 - (b) Describe the main features of IITPAVE software used for pavement design. **04**
 - (c) Explain Friberg's analysis for dowel bar design. **07**
- Q.4**
- (a) Discuss the importance of drainage considerations in pavement design. **03**
 - (b) Explain the difference between WBM and WMM base courses in terms of construction method. **04**
 - (c) Discuss the provision and function of each joint type used in rigid pavement construction. **07**
- OR**
- Q.4**
- (a) Compare lime stabilization to cement stabilization in pavement construction **03**
 - (b) Critically evaluate the suitability of locally available materials for sub-base construction as per IRC/MoRTH standards. **04**

(c) Evaluate the impact of using recycled materials in pavement layers on structural performance and sustainability. **07**

Q.5 (a) Compare techniques for checking surface evenness of new pavements **03**

(b) Evaluate the effectiveness of various maintenance strategies in minimizing pavement deterioration. **04**

(c) Judge the suitability of overlay techniques for strengthening damaged pavements in urban and rural contexts. **07**

OR

Q.5 (a) List key safety precautions to be followed during highway pavement construction. **03**

(b) Write a note on emission reduction potential of Warm Mix Asphalt technologies as per IRC:SP:101. **04**

(c) Examine the effectiveness of cold mix technology for rural road construction in terms of energy saving and environmental benefits as per IRC:SP:100. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V EXAMINATION – SUMMER 2025****Subject Code:3150613****Date:20-05-2025****Subject Name:Pavement Design and Highway construction****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

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|------------|---|-----------|
| Q.1 | (a) Briefly explain CBR. | 03 |
| | (b) Give classification of modified bitumen. | 04 |
| | (c) Explain factors affecting flexible pavement design. | 07 |
| Q.2 | (a) Enlist physical properties requirement for rural road. | 03 |
| | (b) Calculate VDF for wheel load of 2160 kg. Take standard wheel load as 1080 kg. | 04 |
| | (c) Calculate CSA for AADT of 2500 veh/hr, design period of 30 years, LDF=0.75, VDF=2, vehicle growth rate = 7% per year. | 07 |
| | OR | |
| | (c) Write and explain formula for calculating CSA. | 07 |
| Q.3 | (a) Explain effect of temperature stresses in rigid pavement. | 03 |
| | (b) State critical conditions of stress in rigid pavement. | 04 |
| | (c) Compute the radius of relative stiffness and equivalent radius of resisting section of 22 cm thick cement concrete slab from the following data:
E of Cement concrete = 2.1×10^5 kg/cm ² , Poisson's ratio for concrete = 0.15,
Modulus of subgrade reaction = 8 kg/cm ³ , radius of contact area of wheel load = 15 cm. | 07 |
| | OR | |
| Q.3 | (a) Draw neat titled sketch expansion joint in rigid pavement. | 03 |
| | (b) Differentiate between highway and runway. | 04 |
| | (c) Calculate the stresses at interior, edge and corner region of cement concrete pavement using Westergaard's stress equations. Take wheel load = 5200 kg, $E_c = 3 \times 10^5$ kg/cm ² , Pavement thickness = 20 cm, $\mu = 0.15$, Modulus of subgrade reaction $K = 7$ kg/cm ³ , Radius of contact area = 15cm | 07 |
| Q.4 | (a) Describe construction procedure of WMM course. | 03 |
| | (b) Describe construction procedure of Bituminous base course. | 04 |
| | (c) Discuss in detail prime coat and tack coat. | 07 |
| | OR | |
| Q.4 | (a) Describe construction procedure of drainage layer. | 03 |
| | (b) Describe procedure for bituminous mix design. | 04 |
| | (c) Discuss importance of joints in rigid pavement. | 07 |

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|------------|------------|--|-----------|
| Q.5 | (a) | Discuss types of maintenance of flexible pavement. | 03 |
| | (b) | State the need of maintenance of pavement. | 04 |
| | (c) | Discuss design of overlay. | 07 |
| OR | | | |
| Q.5 | (a) | Discuss types of maintenance of rigid pavement. | 03 |
| | (b) | Briefly explain Recycled Asphalt Pavement. | 04 |
| | (c) | Discuss microsurfacing. | 07 |

Enrolment No./Seat No _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2024

Subject Code:3150613

Date:23-05-2024

Subject Name:Pavement Design and Highway construction

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. Any Codes/guidelines are not allowed.

MARKS

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|------------|-----|--|-----------|
| Q.1 | (a) | List and explain the desirable properties of road aggregates. | 03 |
| | (b) | What are the factors influencing stresses on rigid pavement? List the assumptions. | 04 |
| | (c) | What are Emulsions? Explain in detail different types of emulsions. | 07 |
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| Q.2 | (a) | Differentiate between legal axle load and standard axle load. | 03 |
| | (b) | Explain bituminous pavement with cemented base. | 04 |
| | (c) | Discuss Westergaard's concept of temperature stresses in concrete pavements. | 07 |
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| OR | | | |
| | (c) | Discuss Burmister's Two Layer Theory stating the assumptions. | 07 |
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| Q.3 | (a) | Explain the function of longitudinal joints in CC pavements. | 03 |
| | (b) | Explain fatigue and rutting failures in bituminous layer. | 04 |
| | (c) | Explain the Fatigue concept as per the IIT RIGID software package. | 07 |
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| OR | | | |
| Q.3 | (a) | Write the primary purposes for the application of a prime coat on an aggregate base course. | 03 |
| | (b) | What are the various wheel load factors to be considered in pavement design? Explain each in detail. | 04 |
| | (c) | Describe step by step procedure for designing a Flexible Pavement with IRC method. | 07 |
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| Q.4 | (a) | Write a note on: granular sealing. | 03 |
| | (b) | Explain construction methodology for drainage requirements in rigid pavement. | 04 |
| | (c) | Explain the selection and compaction criteria for Binder and wearing course in bituminous mix. | 07 |
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| OR | | | |
| Q.4 | (a) | Discuss the need of maintenance in flexible pavement. | 03 |
| | (b) | Describe the construction procedure of WMM road. | 04 |

(c) Explain the process of selection of different bituminous mix treatments as per specification of MORTH 07

Q.5 (a) Write a note on: Warm Mix Asphalt. 03

(b) Write a short note on micro surfacing. 04

(c) List out the types of overlays and discuss their functions. 07

OR

Q.5 (a) Write a note on: Recycle Aggregate Pavement (RAP) 03

(b) Explain briefly the plant mix technology as per IRC. 04

(c) Explain the salient features of ultra-thin white topping as per IRC SP-76. 07

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- V EXAMINATION-SUMMER 2023****Subject Code: 3150613****Date: 28/06/2023****Subject Name: Pavement Design and Highway construction****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

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|------------|---|-----------|
| Q.1 | (a) What is the difference between bitumen and tar? | 03 |
| | (b) Discuss the environmental characteristics of pavement design. | 04 |
| | (c) Enlist the tests performed for aggregates and explain the Deval abrasion test in detail | 07 |
| | | |
| Q.2 | (a) Define (i) Lane distribution factor, (ii) Vehicle damage factor, and (iii) Equivalent single axle load. | 03 |
| | (b) Write a note on (i) cutback bitumen and (ii) bitumen emulsion. | 04 |
| | (c) Explain various types of joints used in concrete pavements. Point out the differences in their functions. | 07 |
| | | |
| OR | | |
| | (c) Explain the combined effect of temperature stress and load stress considered in concrete pavements. | 07 |
| | | |
| Q.3 | (a) Explain briefly the construction procedure of granular sub-base in bituminous pavement. | 03 |
| | (b) Explain the concept of fatigue failure and rutting failure in bituminous layer. | 04 |
| | (c) Explain the design principles for design of dowel bars and tie bars. | 07 |
| | | |
| OR | | |
| Q.3 | (a) Distinguish between seal coat, prime coat and tack coat. | 03 |
| | (b) Discuss various vehicle parameters considered in design of pavement. | 04 |
| | (c) Mention various steps involved in pavement design of bituminous pavements as per IRC:37. | 07 |
| | | |
| Q.4 | (a) Write a note on: mud pumping. | 03 |
| | (b) Explain the importance of dry lean concrete in construction of rigid pavement as per IRC-49. | 04 |
| | (c) Mention the steps followed in estimating the quantity of aggregates and binder in surface dressing. | 07 |
| | | |
| OR | | |
| Q.4 | (a) Discuss the causes of pavement bleeding. | 03 |
| | (b) Differentiate between wet mix macadam and water bound macadam. | 04 |
| | (c) What is Interlocking Concrete Block Pavement (ICBP). Also explain its procedure of laying. | 07 |
| | | |
| Q.5 | (a) Differentiate between hot in place and cold in place. | 03 |
| | (b) Write a note on pavement roughness. | 04 |

- (c) Describe various types of distresses in pavement and also explain possible surface maintenance measures. **07**

OR

- Q.5** (a) Write a note on: slurry seal. **03**
- (b) Explain briefly the cold mix technology as per IRC SP-100. **04**
- (c) Explain the importance of ultra-thin white topping over the conventional white topping. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150613**Date:13/06/2022****Subject Name:Pavement Design and Highway construction****Time:02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. IRC codes are not allowed.

- Q.1** (a) Explain the flexible pavement components and functions of its. **03**
(b) Write short note on: Stone Matrix Asphalt **04**
(c) Explain Marshall method for design of bituminous mix. **07**
- Q.2** (a) Explain the terms: WBM and WMM **03**
(b) Explain the desirable properties of road aggregates to be used in pavement construction. **04**
(c) What are the various tests carried out on bitumen? Explain any one of them. **07**
- OR**
- (c) Enlist different methods of road construction. Discuss their advantages and disadvantages. **07**
- Q.3** (a) Discuss desirable properties of Soil. **03**
(b) Write short note on: (a) Emulsion (b) Cut back **04**
(c) Explain 'CBR' Test in brief. **07**
- OR**
- Q.3** (a) State advantages and disadvantages of earth roads. **03**
(b) Differentiate between Flexible and rigid pavement with neat sketch. **04**
(c) Explain different types of failures in flexible and rigid pavements. **07**
- Q.4** (a) Discuss the factors affecting the design of pavements. **03**
(b) Explain the following terms in flexible pavement construction: (a) Prime Coat (b) Tack coat (c) seal coat **04**
(c) Explain the procedure of design of rigid pavements as per IRC-58 guidelines. **07**
- OR**
- Q.4** (a) Explain ESWL. **03**
(b) Discuss different software available for design of pavement. **04**
(c) Explain the procedure of design of flexible pavements as per IRC-37 guidelines. **07**
- Q.5** (a) Write short note on: Benkelman beam method **03**
(b) Explain the following: (a) Maintenance of Pavement (b) Dry Lean Concrete **04**
(c) What are the various types of joints in C.C. Pavements? Explain their functions with neat sketch. **07**

OR

- Q.5** **(a)** Explain IRC recommendations for design of dowel bars. **03**
- (b)** As C.C. Pavement has a thickness of 18 cm and has two lanes of 7.2 m with **04**
 a longitudinal joint along the centre. Design the dimensions and spacing of
 the tie bar. Use of the following data:
 Allowable working stress in tension, $S_s = 1400 \text{ kg/cm}^2$; Unit weight of
 concrete, $W = 2400 \text{ kg/ m}^3$; Coefficient of friction = 1.5: Allowable bond
 stress in deformed bars = 24.6 kg/cm^2 .
- (c)** Explain the terms: (a) Cold in place (b) Hot in place (c) Micro surfacing **07**
