GUJARAT TECHNOLOGICAL UNIVERSITY

BE 5 SEMESTER – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Pavement Design and Construction - 3150613

Chapter 1: Pavement Materials and Characterization

Repeated Questions:

1. Aggregates:

- **Q.** Various tests on aggregates and explain any two in detail / Deval abrasion test / impact test **(SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** Desirable properties of road aggregates to be used in pavement construction **(SUMMER 2022, 4 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 7 Marks)**

2. Bituminous Materials:

- **Q.** Note on bitumen emulsion / Emulsions? Explain in detail different types of emulsions / important properties **(SUMMER 2022, 4 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 7 Marks)**
- **Q.** Note on cutback bitumen **(SUMMER 2022, 4 Marks; SUMMER 2023, 4 Marks)**
- **Q.** Difference between bitumen and tar / Compare Tar and Bitumen **(WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks; WINTER 2025, 4 Marks)**
- **Q.** Advantages of modified bitumen in brief / Write a note on: modified bitumen / Give classification of modified bitumen **(WINTER 2022, 4 Marks; WINTER 2023, 4 Marks; SUMMER 2025, 4 Marks)**

3. Subgrade and Soil Tests:

- **Q.** Modulus of resilient / Define resilient modulus, elastic modulus, stiffness modulus, dynamic modulus / Explain modulus of resilient of subgrade **(WINTER 2022, 4 Marks; WINTER 2023, 3 Marks; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks)**
- **Q.** Explain 'CBR' Test in brief / Briefly explain CBR **(SUMMER 2022, 7 Marks; SUMMER 2025, 3 Marks)**

4. Bituminous Mix Design:

- **Q.** Marshall method for design of bituminous mix / State the procedure of Marshall stability test / Describe procedure for bituminous mix design **(SUMMER 2022, 7 Marks; WINTER 2023, 4 Marks; SUMMER 2025, 4 Marks)**

5. Material Requirements for Roads:

- **Q.** Discuss the physical properties requirements for rural road and high-volume road / Enlist physical properties requirement for rural road **(WINTER 2022, 7 Marks; SUMMER 2025, 3 Marks)**

Other Important Questions:

1. Bituminous Materials and Mixes:

- **Q.** Define: Bitumen, Emulsion, Tar. **(WINTER 2022, 3 Marks)**
- **Q.** What are the desirable properties of a bituminous mix? **(WINTER 2024, 3 Marks)**

2. Soil and Environmental Characteristics:

- **Q.** Discuss desirable properties of Soil. **(SUMMER 2022, 3 Marks)**
- **Q.** Discuss the environmental characteristics of pavement design. **(SUMMER 2023, 4 Marks)**

Chapter 2: Design of Highway Pavement

Repeated Questions:

1. Types of Pavements and Pavement Components:

- **Q.** Differentiate between Flexible and rigid pavement with neat sketch / Describe various factors affecting selection of type of pavement **(SUMMER 2022, 4 Marks; WINTER 2025, 3 Marks; WINTER 2025, 3 Marks OR)**
- **Q.** Explain various pavement layers with neat sketch / Draw the cross section of a typical bituminous pavement showing all its components / Explain the flexible pavement components and functions **(SUMMER 2022, 3 Marks; WINTER 2023, 7 Marks; WINTER 2024, 3 Marks; WINTER 2025, 3 Marks)**

2. Design Factors and Traffic Parameters (Theory):

- **Q.** Explain factors affecting pavement design / What are the factors considered for rigid pavement design? / Discuss the factors affecting the design of pavements **(WINTER 2023, 4 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 4 Marks)**
- **Q.** Define (i) Lane distribution factor, (ii) Vehicle damage factor, (iii) Equivalent single axle load / Explain the terms: ESWL, EWLF, VDF, modulus of resilient / Explain ESWL **(SUMMER 2022, 3 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 3 Marks; WINTER 2025, 3 Marks)**
- **Q.** Differentiate between legal axle load and standard axle load **(SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks)**
- **Q.** Write a note on: drainage consideration in pavement design / Discuss the importance of drainage in pavement design. **(WINTER 2022, 3 Marks; WINTER 2023, 3 Marks)**

3. Traffic Calculations (Numerical):

- **Q.** Calculate VDF using fourth power damage law / Calculate VDF for wheel load of 2160 kg / Compute the design traffic (in msa) for bituminous pavement [Diagram required – refer to the original question paper] **(WINTER 2023, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2025, 4 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 4 Marks)**

4. Stress Analysis Theories:

- **Q.** Explain the Boussinesq's theory of stress analysis / boundary conditions and circular loading concept for Boussinesq's problem **(WINTER 2022, 7 Marks; WINTER 2024, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** Explain the Burmister's two-layer and three-layer theory / Burmister's Two Layer Theory stating the assumptions / Burmister three layers theory with neat sketch **(WINTER 2022, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2025, 7 Marks)**

5. Flexible Pavement Design:

- **Q.** Mention various steps involved in pavement design of bituminous pavements as per IRC:37 / Describe step by step procedure for designing a Flexible Pavement with IRC method **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks)**
- **Q.** Explain the concept of fatigue failure and rutting failure in bituminous layer / Discuss the subgrade rutting criteria and fatigue cracking criteria for bituminous layer **(WINTER 2022, 7 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 7 Marks)**
- **Q.** Discuss the criteria of pavement design for low volume road as per IRC SP-62 **(WINTER 2022, 4 Marks; WINTER 2024, 4 Marks)**
- **Q.** Write the steps to be followed for analysing flexible pavements using IITPAVE **(WINTER 2023, 7 Marks; WINTER 2025, 7 Marks)**

6. Rigid Pavement Design (Theory):

- **Q.** Explain various types of joints used in concrete pavements. Point out the differences in their functions. / Requirements of transverse joints and longitudinal joints / Function of longitudinal joints / Discuss importance of joints / Draw sketches **(SUMMER 2022, 7 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 3 Marks)**
- **Q.** Explain the design principles for design of dowel bars and tie bars / Explain the Friberg's analysis of dowel bar design / Differences in design principles / Design dimensions and spacing of tie bar [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks; WINTER 2024, 4 Marks)**
- **Q.** Explain the combined effect of temperature stress and load stress considered in concrete pavements / Discuss Westergaard's concept of temperature stresses / Discuss the critical combination of stresses due to wheel load and temperature effects **(SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 3 Marks; SUMMER 2025, 4 Marks; WINTER 2025, 7 Marks)**
- **Q.** Explain the Fatigue concept as per the IIT RIGID software package / Explain the procedure of design of rigid pavements as per IRC-58 guidelines **(SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks; SUMMER 2024, 7 Marks)**

7. Rigid Pavement Design (Numerical):

- **Q.** Compute the radius of relative stiffness and equivalent radius of resisting section **(SUMMER 2025, 3 Marks; WINTER 2025, 4 Marks)**
- **Q.** Calculate the stresses at interior, edge and corner region of cement concrete pavement using Westergaard's stress equations **(WINTER 2023, 7 Marks; SUMMER 2025, 7 Marks)**

Other Important Questions:

1. Design Parameters and Software:

- **Q.** What are the various wheel load factors to be considered in pavement design? Explain each in detail. **(SUMMER 2024, 4 Marks)**
- **Q.** Discuss various vehicle parameters considered in design of pavement. **(SUMMER 2023, 4 Marks)**
- **Q.** Define: (1) Modulus of subgrade reaction (2) Poisson's ratio (3) warping stress **(WINTER 2023, 3 Marks)**
- **Q.** Discuss different software available for design of pavement. **(SUMMER 2022, 4 Marks)**

2. Pavement Types and Analysis Approach:

- **Q.** Explain the difference in analysis approach between the concrete and bituminous pavements. **(WINTER 2024, 4 Marks)**
- **Q.** Mention the advantages and disadvantages of full depth bituminous pavement. **(WINTER 2024, 3 Marks)**
- **Q.** Explain bituminous pavement with cemented base. **(SUMMER 2024, 4 Marks)**

Chapter 3: Construction of Pavement

Repeated Questions:

1. Rigid and Block Pavement Construction:

- **Q.** Explain the importance of dry lean concrete in construction of rigid pavement as per IRC-49 / Explain Dry lean concrete. Write the advantages / Explain the use of dry lean concrete as subbase for rigid pavement / Define DLC **(SUMMER 2022, 4 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 7 Marks; WINTER 2024, 7 Marks; WINTER 2025, 3 Marks)**
- **Q.** Interlocking Concrete Block Pavement (ICBP). Also explain its procedure of laying / Advantages of concrete block pavement. Enlist various types of concrete blocks / Explain the method of construction of block pavement as per IRC SP 63 **(WINTER 2022, 4 Marks; WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks; WINTER 2024, 4 Marks)**
- **Q.** Describe the strength requirements as per guidelines of IRC SP 63 **(WINTER 2024, 7 Marks)**

2. Granular and Bituminous Layers:

- **Q.** Differentiate between wet mix macadam and water bound macadam / Describe the construction procedure of WMM road / Describe construction procedure of WMM course / Explain the construction process of WBM and WMM **(SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 7 Marks)**
- **Q.** Write the construction procedure for WBM / Write a short note on penetration macadam / Explain the terms: WBM and WMM **(SUMMER 2022, 3 Marks; WINTER 2023, 3 Marks; WINTER 2023, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** Explain briefly the construction procedure of granular sub-base in bituminous pavement / Construction methodology for drainage requirements in rigid pavement / Describe construction procedure of Bituminous base course / Describe construction procedure of drainage layer **(SUMMER 2023, 4 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 4 Marks; SUMMER 2025, 4 Marks)**

3. Prime Coat, Tack Coat and Seal Coat:

- **Q.** Distinguish between seal coat, prime coat and tack coat / Write the primary purposes for the application of a prime coat / Explain the following terms: (a) Prime Coat (b) Tack coat (c) seal coat / Discuss in detail prime coat and tack coat / Give the function of Prime coat and Seal coat **(SUMMER 2022, 4 Marks; SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 3 Marks)**

4. Soil Stabilization:

- **Q.** Discuss the importance of lime stabilized subgrade / How is the quantity of lime decided in soil-lime stabilization? / Briefly explain the need of soil stabilization / Describe cement stabilization **(WINTER 2022, 3 Marks; WINTER 2024, 3 Marks; WINTER 2025, 4 Marks)**

Other Important Questions:

1. General Road Construction:

- **Q.** Enlist different methods of road construction. Discuss their advantages and disadvantages. **(SUMMER 2022, 7 Marks)**
- **Q.** State advantages and disadvantages of earth roads. **(SUMMER 2022, 3 Marks)**
- **Q.** Explain the construction process of Subgrade. **(WINTER 2025, 7 Marks)**
- **Q.** List key safety precautions to be followed during highway pavement construction. **(SUMMER 2026, 3 Marks)**

2. Bituminous Construction:

- **Q.** Write a note on: granular sealing. **(SUMMER 2024, 3 Marks)**

- **Q.** Explain the selection and compaction criteria for Binder and wearing course in bituminous mix. **(SUMMER 2024, 7 Marks)**
- **Q.** Mention the steps followed in estimating the quantity of aggregates and binder in surface dressing. **(SUMMER 2023, 7 Marks)**

3. Rigid Pavement Construction:

- **Q.** Explain with a neat sketch, the transition slab between rigid and flexible pavement. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks)**
- **Q.** List the properties required for joint filler and joint sealer material. **(WINTER 2025, 3 Marks)**
- **Q.** Compare alternate bay and continuous bay methods of construction of cement concrete road. **(WINTER 2023, 4 Marks)**

Chapter 4: Maintenance of Pavement

Repeated Questions:

1. Pavement Maintenance – Need and Types:

- **Q.** Discuss the need of maintenance in flexible pavement / Enlist and explain type of pavement maintenance / Discuss types of maintenance of flexible pavement / State the need of maintenance of pavement / Discuss types of maintenance of rigid pavement / Briefly explain the methodology adopted for rigid pavement maintenance / Evaluate the effectiveness of various maintenance strategies **(WINTER 2023, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks; SUMMER 2025, 4 Marks; SUMMER 2025, 4 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 4 Marks)**

2. Pavement Distresses:

- **Q.** Describe various types of distresses in pavement and also explain possible surface maintenance measures / Explain the types of defects in bituminous surfacing / Classify pavement distress in flexible pavement and mention the causes and preventive measures / Different types of failures in flexible and rigid pavements / Briefly explain the types of defects in flexible pavements **(SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks; WINTER 2024, 7 Marks; WINTER 2025, 4 Marks)**
- **Q.** Discuss the causes of pavement bleeding **(SUMMER 2023, 3 Marks; WINTER 2024, 3 Marks)**
- **Q.** Explain the symptoms and causes of edge-breaking in pavements / symptoms and causes of shallow depressions / symptoms, location and causes of raveling **(WINTER 2022, 3 Marks; WINTER 2024, 7 Marks)**

3. Maintenance Management and Treatments:

- **Q.** Enlist functions of Pavement Maintenance Management System. **(WINTER 2023, 3 Marks)**
- **Q.** Discuss design of overlay / List out the types of overlays and discuss their functions / Judge the suitability of overlay techniques for strengthening damaged pavements **(SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Attributes and warrants for suitable preventive maintenance treatments as per IRC-82 / Explain the criteria for selection of preventive maintenance treatment of pavements **(WINTER 2022, 7 Marks; WINTER 2024, 7 Marks)**

4. Pavement Evaluation:

- **Q.** Compare techniques for checking surface evenness of new pavements **(SUMMER 2026, 3 Marks)**

Other Important Questions:

1. Pavement Distress and Evaluation:

- **Q.** Write a note on: mud pumping. **(SUMMER 2023, 3 Marks)**
- **Q.** Write a note on pavement roughness. **(SUMMER 2023, 4 Marks)**
- **Q.** Write short note on: Benkelman beam method. **(SUMMER 2022, 3 Marks)**

Chapter 5: Introduction to New Technology

Repeated Questions:

1. Recycling of Bituminous Pavement:

- **Q.** Differentiate between hot in place and cold in place / Write a note on: Hot in-plant recycling (HIP) / Explain hot in place recycling in detail / Explain the terms: (a) Cold in place (b) Hot in place (c) Micro surfacing / Concept and procedure of recycling of bituminous pavement **(SUMMER 2022, 7 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks; WINTER 2023, 7 Marks; WINTER 2024, 4 Marks; WINTER 2024, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** Write a note on: Recycle Aggregate Pavement (RAP) / Briefly explain Recycled Asphalt Pavement / Enlist various aspects of recycling / Evaluate the impact of using recycled materials in pavement layers **(SUMMER 2024, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks; SUMMER 2026, 7 Marks)**

2. Surface Treatments:

- **Q.** Write a short note on micro surfacing / Discuss microsurfacing / Explain the terms: Micro surfacing **(SUMMER 2022, 7 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** Explain different types of slurry sealing / Write a note on: slurry seal. **(WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks)**

3. White Topping:

- **Q.** Explain the importance of ultra-thin white topping over the conventional white topping / Explain the salient features of ultra-thin white topping as per IRC SP-76 / Benefits of white topping as per IRC SP:076-2015 / Benefits of white topping on existing bituminous pavements **(SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 7 Marks; WINTER 2025, 7 Marks)**

4. Cold Mix and Warm Mix Technology:

- **Q.** Explain briefly the cold mix technology as per IRC SP-100 / Examine the effectiveness of cold mix technology for rural road construction **(SUMMER 2023, 4 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Write a note on: Warm Mix Asphalt / Explain the moisture susceptibility in warm mix asphalt as per IRC SP 101 / Note on emission reduction potential of Warm Mix Asphalt technologies **(SUMMER 2024, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks)**

Other Important Questions:

1. New Technologies and Reclamation:

- **Q.** Write short note on: Stone Matrix Asphalt. **(SUMMER 2022, 4 Marks)**
- **Q.** Explain briefly the plant mix technology as per IRC. **(SUMMER 2024, 4 Marks)**
- **Q.** Explain the milling process of reclamation in pavement. **(WINTER 2022, 7 Marks)**

Uncategorised Questions

Repeated Questions:

None identified.

Other Important Questions:

1. Highway and Runway:

- **Q.** Differentiate between highway and runway. **(SUMMER 2025, 4 Marks)**

****