

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020****Subject Code:3150613****Date:03/02/2021****Subject Name:Pavement Design & Highway construction****Time:10:30 AM TO 12:30 PM****Total Marks: 56****Instructions:**

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. IRC – 37 and IRC -58 codes are allowed.

	MARKS
<b>Q.1 (a)</b> What are the desirable properties of bituminous mix?	<b>03</b>
<b>(b)</b> Write short notes on (i) Mud pumping (ii) Structural cracks	<b>04</b>
<b>(c)</b> With the help of sketches, mention various layers of flexible pavement. Write function of each layer.	<b>07</b>
<b>Q.2 (a)</b> What are warping stresses? How are they developed in CC pavements?	<b>03</b>
<b>(b)</b> Enlist various tests carried out on bitumen emulsion. Explain any one in detail.	<b>04</b>
<b>(c)</b> Mention various steps involved in mechanistic pavement design of bituminous pavements as per IRC 37	<b>07</b>
<b>Q.3 (a)</b> What are requirements of expansion and contraction joints in rigid pavements?	<b>03</b>
<b>(b)</b> State assumptions and limitations of Boussinesq's theory	<b>04</b>
<b>(c)</b> List the different stresses induced in cement concrete pavements. Discuss the critical combination of these stresses.	<b>07</b>
<b>Q.4 (a)</b> Explain the selection and gradation of Binder course.	<b>03</b>
<b>(b)</b> What is an equivalent single axle load? How can it be determined?	<b>04</b>
<b>(c)</b> A 2.5 cm diameter dowel bar is transferring a vertical load of 3500N across a 0.5 cm wide joint. Compute the dowel bar deflection at the edge of the joint and the corresponding concrete bearing stresses. Can the concrete handle this stress? Given, $K_c$ of 100,000 MPa/m, $E_r$ of 200,000 MPa, and $f_c'$ of 28 MPa.	<b>07</b>
<b>Q.5 (a)</b> Differentiate between WBM and WMM	<b>03</b>
<b>(b)</b> What do you mean by Ultra thin White topping? Explain in brief.	<b>04</b>

- (c) Write the Construction procedure of embankment, subgrade and Sub base **07**

<b>Q.6</b>	<b>(a)</b>	Write a short note on Interlocking Concrete Block Pavement (ICBP)	<b>03</b>
	<b>(b)</b>	Write the steps in Design of overlay	<b>04</b>
	<b>(c)</b>	Explain the construction procedure of Earthwork, Granular sub base, drainage layer and Dry lean concrete as per IRC-49	<b>07</b>
<b>Q.7</b>	<b>(a)</b>	Differentiate between Cold in place (CIP) and Hot in place (HIP)	<b>03</b>
	<b>(b)</b>	Explain types of defects in maintenance of pavement	<b>04</b>
	<b>(c)</b>	Explain the Maintenance of pavement and its methodology as per IRC: SP:83	<b>07</b>
<b>Q.8</b>	<b>(a)</b>	Enlist different bituminous mix treatments used in construction of pavements	<b>03</b>
	<b>(b)</b>	Explain Cold mix technology as per IRC SP-100	<b>04</b>
	<b>(c)</b>	Explain Stone matrix asphalt as per IRC SP-79 and Warm mix asphalt as per IRC SP 101	<b>07</b>

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2021****Subject Code:3150613****Date:20/12/2021****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.

		<b>MARKS</b>
<b>Q.1</b>	(a) Explain the term 'Effective CBR'	<b>03</b>
	(b) What are the objectives of pavement maintenance	<b>04</b>
	(c) Describe the laboratory procedure for determination of toughness property of road aggregates	<b>07</b>
<b>Q.2</b>	(a) Draw the cross section of typical pavement and label components.	<b>03</b>
	(b) What are the factors to be considered in design of pavements?	<b>04</b>
	(c) Design a concrete pavement for the following data as per the guidelines of IRC 58 Design wheel load: 5000 kg Present traffic: 500 CV/day Design life: 20 years Traffic growth rate: 8% Temperature variation: 10°C Modulus of subgrade reaction K: 6 kg/cm <sup>3</sup> Flexural strength of concrete: 40 kg/cm <sup>3</sup> Modulus of elasticity E: 3 × 10 <sup>5</sup> kg/cm <sup>2</sup> Poisson's ratio: 0.15 Co-efficient of thermal expansion α: 10 × 10 <sup>-6</sup> /°C	<b>07</b>
	<b>OR</b>	
	(c) Compare the salient characteristics of cutback and emulsions and describe under what circumstance each one is used	<b>07</b>
<b>Q.3</b>	(a) What are requirements of expansion and contraction joints in rigid pavements	<b>03</b>
	(b) Describe the construction procedure of WBM road	<b>04</b>
	(c) Describe Group Index Method of flexible pavement design.	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Write a brief note on dry lean concrete used in construction of concrete pavement	<b>03</b>
	(b) Write a note on: Equivalent Wheel load factor	<b>04</b>
	(c) Design a flexible pavement for the following data using CBR method Traffic density: 1000 CV/day Traffic growth rate: 8% per annum Road will be opened for traffic after construction period of two years CBR value of WBM course: 70% CBR value of Murum sub base: 40% Load at penetration of 5 mm: 90 kg Load at penetration of 2.5 mm: 60 kg	<b>07</b>
<b>Q.4</b>	(a) Discuss the criteria for selection of binder course in pavement construction	<b>03</b>

- (b) Justify the remedial measures for the following defects in flexible pavement **04**  
 i) Pothole formation ii) Rut formation
- (c) Explain the concept of determining ESWL by graphical method. **07**
- OR**
- Q.4** (a) Enlist general maintenance works required for bituminous road **03**  
 (b) Explain the alternate bay method of construction of concrete road with neat sketch. **04**  
 (c) Briefly describe the quality control tests used in construction of concrete pavements **07**
- Q.5** (a) Discuss the causes of pavement deterioration after period of time **03**  
 (b) Discuss the salient features and suitable sites of Thin White Topping **04**  
 (c) Explain the salient features of Stone matrix asphalt as per IRC SP-79 **07**
- OR**
- Q.5** (a) Write a note on: Hot In-place recycling **03**  
 (b) Explain the method of Improvement of Binder in the Reclaimed Material **04**  
 (c) Explain the procedure of designing thickness of overlay **07**

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2021****Subject Code:3150613****Date:17/09/2021****Subject Name:Pavement Design & Highway construction****Time:10:30 AM TO 01:00 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**

- Q.1**
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|--|-----------|
| (a) Compare between tar and bitumen.   | <b>03</b> |
| (b) What is modified emulsion?   | <b>04</b> |
| (c) Explain concept of modulus of resilient of sub base and base course as per IRC 37. | <b>07</b> |

- Q.2**
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|--|-----------|
| (a) What are the factors affecting pavement design?                                  | <b>03</b> |
| (b) What is the difference between ESWL & EWLF?                                      | <b>04</b> |
| (c) Enlist various tests carried out on bitumen emulsion. Explain any one in detail. | <b>07</b> |

**OR**

- |   |           |
|---|-----------|
| (c) What are requirements of expansion and contraction joints in rigid pavements? | <b>07</b> |
|---|-----------|
- Q.3**
- |   |           |
|---|-----------|
| (a) Explain IITPAVE software for granular base and granular sub base.   | <b>03</b> |
| (b) State assumptions and limitations of Boussinesq's theory.   | <b>04</b> |
| (c) List the different stresses induced in cement concrete pavements. Discuss the critical combination of these stresses. | <b>07</b> |

**OR**

- Q.3**
- |   |           |
|---|-----------|
| (a) What is an equivalent single axle load? How can it be determined? | <b>03</b> |
| (b) Differentiate between WBM and WMM.                                | <b>04</b> |
| (c) Write a short note on Westergaard's stress analysis.              | <b>07</b> |
- Q.4**
- |   |           |
|---|-----------|
| (a) Explain construction of drainage layer in rigid pavement.   | <b>03</b> |
| (b) Explain Pavement quality concrete construction requirements as per IRC: 15 and IRC: 58 and MORTH.                       | <b>04</b> |
| (c) What is importance of joints and its provision Interlocking Concrete Block Pavement (ICBP) and Its procedure of laying. | <b>07</b> |

**OR**

- Q.4**
- |   |           |
|---|-----------|
| (a) Write the steps for design of overlay in flexible pavement. | <b>03</b> |
| (b) Explain warm mix asphalt as per IRC SP 101.                 | <b>04</b> |

- (c) Explain in flexible pavement need of maintenance, types, planning & system approach as per IRC-82. **07**
- Q.5** (a) Write a short note on micro surfacing. **03**
- (b) Differentiate between Cold in place (CIP) and Hot in place (HIP). **04**
- (c) Explain maintenance and its methodology for rigid pavement as per IRC: SP: 83. **07**

**OR**

- Q.5** (a) Explain recycle aggregate pavement as per IRC: 120 (RAP). **03**
- (b) Write a short note on Ultra-thin white topping as per IRC SP-76. **04**
- (c) Describe in detail stone matrix asphalt as per IRC SP-79. **07**

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**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 a longitudinal joint along the centre. Design the dimensions and spacing of the tie bar. Use of the following data: **04**
- 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 =  $24.6 \text{ kg/cm}^2$ .
- (c) Explain the terms: (a) Cold in place (b) Hot in place (c) Micro surfacing **07**

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