Seat No.:_____ Enrolment No._____

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
Q.1	**(a)**	What are the desirable properties of bituminous mix?	**03**
	(b)	Write short notes on (i) Mud pumping (ii) Structural cracks	**04**
	(c)	With the help of sketches, mention various layers of flexible pavement. Write function of each layer.	**07**
Q.2	**(a)**	What are wharping stresses? How are they developed in CC pavements?	**03**
	(b)	Enlist various tests carried out on bitumen emulsion. Explain any one in detail.	**04**
	(c)	Mention various steps involved in mechanistic pavement design of bituminous pavements as per IRC 37	**07**
Q.3	**(a)**	What are requirements of expansion and contraction joints in rigid pavements?	**03**
	(b)	State assumptions and limitations of Boussinesq's theory	**04**
	(c)	List the different stresses induced in cement concrete pavements. Discuss the critical combination of these stresses.	**07**
Q.4	**(a)**	Explain the selection and gradation of Binder course.	**03**
	(b)	What is an equivalent single axle load? How can it be determined?	**04**
	(c)	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, *Kc* of 100,000 MPa/m, *Er* of 200,000 MPa, and $f\,c'$ of 28 MPa.	**07**
Q.5	**(a)**	Differentiate between WBM and WMM	**03**
	(b)	What do you mean by Ultra thin White topping? Explain in brief.	**04**

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

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

****

Seat No.: _____ Enrolment No._____

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.**

			MARKS
Q.1	**(a)**	Explain the term 'Effective CBR'	**03**
	(b)	What are the objectives of pavement maintenance	**04**
	(c)	Describe the laboratory procedure for determination of toughness property of road aggregates	**07**
Q.2	**(a)**	Draw the cross section of typical pavement and label components.	**03**
	(b)	What are the factors to be considered in design of pavements?	**04**
	(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: $10^{o}C$ Modulus of subgrade reaction K: 6 kg/cm^3 Flexural strength of concrete: 40 kg/cm^3 Modulus of elasticity E: 3×10^5 kg/cm^2 Poisson's ratio: 0.15 Co-efficient of thermal expansion α: $10 \times 10^{-6}/^{o}C$	**07**
		OR	
	(c)	Compare the salient characteristics of cutback and emulsions and describe under what circumstance each one is used	**07**
Q.3	**(a)**	What are requirements of expansion and contraction joints in rigid pavements	**03**
	(b)	Describe the construction procedure of WBM road	**04**
	(c)	Describe Group Index Method of flexible pavement design.	**07**
		OR	
Q.3	**(a)**	Write a brief note on dry lean concrete used in construction of concrete pavement	**03**
	(b)	Write a note on: Equivalent Wheel load factor	**04**
	(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	**07**
Q.4	**(a)**	Discuss the criteria for selection of binder course in pavement construction	**03**

	(b)	Justify the remedial measures for the following defects in flexible pavement i) Pothole formation ii) Rut formation	**04**
	(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**

****

Seat No.: _____ Enrolment No._____

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	**(a)**	Compare between tar and bitumen.	**03**
	(b)	What is modified emulsion?	**04**
	(c)	Explain concept of modulus of resilient of sub base and base course as per IRC 37.	**07**
Q.2	**(a)**	What are the factors affecting pavement design?	**03**
	(b)	What is the difference between ESWL & EWLF?	**04**
	(c)	Enlist various tests carried out on bitumen emulsion. Explain any one in detail.	**07**
		OR	
	(c)	What are requirements of expansion and contraction joints in rigid pavements?	**07**
Q.3	**(a)**	Explain IITPAVE software for granular base and granular sub base.	**03**
	(b)	State assumptions and limitations of Boussinesq's theory.	**04**
	(c)	List the different stresses induced in cement concrete pavements. Discuss the critical combination of these stresses.	**07**
		OR	
Q.3	**(a)**	What is an equivalent single axle load? How can it be determined?	**03**
	(b)	Differentiate between WBM and WMM.	**04**
	(c)	Write a short note on Westergaard's stress analysis.	**07**
Q.4	**(a)**	Explain construction of drainage layer in rigid pavement.	**03**
	(b)	Explain Pavement quality concrete construction requirements as per IRC: 15 and IRC: 58 and MORTH.	**04**
	(c)	What is importance of joints and its provision Interlocking Concrete Block Pavement (ICBP) and Its procedure of laying.	**07**
		OR	
Q.4	**(a)**	Write the steps for design of overlay in flexible pavement.	**03**
	(b)	Explain warm mix asphalt as per IRC SP 101.	**04**

	(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**

****

Seat No.: _____ Enrolment No._____

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: Allowable working stress in tension, Ss = 1400 kg/cm^2; Unit weight of concrete, W = 2400 kg/ m^3; Coefficient of friction = 1.5: Allowable bond stress in deformed bars = 24.6 kg/cm^2.	**04**
	(c)	Explain the terms: (a) Cold in place (b) Hot in place (c) Micro surfacing	**07**

****