Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER II EXAMINATION – SUMMER 2017

Subject Code: 2721302 Date: 26/05/2017

Subject Name: Pavement Design, Construction and Evaluation

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.**

Q.1	**(a)**	Explain with sketch the functions of different layers of flexible pavement.	**07**
	(b)	Briefly describe: Contact pressure, ESWL, Vehicle Damage Factor, Lane Distribution Factor, WMM.	**07**
Q.2	**(a)**	Design a suitable bituminous pavement section for a dual two-lane carriageway. The traffic at last count is 600 commercial vehicles per day in both directions with average vehicle damage factor of 2.0. Design subgrade CBR is 4 % and the assumed design life of the pavement is 15 years after completion of construction. Take lane distribution factor 0.75 and assume 2 years between last count and the year of completion of construction. Use Guidelines of IRC 37-2001. (See Fig.1 and Plate 1)	**07**
	(b)	Explain with sketch laboratory procedure of CBR test.	**07**
		OR	
	(b)	Explain with sketch Tri-axial method for flexible pavement design.	**07**
Q.3	**(a)**	Explain with sketch laboratory procedure of Marshall stability test for bituminous mix design.	**07**
	(b)	Calculate the thickness of pavement section using tri-axial test method. E value of Subgrade = 110 kg/cm^2 , E value of base course material = 450 kg/cm^2 , E value of 7.5 cm thick bituminous concrete surface course material = 1050 kg/cm^2, Wheel load = 5200 kg, Radius of contact area = 16 cm, Traffic coefficient (x) = 1.8, Saturation Coefficient (y) = 0.8, Design Deflection = 0.20 cm.	**07**
		OR	
Q.3	**(a)**	Explain with sketches various stresses developed in rigid pavements.	**07**
	(b)	Calculate the stresses at interior, edge and corner region of cement concrete pavement using Westergaard's stress equations. Take wheel load = 5100 kg, Ec = 3 x 10^5 kg/cm^2 , Pavement thickness = 20 cm, μ = 0.15, Modulus of subgrade reaction K = 7 kg/cm^3, Radius of contact area = 15cm.	**07**
Q.4	**(a)**	Briefly explain the construction procedure for Bituminous Macadam as a base course in flexible pavement.	**07**
	(b)	The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is 0.9 m^3/sec. Design the cross section and longitudinal slope of the trapezoidal drain assuming the bottom width of the trapezoidal section to be 1.0 m and cross slope to be 1 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2 m/sec and Manning's roughness coefficient is 0.02.	**07**
		OR	
Q.4	**(a)**	Explain with detailed sketches, construction of expansion joint and contraction joint in rigid pavement.	**07**

(b) Design the spacing of expansion and contraction joints of a plain cement concrete pavement for a 2 lane highway using the given data. Take coefficient of thermal expansion of concrete = 10 x 10^{-6} /^{0}C, allowable tensile stress in C.C. during curing = 0.8 kg/cm^2, width of expansion joint gap = 2.4 cm, coefficient of friction = 1.5, maximum variation in temperature between summer and winter = 20^{0}C. **07**

Q.5 **(a)** Enlist various types of failures in flexible pavement. Describe any two with sketches stating its remedial measures. **07**

(b) Explain with sketch Falling Weight Deflection test. **07**

OR

Q.5 **(a)** Enlist various types of failures in rigid pavement. Describe any two with sketches stating its remedial measures. **07**

(b) Describe 'PSI' and 'PSR'. Discuss their importance and evaluation procedure. **07**

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IRC:37-2001

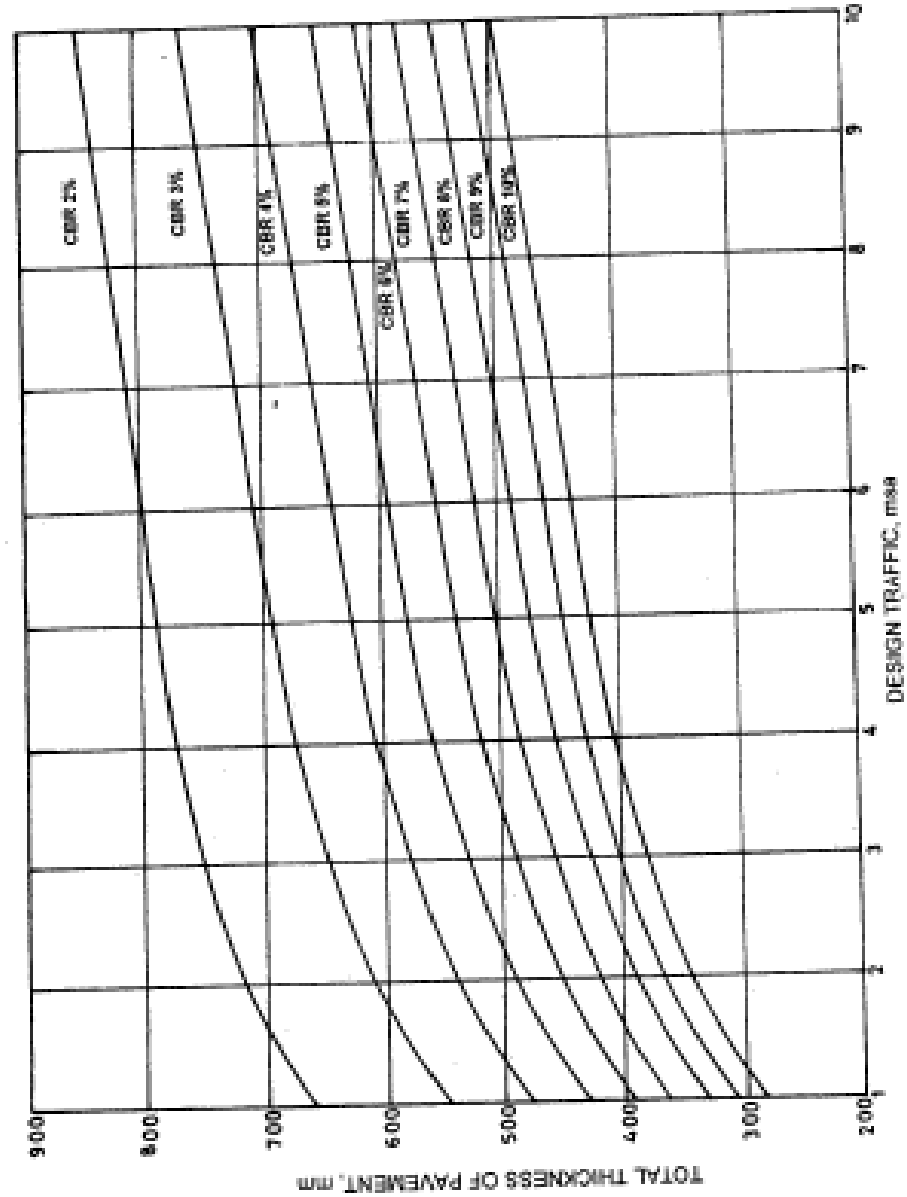

Fig. 1. Pavement Thickness Design Chart for Traffic 1-10 msa

PAVEMENT DESIGN CATALOGUE

PLATE 1 – RECOMMENDED DESIGNS FOR TRAFFIC RANGE 1-10 msa

CBR 4%					
Cumulative Traffic (msa)	Total Pavement Thickness (mm)	PAVEMENT COMPOSITION			
		Bituminous Surfacing		Granular Base (mm)	Granular Sub-base (mm)
		Wearing Course (mm)	Binder Course (mm)		
1	480	20 PC		225	255
2	540	20 PC	50 BM	225	265
3	580	20 PC	50 BM	250	280
5	620	25 SDBC	60 DBM	250	285
10	700	40 BC	80 DBM	250	330