Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019

Subject Code: 2144003 Date: 14/12/2019

Subject Name: Basics of Transportation Engineering

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. **Support your answers with necessary sketches.**

			MARKS
Q.1	**(a)**	Explain camber. What are the objectives of camber? Discuss the factors on which amount of camber depends.	**03**
	(b)	Briefly explain: Tyre pressure, contact pressure, rigidity factor, ESWL	**04**
	(c)	Discuss the MORTH requirements of WMM, DBM, BC, SDBC mixes for pavement.	**07**
Q.2	**(a)**	What is road safety audit? Show its process with flow chart.	**03**
	(b)	Why extra widening shall be provided on the horizontal curve of highway? Derive its necessary expression.	**04**
	(c)	Design following geometric elements on horizontal curve for the ruling design speed of 80 kmph. Ruling minimum radius, Super elevation, Extra widening, Length of transition curve, SSD, ISD, and set-back distance.	**07**
		OR	
	(c)	An ascending gradient of 1:50 meets a descending gradient of 1:80. Determine the length of summit curve to provide ISD and OSD, for a design speed of 90 kmph. Assume all other data.	**07**
Q.3	**(a)**	Explain special points to be considered while road construction in black cotton soil.	**03**
	(b)	The speed-density relationship of traffic on a section of a freeway lane was estimated to be vx = 17.5 ln (225/k) as per Greenberg's model. (a) Find flow, speed and density at Maximum flow, (b) Find jam density.	**04**
	(c)	The loaded wt. on the rear dual wheels of a truck is 5500 kg. The c/c spacing and clear space in the dual wheels are 30 cm and 10 cm respectively. Calculate the ESWL for pavement thickness of (i) 20 cm (ii) 35 cm (iii) 50 cm	**07**
		OR	
Q.3	**(a)**	What are the parameters required as the input for pavements analysis?	**03**
	(b)	Explain with sketches Speed-Flow-Density relationships. Derive Greenshield's equations for maximum flow condition.	**04**
	(c)	Calculate the stresses at interior, edge and corner region of cement concrete pavement using Westergaard's stress equations. Take wheel load = 4100 kg, Ec = 3 x 105 kg/cm2 , Pavement thickness = 20 cm, μ = 0.15, Modulus of subgrade reaction k = 5 kg/cm3, Radius of contact area = 15 cm.	**07**
Q.4	**(a)**	Describe with sketches failures in rigid pavements. Write the remedial measures for them.	**03**
	(b)	Give detailed comparison between Highway and Runway pavements.	**04**
	(c)	A subgrade soil sample has following properties:	**07**

Soil passing 200 no. sieve (0.074 mm) is 50 %, Liquid limit = 45 %, Plastic limit = 35 %. Design the pavement section by G.I. method for heavy traffic and compare the value of G.I. using the standard curves.

OR

Q.4 **(a)** Describe with sketches failures in flexible pavements. Write the remedial measures for them. **03**

(b) Give detailed comparison between Flexible and Rigid pavements **04**

(c) Design a suitable bituminous pavement section for a two-lane road with a Single carriageway. The traffic expected is 600 commercial vehicles per day in both directions with average vehicle damage factor of 1.8. Design subgrade CBR is 7 % and the assumed design life of the pavement is 12 years. Use Guidelines of IRC 37-2001. **07**

Q.5 **(a)** How the speed and delay studies are carried out? What are its applications? **03**

(b) Define: Spot speed, Running speed, SMS, TMS. **04**

(c) From the following data of spot-speed study, draw graphs for frequency (%) –vs- Speed range and Cumulative frequency (%) - vs- Speed. Also, calculate: Modal speed, Median speed, TMS, SMS, speed to be used in geometric design, speed for traffic regulation, standard deviation, coefficient of variation. **07**

Speed range (kmph)	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
No. of vehicles	5	9	15	22	28	21	14	6	3

OR

Q.5 **(a)** Describe with sketches special considerations for Hill Roads construction. **03**

(b) Explain Origin and Destination study. What are the uses of it? **04**

(c) On the right angled crossing of four arm signalized intersection, design 4 phase signal cycle for the given data using Webster's method and IRC recommendations. Assume, amber = 3 sec/phase, lost time = 2 sec/phase, saturation flow rate=600W [W= Width of approach (m)], pcu value for the left and right turning vehicles are 25% and 75% more respectively. All left (L), straight (S) and right (R) turning vehicles on an approach are allowed to depart simultaneously during a green interval. Road AB crosses road CD at right angle. **07**

Approach	A			B			C			D		
Width(m)	10			10			9			9		
Turning	L	S	R	L	S	R	L	S	R	L	S	R
Volume (pcu/hr)	400	900	300	300	800	150	100	480	60	120	450	60

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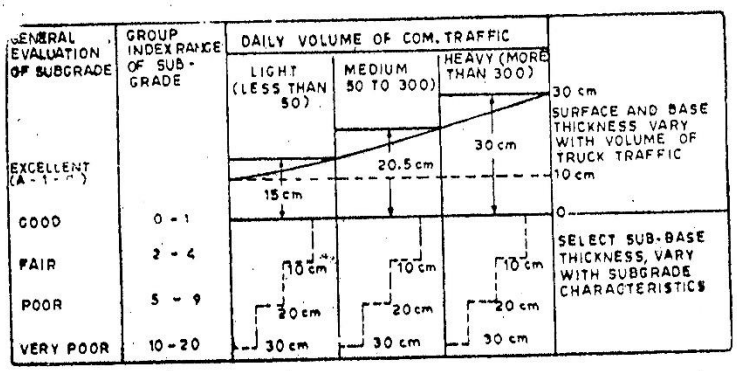
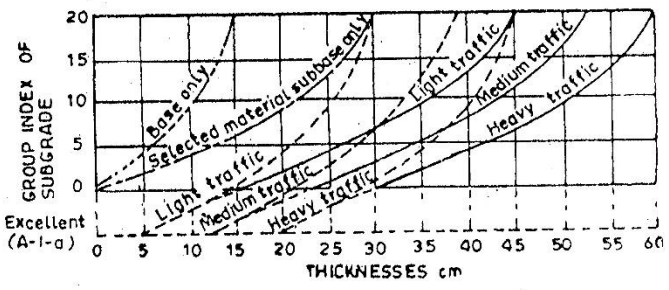


(a)



(b)

— Combined thickness of surface, base and sub-base

--- Thickness of surface and base.

Design Chart by Group Index value