

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institution of Manipal University

## V SEMESTER B.TECH. (CIVIL ENGINEERING)

### END SEMESTER EXAMINATIONS, NOV/DEC 2017

## SUBJECT: HIGHWAY ENGINEERING [CIE 3104]

#### REVISED CREDIT SYSTEM (24/11/2017)

Time: 3 Hours

MAX. MARKS: 50

#### Instructions to Candidates:

- Answer ALL the questions. Draw the neat sketch wherever necessary.
- ✤ Missing data may be suitably assumed.
- Code books are not allowed only the design charts and tables are permitted.

1A.	What is curve resistance? Explain with a neat diagram.	2 marks
1B.	Describe Critical length and Creeper lane on a road network.	2 marks
1C.	A new Highway is to be aligned on a built up area on plain terrain with a horizontal curve of a radius 300m. The road is designed for speed of 75kmph with the width of the pavement as 10.5m and the maximum length of wheel base considered is 6m. Design the following (i) Super elevation (ii) Extra widening of pavement (iii)Length of transition curve.	6 marks
2A.	What is Right of way? What are the factors that governs the right of way?	2 marks
2B.	With a neat sketch, derive an equation for over taking sight distance on two way traffic.	4 marks
2C	Two State Highway intersect each other at an angle $30^{\circ}$ . The design speed on these roads are 75kmph and 80kmph respectively. Determine the lengths of sides of stopping sight distance triangle formed at the intersection.	4 marks
3A.	Using the given data determine the edge wheel load stress, edge warping stress and corner stress induced in the rigid pavement. Location: Manipal, Single axle load = 23 tonnes, thickness of slab = 25cm, subgrade reaction = $8 \text{kg/cm}^2/\text{cm}$ , grade of concrete = M40, Poisson's ratio = 0.15, coefficient of thermal expansion = 10 X $10^{-6/0}$ C, tyre pressure = $8 \text{kg/cm}^2$ , c/c between two tyres = 31cm.	6 marks
3B.	Determine the max. quantity of rain water drained by the open longitudinal drain on a clayey soil with Manning's coefficient 0f 0.02. The drainage cross section is trapezoidal with the actual depth of 0.45m, free board 0.15m, bottom width of 1.0m, side slope 1.0 vertical to 1.5 horizontal and longitudinal slope of 1 in 320. What should be the value of longitudinal slope if the discharge is $2.5m^3$ /sec. (Note: The area of cross section should remain same)	4 marks



6

W-E

9

24

# **MANIPAL INSTITUTE OF TECHNOLOGY**

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4A.	Expla neat d	in the relatio iagram.	nship	betwe	een spee	ed, traf	fic flow a	nd traffic	density with a	5 marks
	The commethod method below of the	onsolidated of od on a stret . Determine traffic strear	data co cch of the av n alon	ollecto urbai g. val g botl	ed from n road ues of v h directi	speed of leng olume, ion.	and delay th 5km, journey s	y studies running E speed and	by floating car E-W are given running speed	
	Trip	Direction	Journey Time		Total stopped delay		No. of vehicles			
4B.	NO	of trip	Min.	Sec.	Min.	Sec.	Over- taking	Over- taken	Opp. direction	5 marks
	1	E-W	8	12	1	40	4	7	268	
	2	W-E	9	08	1	50	5	3	186	
	3	E-W	8	24	1	30	5	3	280	
	4	W-E	9	16	2	00	2	1	200	
	5	E-W	8	36	1	10	3	5	250	

22

2

2

170

7 E-W 8 5 290 48 1 40 2 8 W-E 9 32 1 40 3 2 160 5 marks What is planning survey? Discuss the studies conducted in planning survey. 5A. An existing road link of length 21kms, has bad alignment, inadequate width and poor surface conditions. There are two proposal to improve the situation. Alt. A: increase the width of road and re-surface the existing road Alt. B: have a new alignment 17.5kms long.

2

The traffic for the design period, on the average shall be 600 vehicles per day. The life, estimated details of the cost, speed, length and vehicle operating cost for the mentioned speeds are given below:

	Element	Estimated	Cost in hund				
		useful life	Proposal A	Proposal B			
		(years)					
5B.	Right of way	100	0	270	5 marks		
	Grading	50	150	290			
	Structures	50	160	250			
	Pavement	10	310	1550			
	Speed	NA	50kmph	65kmph			
	Length	NA	21km	17.5km			
	vehicle operating cost	NA	Rs. 0.25 per	Rs. 0.1 per			
	for the mentioned		vehicle km	vehicle km			
	speeds						
	Rate of interest may be taken as 8% and annual maintenance cost of Rs. 500						
	per km. Determine the best alternative.						
	Pavement Speed Length vehicle operating cost for the mentioned speeds Rate of interest may be ta per km. Determine the be	10 NA NA NA ken as 8% and annu st alternative.	310 50kmph 21km Rs. 0.25 per vehicle km al maintenance c	1550 65kmph 17.5km Rs. 0.1 per vehicle km cost of Rs. 500			