Ref. No.: Ex/CE/T/321/2018

B. E. CIVIL ENGINEERING 3RD YEAR 2ND SEMESTER EXAMINATION 2018
TRANSPORTATION ENGINEERING – II

Time: 3 Hours **Full Marks: 100**

GROUP – A [Answer Question 1 and any ONE from rest]

1. Illustrate the following - 4+3+4+4
   a. Parking Survey methods
   b. Representation of Accident Data
   c. Regulatory Traffic Sign
   d. Road Marker

2. From the following observations, determine the total volume of traffic, journey speed and running speed over the section AC. 10

Section	Length (m)	Time Taken (sec)	Vehicles met with		
			Opposite Direction	Overtaking	Overtaken
AB	500	189	19	9	8
B	---	58	28	--	--
BC	600	163	17	14	6
C	---	43	16	--	--
CD	400	151	11	12	11
D	---	55	11	--	--
DC	400	181	20	10	13
C	---	53	19	--	--
CB	600	169	29	7	10
B	---	55	17	--	--
BA	500	162	30	14	11

3. The parking survey data collected from a 12-bay parking lot by license plate method is as shown below. Determine Overall Parking Load, Average Parking Index, Parking Volume, Average Turnover, and Average Duration of the parking lot. 10

Time	Bays											
	1	2	3	4	5	6	7	8	9	10	11	12
0-10	3886	4959	--	2651	1153	8629	4097	3751	4894	8907	9155	5950
10-20	5014	4059	--	2651	1153	8629	4097	3751	3087	8907	9155	5950
20-30	5014	2717	2206	2651	1153	8629	4097	3751	3087	8907	9155	5950
30-40	--	2717	2206	--	1153	8629	4097	3751	3087	5930	9155	5950
40-50	3223	--	2206	7763	1153	8629	--	--	3087	--	8407	5950
50-60	3223	1577	2206	--	1153	--	--	--	--	--	--	5950

GROUP – B [Answer any TWO question]

4. Two 4-lane single carriageway undivided roads spreading in North-South and East-West direction intersect each other perpendicularly at point X. Solve the intersection carrying traffic as given below by designing a suitable 5-phase optimum signal cycle with 1 dedicated phase for pedestrian movement from all sides and 4 vehicular phase each allowing traffic from one source direction. The pedestrian crossing speed, pedestrian green time, vehicular starting delay, and vehicular Amber period are 1.5m/sec, 10sec, 3sec and 4sec respectively for each phase.

From	North			South			East			West		
To	E	S	W	W	N	E	S	W	N	N	E	S
flow	94	554	43	41	804	41	36	557	72	40	516	54

5. Two 4-lane single carriageway undivided roads spreading in North-South and East-West direction intersect each other perpendicularly at point X. Solve the intersection carrying traffic as given below by designing a suitable 4-phase optimum signal cycle with opposite right turners provided dedicated phase separately from corresponding straights & left turns. The vehicular starting delay and vehicular Amber period are 3sec and 4sec respectively for each phase.

From	North			South			East			West		
To	E	S	W	W	N	E	S	W	N	N	E	S
flow	34	885	37	63	518	50	28	769	43	85	997	84

6. State warrants for traffic signal system.
   Comment on modification of intersection saturation flow on the basis of intersection quality.

GROUP – C [Answer any TWO question]

7. Classify Pavements on the basis of their structure, explain each of them and illustrate on their major differences.

8. Draw a neat and typical structural cross section of a pavement and explain the functions of the topmost and bottommost layers.
   Draw neatly a typical curve of CBR test that requires correction of origin and explain.

9. Determine the CBR value of subgrade soil from the following laboratory test observations

Penetration (mm)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0	7.5	10.0	12.5
Load (kg)	0	5	17	29	42	50	58	70	78	92	102	108

GROUP – D [Answer Question 10 and any ONE from rest]

10. Explain the following in context with design of pavements –
    a. Significance and Placement of Dowel Bars in a rigid pavement
    b. Significance of Lane Distribution Factor as suggested in IRC code
    c. Significance of expansion and contraction joint

11. Applying IRC (2002) recommended methods, design the required joints and reinforcements at joints for a 250mm thick rigid pavement, considering the following data and the formulas –
    Design wheel load = 8160Kg, Maximum permissible joint spacing = 25mm, Maximum seasonal temperature variation = 35°c, Modulus of sub-grade reaction= 8kg/cm^3, Width of Slab= 3500mm, Coefficient of friction = 1.5, Diameter of dowel = 20mm, Diameter of tie = 10mm, Radius of

equivalent contact area = 150mm, Modulus of elasticity of concrete = 3×10^5kg/cm^2, Coefficient of thermal expansion of concrete = 1×10^{-5}/°c, Unit weight of concrete = 2400kg/cm^3, Poisson ratio of concrete = 0.15, Flexural strength of concrete = 40kg/cm^2, Tensile strength of concrete = 0.8kg/cm^2, Bearing strength of concrete = 100kg/cm^2, Load transfer through dowel = 40%, Flexural strength of dowel = 1400 kg/cm^2, Shear strength of dowel = 1000 kg/cm^2, Bond strength of deformed bar= 24.6 kg/cm^2.

10

- Radius of Relative Stiffness, $l = \left[\frac{E.t^3}{12k(1-\nu^2)}\right]^{1/4}$
- Effective Length of Dowel $L_d = 5d\left[\frac{f_{st}}{f_{bc}} \times \frac{L_d+1.5\delta}{L_d+8.8\delta}\right]^{1/2}$
- Capacity of a Dowel: Shear = $0.785d^2 f_{ss}$; Bending = $\frac{2d^3 f_{st}}{L_d+8.8\delta}$; Bearing = $\frac{dL_d^2 f_{bc}}{12.5(L_d+1.5\delta)}$
- Area of Tie = $\frac{L_Y \mu \gamma_c t}{f_{st}}$
- Length of Tie = $\frac{d_{tie} f_{st}}{2f_{bc}}$

12. Applying IRC (2001) method and the given pavement design catalogue, design suitable flexible pavement section and draw neatly a scaled cross-section diagram of it for a single carriageway 4-lane 2-way street considering Subgrade CBR 4.4%; Annual traffic growth rate 7.5% and design life 20 years from present day traffic as recorded –

10

Direction of flow	Traffic Volume (in veh/day)					
	Tandem Axle		Single Axle			
	12.0t	10.0t	8.0t	6.0t	5.0t	3.0t
Onward	1000	2500	5000	4500	2500	1300
Return	1500	1500	7500	4000	3000	1200

Pavement Design Catalogue (IRC:37 – 2001)

Cumulative Traffic (in msa)	PAVEMENT COMPOSITION (Thickness in mm)					
	Wearing Course	Base Course	Subgrade CBR 4%		Subgrade CBR 5%	
			Surface Course	Sub-base Course	Surface Course	Sub-base Course
1	20	225	--	255	--	205
2	20	225	50	265	50	215
3	20	250	50	280	50	230
5	25	250	60	285	55	250
10	40	250	80	330	70	300
20	40	250	110	330	100	300
30	40	250	130	330	120	300
50	40	250	160	330	140	300
100	50	250	170	330	150	300
150	50	250	190	330	170	300

GROUP – E [Compulsory]

13. Name the major components of an Airport. Explain one of the major functions of each and Draw a typical schematic layout to show their relative positions

3+6+1