Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/CE/SEM-8/CE-801/1/2013

2013

ADVANCED TRANSPORTATION ENGINEERING

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) Which of the following relation is correct under typical speed conditions on rural highways ?

      a) Space-mean speed > Time mean speed

      b) Space-mean speed < Time mean speed

      c) Space-mean speed = Time mean speed

      d) Space-mean speed ≥ time mean speed.

   ii) ESWL at depth 2*S* is equal to

      a) P b) 0·5 P

      c) 2 P d) 3 p.

iii) The most efficient traffic signal system is

a) simultaneous system

b) alternate system

c) flexible progressive system

d) simple progressive system.

iv) If V is speed in km/hr and R is radius of the curve, the super elevation e is equal to

a) $\frac{V^2}{125\ R}$ b) $\frac{V^2}{225\ R}$

c) $\frac{V^2}{325\ R}$ d) $\frac{V^2}{25\ R}$.

v) The concrete edge expected to sustain infinite no. of repetitions for a stress ratio of

a) 0·40 b) 0·45

c) 0·50 d) 0·55.

vi) Diamond interchange is the simplest form of

a) 3-leg interchange b) 4-leg interchange

c) multi-leg interchange d) none of these.

vii) Optimum density occurs when

a) flow approaches zero

b) speed approaches zero

c) both flow and speed approaches zero

d) flow approaches maximum.

viii) Stationary shockwaves will occur

a) when two streams having the same flow value but different densities meet

b) when two streams having the different flow value but same densities meet

c) when two streams having the same flow value and densities meet

d) when two streams with different speeds meet.

ix) Structural number SN of a flexible pavement is a function of

a) layer co-efficient

b) depth of the layer

c) product of layer co-efficient and depth of the layer.

x) A bituminous pavement over a lean cement concrete base is a

a) flexible pavement b) rigid pavement

c) semi-rigid pavement d) none of these.

xi) In a traffic stream if demand is distributed uniformly, the peak hour factor will be near to

a) 0 b) 0·5

c) 1·0 d) 60·0.

xii) The traffic conflicts that may occur in rotary intersections are

a) merging and diverging

b) crossing and merging

c) crossing and diverging

d) crossing, merging and diverging.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. The free speed on a section of a highway was found to be 120 km per hour and the Jam Density was 80 vehicles per km. Determine

   a) What is the expected maximum flow ?

   b) At what speed the maximum flow will occur ?

3. Two roads are crossing each other at a right angle 4-legged intersection at grade. Show a neat sketch indicating the crossing conflicts, diverging conflicts and merging conflicts. Find out the number of each type of conflicts if the two crossing roads are carrying two-way traffic.

4. A vertical summit curve is formed at the intersection of two gradients + 3·0 and – 5·0 percent. Design the length of summit curve to provide a stopping sight distance for a design speed 80 kmph. Assume other data.

5. What are the stresses produced by temperature in a cement concrete pavement ? Briefly discuss each of these with mathematical and empirical formula.

6. What is ESWL ? Derive the equation for ESWL for two wheels, each carrying a load P. The clear distance between the wheel is *d* and centre to centre distance between the wheel is S.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What is a roundabout intersection ? 4

   b) Draw a neat sketch of a roundabout indicating the flow diagram and marking particularly the weaving length, entry radii, exit radii, central island and width of entry and exit carriageway. 6

   c) Discuss the merits and demerits of rotary operation at a roundabout. 5

8. A fixed time 2-phase signal is to be provided at an intersection having a north-south and East-West road where only straight ahead traffic is permitted. The design hour flows from the various arms and saturated flows for these arms are given in the table below :

	North	South	East	West
Design hour flow (q)	800	400	750	600
In PCUs/hour	2400	2000	3000	3000

Calculate the optimum cycle time and green times for the minimum overall delay. The intergreen time should minimum necessary for efficient operation. The time lost per phase due to starting delays can be assumed to be 2 seconds. The value of amber period in 2 seconds. Sketch the timing diagram for each phase.

9. a) Define flow and density of a traffic stream. 3

b) From the following relation find out the maximum velocity of vehicle : 5

$V = 60 - 0{\cdot}43\ K$

where V is the speed of the vehicle

K is the density of traffic stream.

c) From a moving vehicle survey following data are obtained.

Direction	Travel time	No. of vehicle		
		Travelling in opposite direction	Overtaking test vehicle	Overtaken by test vehicle
North bound	T_n	N_n		
1	3·20	75	3	1
2	2·80	80	2	2
3	3·25	85	0	1
4	3·01	70	2	1
South bound	T_s	N_s		
1	3·20	78	4	0
2	3·25	74	2	2
3	3·40	79	0	2
4	3·35	82	3	3

Find out :

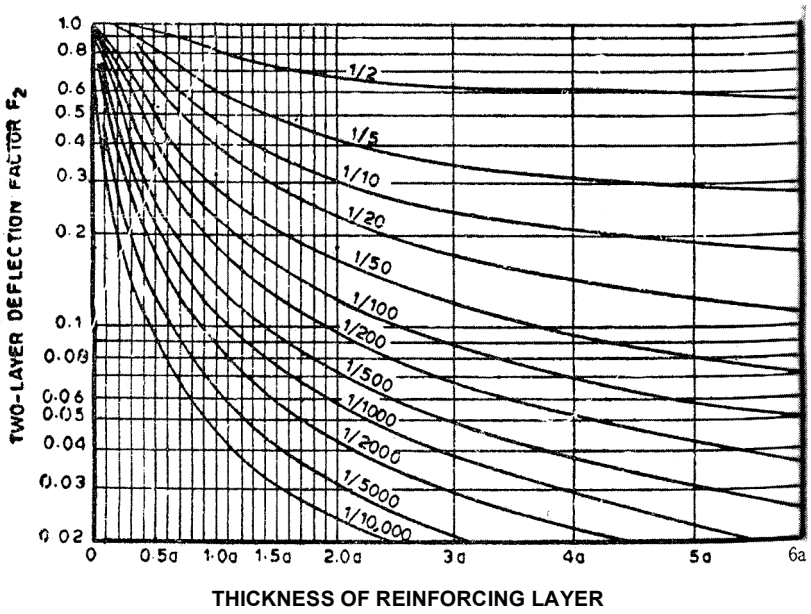
i) Flow of the traffic stream

ii) Mean time of north bound and south bound. 7

10. a) Discuss briefly Burmister two layer theory for design of base course of a flexible pavement. 5

b) Determine the thickness of a flexible pavement base course to sustain a wheel load of 1600 kg. The contract pressure between the tyre and base course is 7 kg/cm^2. The plate bearing test on the sub-grade produces 0·5 cm deflection at 1·05 kg/cm^2 on a 75 cm dia plate. The plate bearing test on a test section of stabilized gravel base course 15 cm thick yielded under 2·8 kg/cm^2 pressure, 0·5 cm deflection.

(Burmister's deflection factor curve given below)



10

11. Write short notes on any *three* of the following : 3 × 5

a) Factors affecting level of service

b) Advantage and disadvantage of traffic signal

c) Acceleration lane and declaration lane

d) 3-phase signalling system

e) Design modulus of rapture.