CS/B.Tech (CE-NEW)/SEM-8/CE-801/1/2011

2011
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 × 1 = 10

   i)   In case of multi-lane road overtaking is generally permitted from

        a)   left side   b)   right side

        c)   both sides   d)   any one of these.

    ii) Weight of a vehicle affects

        a)   passing sight distance

        b)   extra-widening

        c)   pavement thickness

        d)   width of lanes.

iii) The maximum width of expansion joint in concrete pavement is

   a)   5 mm   b)   10 mm

   c)   25 mm   d)   35 mm.

iv) Structural Number (SN) of a flexible pavement is a function of

   a)   layer coefficient

   b)   depth of the layer

   c)   product of layer coefficient and depth of the layer

   d)   product of layer coefficient, depth of the layer and drainage coefficient.

v) Concrete is expected to sustain infinite number of repetitions as per IRC, for the stress-ratio value of

   a)   0·35   b)   0·4

   c)   0·45   d)   none of these.

vi) No. of conflicts for a three-lagged intersection is

   a)   8   b)   9

   c)   10   d)   none of these.

vii) Diamond interchange is the simplest form of

   a)   3-leg interchange

   b)   4-leg interchange

   c)   multi-leg interchange

   d)   none of these.
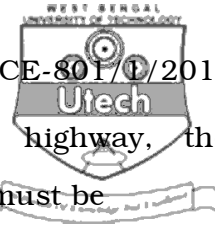
viii) For a 80 kmph design speed on highway, the recommended taper length by AASHTO must be

a) 57 m
b) 69 m

c) 81 m
d) none of these.

ix) Weaving length depends on

a) width of the weaving section

b) width of entry

c) total traffic and proportion of weaving traffic

d) all of these.

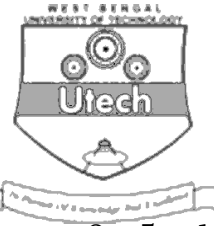x) A bituminous pavement over a lean cement concrete base is a

a) flexible pavement
b) rigid pavement

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

xi) The terminal serviceability index of major arterial road should be

a) 1·5
b) 2·0

c) 2·5
d) 3·5.

xii) Flashing yellow beams are sometimes employed as

a) stopping signal
b) proceeding signal

c) warning signal
d) none of these.

GROUP – B

### (Short Answer Type Questions)

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

2. Determine the thickness of a flexible pavement to sustain a wheel load of 100 kN. The contact pressure between the tyre and base course is $0 \cdot 6 \, N/mm^2$. The plate bearing test on the subgrade produced 5 mm deflection at $0 \cdot 105 \, N/mm^2$ on a 750 mm dia plate. The plate bearing test on a test section of the stabilized gravel base course 150 mm thick yielded under $0 \cdot 28 \, N/mm^2$ pressure, 5 mm deflection.

Burmister's curve for two layer deflection factors are given below.

       4
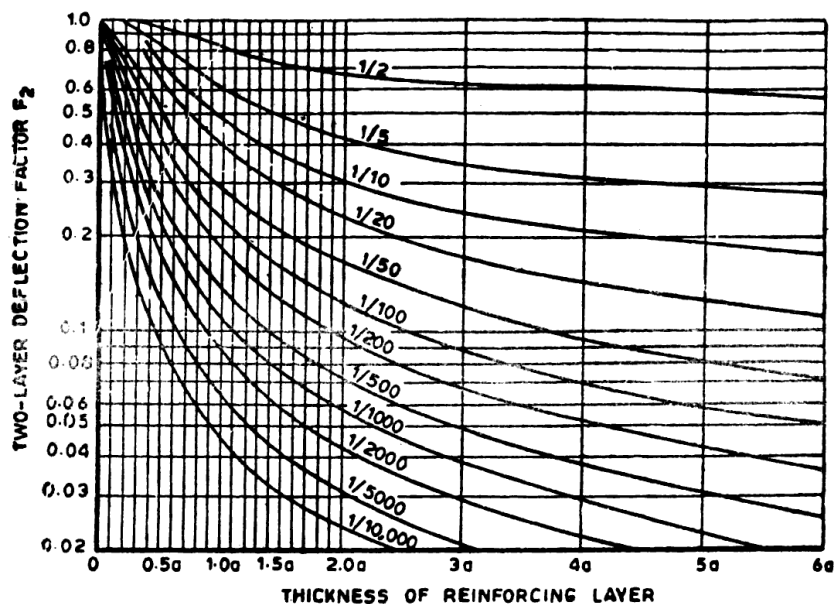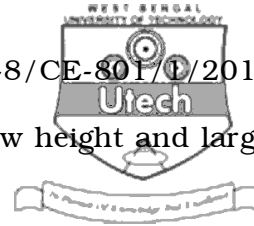
3. Show mathematically that vehicles with low height and large width are safer on horizontal curves.

4. Classify intersection with neat sketches.

5. Discuss the importance of camber in cross-section of a road with reference to its value recommended by IRC & AASHTO.

6. Discuss any *two* of the following :

i) Damage

ii) Stress ratio

iii) Endurance limit

iv) Dynamic modulus.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. What do you understand by pavement unevenness ? Give its acceptable and unacceptable values. Discuss various types of pavement surfaces, when light reflecting characteristics are considered.

8. While aligning a highway in a built up area, it was necessary to provide a horizontal circular curve of radius 325 m. Design the following geometric features :

i) Superelevation

ii) Extrawidening of pavement

iii) Length of transition curve.

Data available are :

Design speed = 65 kmph. Length of wheel base of largest truck = 6 m. Pavement width = 10·5 m.
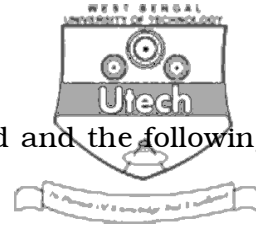
9. A test car was used on a north-south road and the following data for the moving car were collected :

North trip no.	Travel time while travelling north (min)	No. of vehicles met against stream	No. of vehicles overtaking test car	No. of vehicles overtaken by test car
1	2·65	85	1	0
2	2·7	83	3	2
3	2·35	77	0	2
4	3	85	2	0
5	2·42	90	1	1
6	2·54	84	2	1

South trip no.	Travel time while travelling north (min)	No. of vehicles met against stream	No. of vehicles overtaking test car	No. of vehicles overtaken by test car
1	2·33	112	2	0
2	2·3	113	0	2
3	2·71	119	0	0
4	2·16	120	1	1
5	2·48	105	0	2
6	2·54	100	0	1

Calculate the traffic volume, and space mean speed for both the directions.

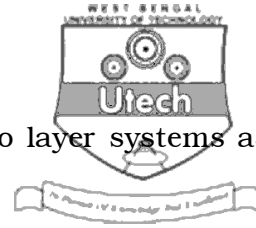10. Design a concrete pavement for the following load spectrum. 98 percentile axle load is 16 tonnes. Conctrete is of M-40 grade with flexural strength of $4 \cdot 5 \, \text{N/mm}^2$. Present traffic is 3200 cvpd. Design life is 20 year and annual traffic growth is 7·5 per cent.

Single Axle Loads			Tandem Axle Loads		
Axle load class, tonnes	Percentage of axle loads	Flexural edge stress $\left(\text{N/mm}^2\right)$ for 1·2 times mean axle load for 32 cm thick pavement	Axle load class, tonnes	Percentage of axle loads	Flexural edge stress $\left(\text{N/mm}^2\right)$ for 1·2 times mean axle load for 32 cm thick pavement
19-21	0·4	2·52	34-38	0·3	2·01
17-19	1·5	2·30	30-34	0·3	1·84
15-17	4·9	2·07	26-30	0·6	—
13-15	10·8	1·85	22-26	1·8	—
11-13	22·1	—	18-22	1·5	—
9-11	23·3	—	14-18	0·5	—
Less than 9	30·0	—	Less than 14	2·0	—
Total %	93·00			7·0	

11. a) Explain the stresses developed in two layer systems as suggested in Burmister analysis.

    b) What is rotary intersection.

       Discuss the following design elements of rotary intersections with sketches :

       i) Pavement cross slope

       ii) Weaving width and length

       iii) Entry and exit curves.

12. Discuss the various levels of services. Which level of service should be adopted considering both economy and traffic flow ?