

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech (CE)/SEM-8/CE-801/1/2012**

**2012**

**ADVANCED TRANSPORTATION ENGINEERING**

*Time Allotted : 3 Hours*

*Full Marks : 70*

*The figures in the margin indicate full marks.*

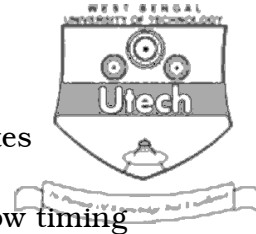
*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

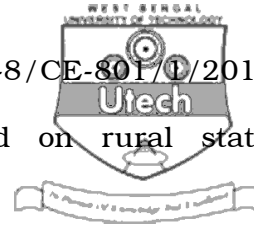
**( Multiple Choice Type Questions )**

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

- i) The maximum number of vehicles can be parked with
  - a) parallel parking
  - b) right angle parking
  - c)  $45^\circ$  angle parking
  - d)  $75^\circ$  angle parking.
- ii) The colour of light used for visibility during fog is
  - a) red
  - b) yellow
  - c) green
  - d) white.
- iii) The most efficient traffic signal system is
  - a) simultaneous system
  - b) alternate system
  - c) flexible progressive system
  - d) simple progressive system.



- iv) A complete signal-time cycle constitutes
- a) red timing
  - b) yellow timing
  - c) green timing
  - d) all of these.
- v) Flashing yellow beam are sometimes employed as
- a) stopping signal
  - b) proceeding signal
  - c) warning signal
  - d) none of these.
- vi) If the free mean speed of a roadway is 80 kmph and average spacing between the vehicles under stopped condition is 6.9 m, the capacity of flow will be
- a) 2000 vph
  - b) 2900 vph
  - c) 3000 vph
  - d) 3200 vph.
- vii) Diamond interchange is the simplest form of
- a) 3-leg interchange
  - b) 4-leg interchange
  - c) multi-leg interchange.
- viii) Width of roadway of National and State highways on plain area for two-lane carriageway is
- a) 9.0 m
  - b) 7.5 m
  - c) 12 m
  - d) 8.80 m.



ix) Recommended ruling design speed on rural state highways in plane area is

- a) 50 kmph                                      b) 80 kmph
- c) 40 kmph                                      d) 100 kmph.

x) 10000 rep of 160 kN axle load is equivalent to  $N$  nos. of rep of 80 kN axle load where  $N$  is

- a)  $8 \times 10^5$                                       b)  $16 \times 10^5$
- c)  $8 \times 10^4$                                       d)  $16 \times 10^4$ .

xi) The average running speed at intersection must be

- a) design speed
- b) 75% of design speed
- c) 80% of design speed
- d) none of these.

xii) If an ascending gradient of 1 in 50 meets a descending gradient of 1 in 50, the length of summit curve for a stopping sight distance of 80 m will be

- a) zero    b) 64 m
- c) 80 m    d) 60 m.



**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

3 × 5 = 15

2. Draw a labelled and dimensioned sketch of an expressway. Mention the values of cross-fall ( carriageway, treated shoulder and untreated shoulder ).
3. Discuss the benefits derived from channelising road intersections. Illustrate your answer with sketches.
4. Describe the relationship between speed, travel time, volume, density & capacity.
5. Derive the expression :  $e + f = \frac{v^2}{127 R}$ , where symbols have usual meaning.
6. A track has to carry a load of 16 tonnes at its real axle. Find the ESWL on a flexible pavement 50 cm thick for the following conditions :
  - i) Single axle with dual tiers where tier pressure  $7 \text{ kg/cm}^2$
  - ii) Tendon axle with dual tiers, where tier pressure  $7 \text{ kg/cm}^2$

Tiers are 30 cm and tendons are 60 cm apart ( c/c ), and the clear distance of tier for both the cases is 10 cm.



**GROUP – C**

**( Long Answer Type Questions )**

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

7. a) From a moving vehicle survey following are obtained :

| Direction   | Travel time | No. of Vehicles                  |                         |                            |
|-------------|-------------|----------------------------------|-------------------------|----------------------------|
|             |             | Travelling in opposite direction | Overtaking test vehicle | Overtaking 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 traffic stream
  - ii) mean time of north bound and south bound. 8
- b) A minor road with a design speed of 60 kmph meets a preferential road having design speed of 80 kmph angle of margins  $30^\circ$  and the intersection is uncontrolled. Find the sides of minimum and safe distance of side triangle. Assume any other condition if needed. 7



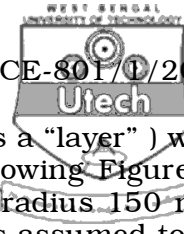
8. A 40 cm PCC pavement is designed with a 20 year life to accommodate 4 types of heavy daily traffic of mix given below. Design  $M_R = 41 \text{ kg/cm}^2$  and  $k = 9 \text{ kg/cm}^2$ . Determine how much remaining life would exist after 20 years service, using

- Vesie's equation
- IRC method.

| Vehicle life | Expected repetitions | Calculated tensile stress in $\text{kg/cm}^2$ |
|--------------|----------------------|---|
| A            | 2000                 | 27.09   |
| B            | 25000                | 23.52   |
| C            | 100000               | 20.91   |
| D            | 87300                | 17.36   |

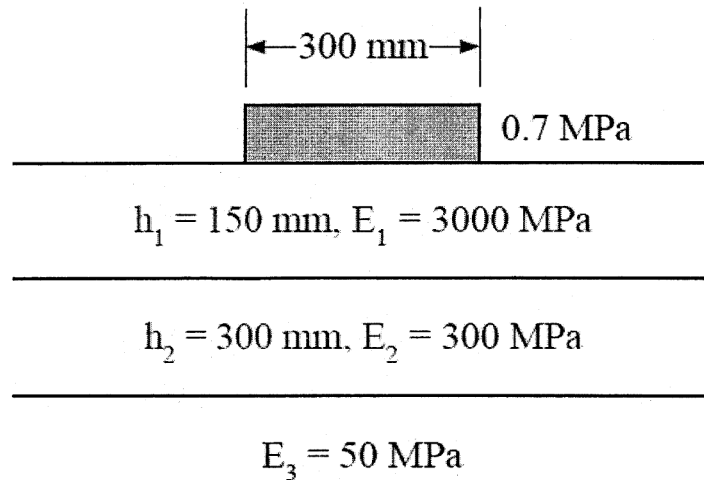
9. Write short notes on any *three* of the following : 3 × 5

- Fatigue of pavement
- Acceleration lane and deceleration lane
- Design modulus of rupture
- Effect of lateral wander
- 3-phase signalling system.

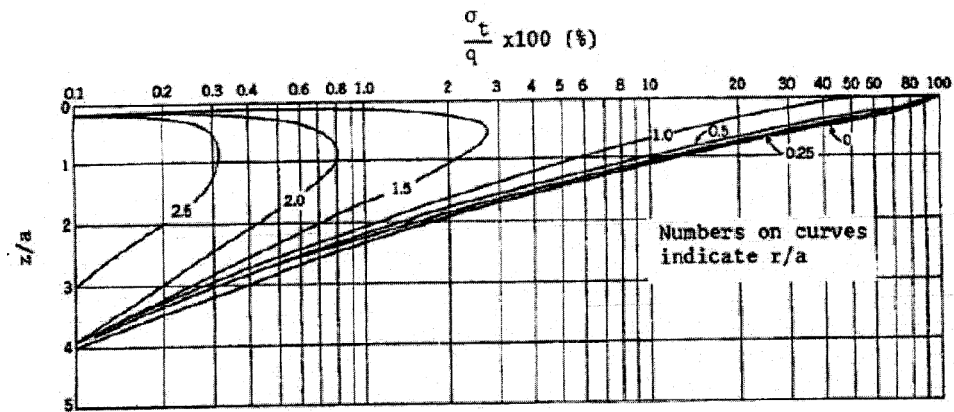


10. A three layer system ( subgrade is counted as a "layer" ) with the thickness and moduli shown in the following Figure is loaded by a uniformly distributed load with radius 150 mm and contact stress 0.7 MPa. Poisson's ratio is assumed to be 0.35 for all materials. Find out

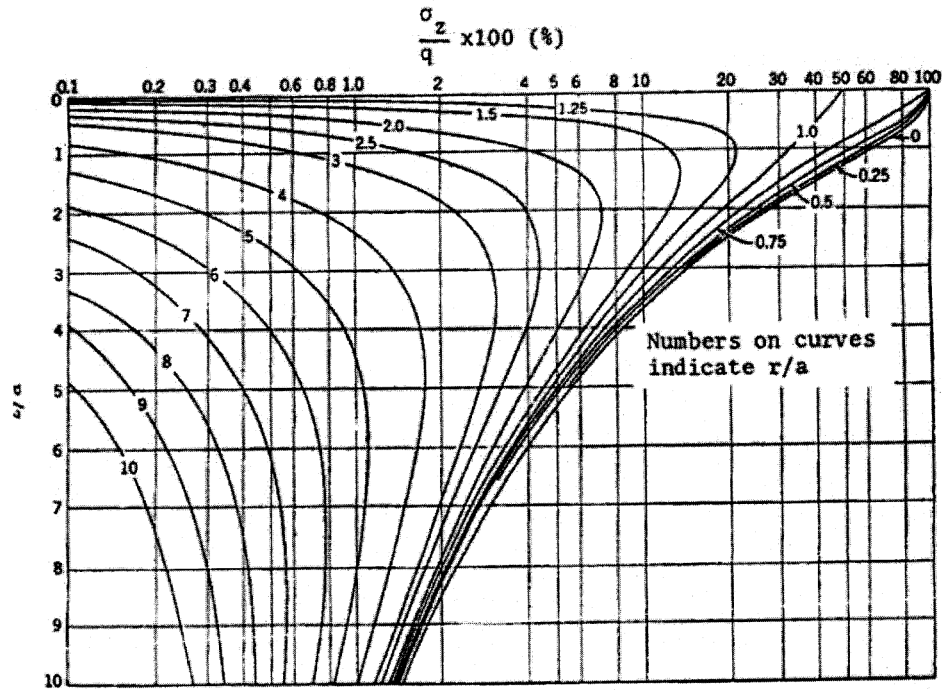
- Horizontal strain at the bottom of the asphalt.
- Vertical stress on subgrade.



( vertical and tangential stress for a circular loading is given below )



Tangential stress due to circular loading



Vertical stress due to circular loading

11. Calculate the values of ruling minimum and absolute minimum radius of horizontal curve of a NH in plain terrain. Assume ruling design speed and minimum design values as 100 and 80 kmph respectively.
12. a) State the purpose of capacity analysis. What is LOS ? What is the significance of LOS in capacity analysis ? Define space headway and time headway.
- b) Explain in detail, the AASHTO design method of flexible pavement.