Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/(CE-OLD)/SEM-6/CE-602/2013

2013

TRANSPORTATION ENGINEERING-I

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) The Motor Vehicle Act was enacted in

a) 1930 b) 1934

c) 1939 d) 1948.

ii) For the water-bound macadam road, in localities of heavy rainfall, the recommended camber is

a) 1 in 40 b) 1 in 33

c) 1 in 25 d) 1 in 50.

iii) The terrain may be classified as rolling terrain if the cross slope of land is

a) up to 10%

b) between 10% and 20%

c) between 25% and 60%

d) more than 60%.

iv) As per IRC recommendation, the maximum limit of super elevation for mixed traffic in plain terrain is

a) 1 in 15 b) 1 in 12.5

c) 1 in 10 d) equal to the camber.

v) The mechanical extra widening required for 10.5m wide pavement on a horizontal curve of radius *R* metre is

a) $L^2 / (2R)$ b) $2L^2 / (3R)$

c) $L^2 / (R)$ d) $3L^2 / (2R)$.

vi) The maximum width of the vehicle as per IRC recommendation is

a) 1.85 m b) 2.44 m

c) 3.81 m d) 4.72m.

vii) Traffic volume is equal to

a) Traffic density × Traffic speed

b) Traffic density / Traffic speed

c) Traffic speed / Traffic density

d) none of these.

viii) Dead slow is

a) regulatory sign b) warning sign

c) informatory sign d) none of these.

ix) In CBR test the value of CBR is calculated at

a) 2.5 mm penetration only

b) 5 mm penetration only

c) 7.5 mm penetration only

d) both 2.5 mm and 5mm penetrations.

x) The maximum allowable Los Angeles abrasion value for high quality surface course is

a) 10% b) 20%

c) 30% d) 45%.

xi) The maximum spacing of contraction joints in rigid pavement is

a) 2.5m b) 3.5 m

c) 4.5m d) 5.5m.

xii) The thickness of bituminous carpet varies from

a) 20 mm to 25 mm b) 50 mm to 75 mm

c) 70 mm to 100 mm d) 100 mm to 120 mm.

xiii) The ductility value of bitumen for suitability in road construction should not be less than

a) 30 cm b) 40 cm

c) 50 cm d) 60 cm.

xiv) The most suitable equipment for compacting clayey soils is

a) smooth wheel roller b) pneumatic tired roller

c) sheep foot roller d) vibrator.

xv) Which of the following represents the hardest grade of bitumen ?

a) 30/40 b) 60/70

c) 80/100 d) 100/120.

GROUP – B
(Short Answer Type Questions)

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

2. Classify roads based on location and function and briefly discuss about each class.
3. Discuss briefly the various engineering surveys carried out before finalizing a new highway project.
4. What are the importances and significances of softening point and penetration tests of bitumen.
5. Distinguish between flexible and rigid pavements.
6. Explain with the aid of neat sketches the methods of eliminating camber and introduction of superelevation.
7. Discuss the various types of gradients.

GROUP – C
(Long Answer Type Questions)

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

8. Why is pavement widening necessary on horizontal curves ? Explain the various methods of introducing extra widening. Determine the off-tracking of a vehicle with wheel base 7m while negotiating a horizontal curve of radius 100m. 5 + 5 + 5
9. Write short notes on any *three* of the following : 3 × 5
   a) Motor Vehicle Act
   b) Cross slope or camber
   c) Road margins
   d) PIEV theory
   e) Contraction joints
   f) Expansion joints.

10. Explain the significances of stopping, intermediate and overtaking sight distances. What do you mean by reaction time of the driver ? How is it related to sight distances ? Calculate the minimum sight distance required to avoid a head-on-collision of two cars approaching from opposite directions at 90 and 60 kmph respectively. Assume a reaction time of 3.5 seconds, coefficient of friction 0.7 and braking efficiencies 40% and 60% respectively. 5 + 3 + 7

11. Explain ESWL and the concept in the determination of the equivalent wheel load.

    Design the pavement for construction of a new bypass with the following data :

    Two lane carriage way

    Initial traffic in the year of completion of construction = 400 CVPD (sum of both directions)

    Traffic growth rate = 7.5%

    Design life = 15 years

    Vehicle damage factor = 2.5 standard axle per commercial vehicle

    Design CBR of subgrade soil = 4% 7 + 8

12. A vertical summit curve is to be designed when two grades, + 1/50 and – 1/80 meet on a highway. The stopping sight distance and overtaking sight distance required are 180m and 640m respectively. But due to sight considerations the length of vertical curve has to be restricted to a maximum value of 500m if possible.

    Calculate the length of the summit curve needed to fulfill the requirements of —

    a) stopping sight distance

    b) overtaking sight distance or at least intermediate sight distance and discuss the results.

    A national highway passes through a rolling terrain in heavy rainfall area has a horizontal curve of radius 500m. Design the length of transition curve assuming suitable data. 8 + 7

13. Design the flexible pavement section by triaxial test method using the following data :

    Wheel load = 4100 kg

    Radius of contract area = 15 cm

    Traffic coefficient (X) = 1.5

    Rainfall coefficeint (Y) = 0.9

    Design deflection = 0.25 cm

    E-value of sub-grade soil, E_s = 100 kg/cm ^{2}

    E-value base course material E_b = 400 kg/cm ^{2}

    E-value of 7.5 cm thick bituminous concrete surface course = 1000 kg/cm ^{2}

    Write down the construction steps for Water Bound Macadam road. 7 + 8