Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CE)/SEM-6/CE-602/2011

2011
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 : $10 \times 1 = 10$

   i) As per third road development plan, primary road system includes
      a) NH and SH b) NH only
      c) Express way and NH d) Express way only.

   ii) Service lane for a broken down vehicle operation is provided by
      a) Carriage way b) Shoulder
      c) Road margin d) All of these

   iii) The sequence of four stages of survey in a highway alignment is
      a) reconnaissance, map study, preliminary survey and detailed survey
      b) map study, preliminary survey, reconnaissance and detailed survey
      c) map study, reconnaissance, preliminary survey and detailed survey
      d) preliminary survey, map study, reconnaissance and detailed survey.

iv) When the path travelled along the road surface is more than the circumferential movement of the wheels due to rotation, then it results in
   a) slipping b) skidding
   c) turning d) revolving.

v) Ranges of camber in WBM road is provided in the area of high rainfall
   a) 1 in 50 b) 1 in 40
   c) 1 in 33 d) 1 in 25.

vi) On a single lane road with two-way traffic, the minimum stopping sight distance is equal to
   a) stopping distance
   b) two times the stopping distance
   c) half the stopping distance
   d) three times the stopping distance.

vii) The terrain may be classified as rolling terrain if the cross slope of the land is
   a) up to 10%
   b) between 10% and 25%
   c) between 25% and 60%
   d) more than 60%.

viii) One important recommendation of Jayakar Committee was
   a) Central Road Fund should be developed by levying extra tax on petrol consumption by road users
   b) Roads should be classified based on traffic volume they carry
   c) Each state Govt. should look after the part of the National Highway running in its state
   d) A set of traffic rules should be formulated for road users to follow.

ix) The CBR value when the load sustained by the stone aggregates are 55 kg and 75 kg at penetration level of 2·5 mm and 5 mm respectively, is
   a) 3·5 % b) 4·0 %
   c) 4·5 % d) 5·0 %.

x) 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.

xi) The most suitable equipment for compacting clayey soils is
   a) smooth wheel roller b) pneumatic tired roller
   c) sheep foot roller d) vibrator.

xii) Temperature stress is more prominent in
   a) Rigid pavement b) Flexible pavement
   c) Equal in both d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. How can you classify the benefit due to highway improvement ?

3. There are four alternative road plans for an area. The details are given below. Justify with reason which proposal is the best assuming suitable data.

Proposal	Road Length	No. of towns and villages served with population range			Total agricultural and industrial products
		1001-2000	2001-5000	5001-10000	
A	200	100	70	20	200×10^3 tonnes
B	300	1500	90	60	300×10^3 tonnes
C	400	200	80	70	250×10^3 tonnes
D	500	240	100	75	160×10^3 tonnes

4. Explain (i) Warping stresses and (ii) Frictional stresses for a rigid pavement. $2 \times 2\frac{1}{2}$

5. Why and how camber is provided ? In a district where rainfall is heavy a major district road 3·8 m wide of WBM pavement and a stopped highway of cement concrete pavement 7·0 m wide are to be constructed. What will be the height of the crown with respect to edge as per IRC recommendation ?

6. What is WBM ? Discuss the construction procedure of WBM.

7. What are the different types of bituminous materials used in road construction ?

GROUP – C

(Long Answer Type Questions)

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

8. a) Calculate minimum sight distance required to avoid ahead on collision between two cars approaching each other at 90 km per hour and 60 km per hour. Assume a reaction time of 2·5 sec, coefficient of friction 0·7 and brake efficiency 50% for both the car. 8

   b) Radius of a horizontal circular curve road is 100 m. Design speed is 50 km/hr and design coefficient of friction is 0·15.

      i) Calculate the superelevation required if full friction is developed

      ii) Calculate the coefficient of friction needed if no superelevation is provided

      iii) Calculate the equilibrium superelevation if the pressure on inner and outer wheel is equal. 7

9. Write short notes on any *five* of the following : 5 × 3
   i) PIEV theory
   ii) Motor vehicles operation cost
   iii) Express way
   iv) Traffic separator
   v) Construction of gravel road
   vi) Equivalent single wheel load
   vii) Softening point test
   viii) Extrawidening of roads.

10. a) A cement concrete pavement has a thickness of 18 cm and has two paves 7.2 m wide with a longitudinal joint along the central line. Design the dimensions and spacing of the tie bars. Use the following data :
   Allowable working stress in tension (S_s) = 1400 kg/ cm^2
   Unit weight of concrete = 2400 kg/ m^3
   Coefficient of friction (f) = 0·15
   Allowable bond stress = 24·6 kg/ cm^2. 8
   b) Write down stress for construction of rigid pavement. 7

11. a) Bring out the points of differences between Flexible pavement and Rigid pavement. 6
   b) A vertical summit curve is formed by an ascending gradient of 1 in 30 meeting a descending gradient of 1 in 20. Design the length of the summit curve to provide the stopping sight distance of 128m for a design speed of 80 kmph. Assume :
   Height of eyelevel of driver above road surface = 1·2m
   Height of the object above the pavement surface = 0·15m. 6
   c) What is meant by CBR value of soil ? 3

12. a) Describe the procedure in detail for determining the aggregate impact value of stone aggregate to be used for construction of road pavement. 5

b) What are the various tests carried out on bitumen ? 3

c) Explain what do you understand by the term "80/100 grade bitumen". 3

d) A subgrade soil sample has the following properties :

Soil passing 0·075 mm sieve = 60 %

Liquid limit = 50%

Plastic limit = 45%

Calculate the group index for the soil. 4

13. a) A valley curve is formed between a descending grade of 1 in 25 and a ascending grade of 1 in 30. Design the length of Valley curve to fulfill both comfort condition and headlight sight distance requirement. Design speed is 80 kmph and allowable rate of change of centrifugal acceleration = $0 \cdot 6\,m/sec^3$. 8

b) Calculate the extrawidening required for a pavement of width 7 m on a horizontal curve of radius 250 m if the longest wheel base is 7·0 m and design speed is 70 kmph. 7

14. a) Write down some of the important points recommended by IRC for the CBR method of design. 6

b) Design the pavement for construction of a new by pass with the following data. 9

i) Two-lane single carriage way

ii) Initial traffic in the year of completion of construction = 400 CVPD

iii) Traffic growth 8·5% per annum

iv) Design life = 20 years

v) Vehicle damage factor = 2·5 (Standard axles per commercial vehicle)

vi) Design CBR of sub-grade soil = 6%.

Assume any other data if required.