BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
M. E. (Civil Engineering) 1st Semester Final Examination, 2011
Highway Economics and Geometric Design (CE 916)

Time: 3 Hours Full Marks: 70

*Answer any **Five** questions taking at least **Two** from each group*

Assume data reasonable, if required

Group A

1. a) What is intersection sight distance? Explain with neat sketch the safe sight distance for 4-leg uncontrolled intersection enabling vehicles to stop. [2+4]

   b) A 15m wide road 'X' meets a 7.5m wide road 'Y'. The corner of a monumental building is 5m from the nearest vehicle path of 'X' and 15m from the furthest vehicle path of Y. The design speed of vehicle on X is 80km/hr. Find the restricted speed of vehicle on Y so that the vehicle on X may have unrestricted speed. [8]

2. a) What is a speed change lane? Describe the different forms of acceleration lane with neat sketch. [2+4]

   b) Design a deceleration lane from a 20m wide divided road with design speed of 100 km/hr. The comfortable deceleration may be taken as 7 km/hr/sec. Width of deceleration lane is 3.5m (single lane). [8]

3. a) Draw with neat sketch showing the different elements of traffic rotary. State the advantages of traffic rotary over at-grade road intersection. What are the basic elements controls the capacity of a rotary? [2+2+2]

   b) Determine the capacity of the rotary formed by two urban road intersecting at right angles. The design hour flow in PCU/hr of the urban intersection is given below. The average width of entry may be taken as 15m. Assume data suitably as per IRC if required. [8]

Approach	Left Turn	Straight Ahead	Right Turn
North	350	500	280
South	320	390	360
East	430	290	320
West	390	340	410

4. a) What are the differences between interchange and flyover? Show in schematic diagram the traffic flow pattern of a trumpet interchange at a 3-leg intersection. State the basic rules for selecting types of intersection. [2+2+3]

   b) What is known as channelization? Show with neat sketch the basic types of channelization provided at a 4-leg at-grade junction. State the purposes of channelization. [2+3+2]

Group B

5. a) What is the necessity of valuation of travel time? Explain briefly. [4]

   b) Distinguish between: i) in-vehicle travel time and out vehicle travel time; and ii) on the clock time and off-the clock time. [4]

   c) Determine total weighted travel time value of car user for the following information: [6]

   i) hourly wage rate of the driver: ₹ 60.00; ii) hourly other benefits: ₹ 15.00; iii) On-the clock average occupancy: 1.75; iv) Off-the clock average occupancy: 2.50; v) Ratio of car travel during working hour and non-working hour 70:30; vi) driver's and passenger's off-the clock travel time value: 70% and 50% of hourly wage rate, respectively.

6. a) Explain briefly the following indicators used in economic efficiency evaluation of transport project) Present worth of Cost; ii) Equivalent Uniform Annual Costs; iii) Net Present Value. [6]

   b) Compare the merits and demerits of B/C and IRR methods as indicators of evaluation of economic efficiency of transport projects. [4]

   c) Why is economic evaluation of project not made on the basis of financial cost? Discuss. [4]

7. a) Enumerate different categories of highway transportation benefits with examples. [6]

   b) After several years of service a road is required to be reconstructed. The estimated service life of the jetty is 20 years. The reconstruction cost is ₹ 500 lac. During its replacement cycle the road requires rehabilitation three times. It requires ₹ 10 lac at 5 years, ₹ 20 lac at 10 years and ₹ 40 lac at 15 years for rehabilitation. Average annual maintenance cost is ₹ 6 lac. At the end of each replacement cycle the road would require reconstruction again. The entire process would continue in perpetuity. What is the present worth of cost? Assume rate of interest as 6%. [8]

8. a) What is the necessity of estimating vehicle operating cost in economic evaluation of a project? Discuss the effects of i) frequent speed change and ii) road surface condition on vehicle operating cost. [3+4]

   b) The average gradient of a 4 km stretch of a highway is changed from 3.5% to 2%. The traffic volume in the highway is 60000 vehicle / day and directional distribution is estimated to be 50:50. If traffic volume, composition and speed remain same after the improvement in gradient, estimate the benefit in change in vehicle operating cost due to this improvement. The vehicle operating cost and gradient follows the relation: $Y=2.5X^2+3.2X+200$ where Y is vehicle operating cost in lacs of rupees for 1000 vehicle kilometer travelled and X is the longitudinal grade in percentage. [7]