Time: 3 Hours   Full Marks: 70

*Answer any **Five** questions*

Assume reasonable data, if required

1. a) What do you mean by Road Users' Cost? Discuss briefly with examples   [4]

   b) With examples briefly discuss various types of benefits likely to be obtained from a newly constructed expressway.   [4]

   c) What is discounting? What is its utility in economic evaluation of a project?   [3]

   d) Why is economic evaluation of a highway project not undertaken on the basis of financial cost? Discuss.   [3]

2. a) After several years of service a runway is required to be reconstructed. The estimated service life of the runway is 20 years. The reconstruction cost is ₹ 1000 lac. During its replacement cycle the runway requires rehabilitation three times. It requires ₹ 40 lac at 5 years, ₹ 60lac at 9 years and ₹ 80 lac at 16 years for rehabilitation. Average annual maintenance cost is ₹ 12 lac. At the end of each replacement cycle the runway would require reconstruction again. The entire process would continue in perpetuity. What is the present worth of cost? Assume rate of interest as 5%.   [10]

   b) Why Internal Rate of Return method is preferred over Benefit Cost Ratio method?   [4]

3. a) A survey was conducted among 10 commuters to find out the value of time they assign in selecting the alternative travel mode. The result of the survey is given below. Determine the value of time per hour.   [10]

Commuter No.	Time (min)		Cost (₹)	
	Mode Selected	Mode Not Selected	Mode Selected	Mode Not Selected
1.	47	55	12	8
2.	38	31	15	18
3.	44	50	10	8
4.	28	34	13	10
5.	29	38	16	11
6.	37	31	11	15
7.	42	36	9	14
8.	40	45	12	7
9.	30	27	15	16
10.	39	34	12	17

   b) Discuss -- i) wheel pavement surface contact and ii) vehicle repair and maintenance components of Vehicle Operating Cost,   [4]

4. a) Explain with neat sketch showing the different elements of traffic rotary for capacity determination. [4]

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 12m. Assume data suitably as per IRC if required. [10]

Approach	Left Turn	Straight Ahead	Right Turn
North	360	490	290
South	310	400	370
East	440	300	330
West	380	350	420

5. What is Intersection sight distance? Discuss with neat sketch the different sight triangle applicable for approaching and departing vehicles in a four leg intersection. [4+5+5 = 14]

6. A 6.0 m length vehicle from a minor road is willing to cross a major road in a yield controlled intersection. The width of the major road is 14m and that of minor road is 5.5m. The width of the intersection to be crossed is 18m. Design speed of major road is 100km/h and that of minor road is 45km/h. Determine the length of leg of sight triangle on major road approach and travel time. Travel time in minor road is 6.3second to cross the intersection without stopping. The other values if required may be assumed as per AASHTO 2001. [14]

7. Write short notes on any *FOUR* of the following [4 x 3½]

a) Effect of frequent speed change and road curvature on Vehicle Operating Cost.

b) Factors affecting travel time value

c) Relationship between mobility and accessibility

d) Factors affecting PRT values

e) Decision sight distance