Ref. No.: Ex/CE/PE/B/T/422E/2024

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2024

ADVANCED TRAFFIC ENGINEERING

Time: 3 Hours **Full Marks: 100**

Answer ALL Questions

Answer brief & to the point. Assume standard value for any parameter, if required

Group: I (CO1]

1. Following the IRC:108-2015, name and explain the Components of Traffic Forecast. **[12]**
2. The time series data on Traffic Volume at a certain location and the corresponding data on GDP of the region from 2005 to 2014 are given below. If the GDP is expected to grow at a rate of 6 percent determine the possible rate of growth of traffic.

Year	Traffic (PCUs/day)	GDP at constant Price (Rs. Crores)
2005	6,250	49,500
2006	6,550	51,200
2007	7,000	52,850
2008	7,250	54,275
2009	7,650	56,000
2010	8,000	57,500
2011	8,500	59,450
2012	8,850	61,000
2013	9,350	64,000
2014	9,900	65,300

[13]

Group: II (CO2]

3. Explain the flow-density characteristics of a traffic stream if half the number of lanes of a highway section are closed. With a neat sketch explain the situations which will lead to formation of bottleneck and shockwave. Further explain the impact of bottleneck on speed, density and shockwave of the traffic flow at bottleneck and approach to bottleneck. Consider the speed-density relationship as linear. **[12]**
4. The mean free speed and jam density on a lane of a highway are observed as 60 KmpH and 200 pcu/Km respectively. The average traffic flow on the lane is observed as 1000 pcu/Hr. A slow moving vehicle travelling at 15 KmpH enters the lane, forcing the vehicles behind to queue up and move in a platoon. Using the information, find -
    a. The speed of the stream under the average flow condition.
    b. The flow in the queued up platoon of vehicles
    c. The speed of the resultant shockwave.
    d. The length of the queue if the slow moving vehicles remain in the stream for 1.5Km **[13]**

Group: III (CO3]

5. Name the three 'E's associated with road accident management and explain their role. What is the fourth 'E' added to the group as part of India's accident management strategy?
   Stating two major differences, explain the 'collision diagram' and 'condition diagram' as associated with accident reporting **[6+6]**
6. The accident counts at an uncontrolled intersection for five consecutive observed years are 8,3,2,8 and 4 respectively. Assuming exponential distribution, estimate the probability of at least 2 accidents in that spot **[6]**
7. At a particular stretch of the highway, over a period of 10 years the traffic has increased by 1.8 times. In the same time period the number of road accidents have increased from 400 per year to 900 per year. Considering critical chi-square value as 3.841 test whether there is any significant increase in the accident rate. **[7]**

Group: IV (CO3]

8. Write Schull's equation and explain the terms involved in it. State two major limitations of using this equation in estimating headway probability **[1+4+2]**
9. The 20 headway distributions in seconds as recorded at an uncontrolled intersection are – 6.2, 2.8, 7.9, 6.2, 8.6, 9.2, 5.9, 6.6, 8.5, 16.3, 6.1, 3.7, 12.1, 6.5, 16.9, 15.6, 17.3, 13.5, 5.1, and 9.2. Find the probability of headway more than 12secs if the flow gets retarded for headway less than 10 secs **[6]**
10. With proper justification find the minimum number of channels required to serve an arriving flow of 1500 veh/hr for a multi-channel toll both with service rate of 360 veh/hr. Both arrival and service can be assumed as exponential. **[4]**
11. In a gas station there is 1 service channel and the average service time is 3 mins per vehicle. Considering the average arrival rate of 15 veh/hr, and both arrival and service to follow poisonian distribution, determine the following –
    a. The average number of vehicles in the system
    b. The average time spent by a vehicle in the system
    c. The probability of no queue in the system
    d. The probability of an idle system **[8]**