

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2025**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)**

- Following the IRC:108-2015, briefly explain the Components of Traffic Forecast. [10]
- The time series data at a certain location on Traffic Volume and the corresponding GDP of the region from 2015 to 2024 are given below. If the GDP is expected to grow at a rate of 6 percent determine the possible rate of growth of traffic considering a log-log relationship between them

Year	Traffic (PCUs/day)	GDP at constant Price (Rs. Crores)
2015	6,250	49,500
2016	6,550	51,200
2017	7,000	52,850
2018	7,250	54,275
2019	7,650	56,000
2020	8,000	57,500
2021	8,500	59,450
2022	8,850	61,000
2023	9,350	64,000
2024	9,900	65,300

[10]**Group: II (CO2)**

- Explain the flow-density characteristics of a traffic stream if one lane of a three lane highway section is 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. [10]
- The mean free speed and jam density on a lane of a highway are observed as 80 Kmph and 200 pcu/Km respectively. The average traffic flow on the lane is observed as 2000 pcu/Hr. A slow moving vehicle travelling at 25 Kmph enters the lane, forcing the vehicles behind to queue up and move in a platoon. Using the information, find -
 - The speed of the stream under the average flow condition.
 - The flow in the queued up platoon of vehicles
 - The speed of the resultant shockwave.

[10]

[Turn over

Group: III (CO3)

5. Name the three major forms of representation of accident data and state the major differences between them [1+6]
6. The accident counts at an uncontrolled intersection for 10 consecutive observed years are 9, 8, 6, 4, 3, 6, 9, 6, 4 & 7 respectively. Assuming exponential distribution, estimate the probability of at least 3 accidents in that spot [8]

Group: IV (CO3)

7. Name the parameters and their different types associated with modelling a queueing problem [10]
 8. Considering M/M/1 situation, explain how the probability of having $(n - 1)$ vehicles at time $(t + \delta t)$ can be reached for $n > 0$ [10]
 9. People started arriving at the entry gate of an amusement park from 8am at a constant hourly rate of 120 persons. The park gate opens at 9am and average entry time required for each person is 30 secs. From 9am the arrival rate gets doubled for an hour and after that the hourly rate of arrival declines to 60 persons. Considering a D/D/1 model, draw neatly the accumulation diagram and determine the following –
 - a. Length of longest queue
 - b. Maximum waiting time
 - c. Clock time, when the queue is longest
 - d. Clock time, when the queue vanishes [10]
 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 350 veh/hr. Both arrival and service can be assumed as exponential. [5]
 11. In a gas station there is 1 service channel and the average service time is 4 minutes per vehicle. Considering the average arrival rate of 10 veh/hr, and both arrival and service to follow poissonian 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
 - e. The probability of more than 3 vehicles in the system [10]
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