

# Lukhdhirji Engineering College, Morbi

## Department of Mechanical Engineering

### Assignment 3. Queuing Theory (CO3)

**Subject: Operation Research (3151910)**

**Semester: 5<sup>th</sup>**

**Year: 2022-23**

1. A self-service store employs one cashier at its counter, Nine customer sarrive on an average every 5 minutes while the cashier can serve 10customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service rate, find
  1. Average number of customers in the system
  2. Average number of customers in queue
  3. Average time a customer spends in the system
  4. Average time a customer waits before being served
2. A chemical company distributes its products by trucks loaded at its only loading station and loading station is working 24 hours, continuously. Both company's trucks and contractor's trucks are used for this purpose. It was find out that on an average 10 minutes one truck arrived and average loading time was 6 minute. If 50% trucks are contractor's trucks find (i) Traffic intensity factor, (ii) Weighting time of trucks in system, (iii) The expected weighting time of contractor's trucks per day.
3. A copy maker has one copy making machine and he operates as the order comes. The order arrival is poison distribution having interval time of 0.5 min. The average time to serve a copy is distributed with mean of 0.3 min. Determine the following:
  - (1) Utilization factor of the machine
  - (2) Idle time for machine in a day having working hours of 10 hours
  - (3) No of persons waiting in the system
  - (4) No of persons waiting in the queue
  - (5) Average waiting time in the queue [

---

**1**

**Vision of the Department:**

To deliver quality engineering education for Mechanical Engineers with Professional competency, Human values and Acceptability in the society.

**Mission of the Department:**

- To nurture engineers with basic and advance mechanical engineering concepts
- To impart Techno-Managerial skill in students to meet global engineering challenges
- To create ethical engineers who can contribute for sustainable development of society

4. On an average 95 patients per 24 hrs.day require the service of an emergency clinic. Also on the average, a patient requires 12 minutes of an active attention. Assume that the facility can handle only one emergency at a time. Suppose that it cost the clinic Rs.100 per patient treated to obtain an average servicing of 10 minutes & that minute of decreasing in this average time would cost Rs. 10 per patient treated. How much would have to be budgeted by the clinic to decrease the average size of the queue from one to one third patients to half a patient.
5. Customers arrive at one person barber shop according to Poisson process with a mean inter-arrival time 20 minutes. Customer spends on an average of 15 minutes in barber's chair.
- 1) What is the probability that new arrival need not wait for the barber to be free?
  - 2) What is the expected number of customers in barber shop?
  - 3) How much time can a customer expect to wait for his turn?
  - 4) How much time can a customer spend in the shop?
  - 5) Management will put in another chair and hire another barber when customer's average time in shop exceeds 1.25 hours. How much must average rate of arrival increase to warrant a second barber.

\*\*\*\*\*

---

2

**Vision of the Department:**

To deliver quality engineering education for Mechanical Engineers with Professional competency, Human values and Acceptability in the society.

**Mission of the Department:**

- To nurture engineers with basic and advance mechanical engineering concepts
- To impart Techno-Managerial skill in students to meet global engineering challenges
- To create ethical engineers who can contribute for sustainable development of society