

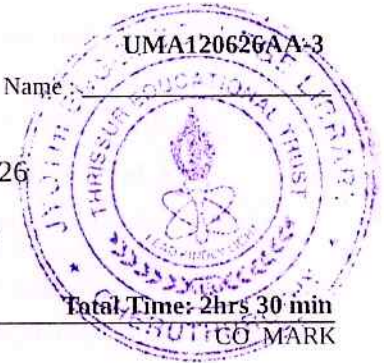
Reg No.: _____

Name: _____



Jyothi Engineering College(Autonomous)
BTech Degree S2 (Challenge Course) Examination, June 2026
(2025 Scheme)

**25MAT301 - MATHEMATICS FOR COMPUTER AND
INFORMATION SCIENCE-3**



Total Mark: 60

Total Time: 2hrs 30 min
CO MARK

PART A

(Answer All Questions. Each question carries 3 marks)

1. Two fair six dice are tossed independently. Let M denote the maximum of two tosses. What is the pmf of M? Determine the CDF of M. CO1 (3)
2. The n candidates for a job have been ranked 1, 2, 3, n . If X denote the rank of a randomly selected candidate which has pmf $p(x) = \begin{cases} \frac{1}{n}, x = 1, 2, \dots, n \\ 0, \text{otherwise} \end{cases}$. Compute E(X) and Var(X). CO1 (3)
3. A random variable X has the pdf f(x) is given by $f(x) = \begin{cases} cxe^{-x}, x > 0 \\ 0, x \leq 0 \end{cases}$. Find the value of c and CDF of X. CO2 (3)
4. A random variable X is uniformly distributed in the interval (-k, k). Find K if $P(X \geq 1) = \frac{1}{3}$. CO2 (3)
5. The number of items produced in a factory during a week is a random variable with mean 250. What can be said about the probability that the week's production will be at least 1000? CO3 (3)
6. Give an example for i) discrete time discrete state space Stochastic process. CO3 (3)
ii) Continuous time discrete state space Stochastic process.
iii) Discrete time Continuous state space Stochastic process.
7. Suppose it rains today, then it will rain tomorrow with probability 0.7 and it does not rain today, then it will rain tomorrow with probability 0.4. Calculate the probability that it will rain 4 days from today given that it is raining today? CO4 (3)
8. At an intersection, a working traffic light will be out of order the next day with probability 0.07 and an out of order traffic light will be working the next day with probability 0.88. Let $X_n = 1$ if on day n the traffic light will work, $X_n = 0$ if on day n the traffic light will not work. Is $\{X_n : n = 0, 1, 2, \dots\}$ a Markov chain? If so write the transition probability matrix? CO4 (3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module - 1

9. a) A certain type of flashlight requires 2 type D-batteries and the flashlight will work only if both its batteries have acceptable voltages. Suppose that 90% of all batteries from a certain supplier have acceptable voltages. Among 10 randomly selected flashlights, what is the probability that at least 9 will work? CO1 (5)

b) The joint probability function of X and Y is given by $f(x, y) = k(2x + 3y)$, CO1 (4)
 $x = 0, 1, 2, y = 1, 2, 3$
 i) Find the value of k.
 ii) Find the marginal distributions of X and Y.

OR

10. a) An article reports that 1 in 200 people carry the defective gene that causes inherited colon cancer. In a sample of 1000 individuals, what is the approximate distribution of the number who carry the gene? CO1 (5)

Use this distribution to approximate probability that

- i) Between 5 and 8 (inclusive) carry the gene.
- ii) At least 8 carry the gene

b) Derive the mean and variance of Binomial Distribution. CO1 (4)

Module - 2

11. a) Starting at 5.00 am every half hour there is a flight from San Francisco airport to Los Angeles International airport. Suppose that none of these planes is completely sold out and that they are always have room for passengers. A person who wants to fly to Los Angeles arrives at the airport at a random time between 8.45 am and 9.45 am. Find the probability that she waits CO2 (5)

- i) at most 10 minutes and,
- ii) at least 15 minutes.

b) Suppose the joint pdf is given by $f(x, y) = \begin{cases} \frac{6}{5}(x + y^2), & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{otherwise} \end{cases}$ CO2 (4)

- i) Find $P(0 \leq x \leq \frac{1}{4}, 0 \leq y \leq \frac{1}{4})$.
- ii) Find the marginal distributions of X and Y.

OR

12. a) The reaction time for an in-traffic response to a brake signal from standard brake lights can be modeled with a normal distribution having mean value 1.25 seconds and standard deviation of 0.46 seconds. What is the probability that the reaction time is between 1.00 second and 1.75 seconds? CO2 (5)

b) A component has an exponential time to failure distribution with mean of 10000 hours. The component has already been in operation for its mean life. CO2 (4)

i) What is the probability that it will fail by 15000 hours given that the component is already in operation for its mean life.

ii) What is the probability that it operates for another 5000 hours.

Module - 3

13. a) Messages arrive at a computer from two telephone lines according to independent Poisson processes with rates 3 per hour and 5 per hour respectively. CO3 (5)
- i) What is the probability that no message would arrive at the computer in the first 30 minutes of operation?
- ii) What is the probability distribution of the interarrival time of the messages arriving at the computer?
- b) A pair of dice be rolled 900 times and X denote the number of times a total of 9 occurs. CO3 (4)
Find $P(80 \leq X \leq 120)$ using Chebyshev inequality.

OR

14. a) Cell phone calls processed by certain wireless base station arrive according to a Poisson process with an average of 12 per minute. What is the probability that more than 3 calls arrive in an interval of length 20 seconds? What is the probability that more than 2 calls arrive in each of 2 consecutive intervals of length 30 seconds? CO3 (5)
- b) The lifetime of a special type of battery is a random variable with mean 40 hours and standard deviation 20 hours. A battery is used until it fails, at which point it is replaced by a new one. Assuming a stockpile of 25 such batteries, the lifetimes of which are independent, approximate the probability that over 1100 hours of use can be obtained. CO3 (4)

Module - 4

15. a) A man either drives a car or catches a train to go to the office each day. He never goes 2 days in row by train; but if he drives one day, then the next day he is just as likely to drive again as he travels by train. Now suppose that on the first day of the week, the man tossed a fair dice and drove to work if and only if a 6 appeared. Find CO4 (5)
- i) the probability that he takes a train on the third day and
- ii) the probability that he drives to work in the long run.
- b) Find the nature and states of the Markov chain with TPM $\begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{2} & 0 & \frac{1}{3} \\ 0 & 1 & 0 \end{bmatrix}$ with state space $\{0, 1, 2\}$. CO4 (4)

OR

16. A gambler has Rs 2 and he plays a betting game where he wins Re 1 if a head shows up and loses Re 1 if a tail shows up in tossing of a fair coin. He stops playing this game if he wins Rs 2 or loses Rs 2. Find the CO4 (9)
- i) Transition probability matrix of the given Markov chain.
- ii) Probability that the gambler has lost his money at the end of 5 plays.
