

Reg No : Name :

**MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May 2026

Course Code: B24MA2T04B

Course Name: STATISTICAL ANALYSIS AND NUMERICAL METHODS

Max. Marks: 100

Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)**Answer all questions**

1. Check whether the following function can be a pmf $f(x) = \frac{x^2}{25}$, $x = 0, 1, 2, 3, 4$.
2. In a city 4% of all licensed drivers will be involved in at least one road accident in a given year. Use Poisson approximation to determine the probability that among 150 licensed drivers randomly chosen in this city at most 3 will be involved in at least one road accident in any given year.
3. The diameter of an electric cable is a continuous random variable with density function,

$$f(x) = \begin{cases} \frac{1}{18}(9 - x^2) & \text{if } 0 \leq x \leq 3 \\ 0 & \text{otherwise} \end{cases}$$
. Find $P(X > 2)$.
4. If X is normally distributed with mean 1 and variance 4. Find $P(-3 < X < 3)$.
5. A random sample of 500 pineapple was taken from a large consignment and 65 of them were found to be bad. Determine the standard error of the proportion of bad ones in this sample.
6. The mean score of a random sample of 100 students who attended a certain board examination is 75 with standard deviation 10. Construct a 90% confidence interval for the population mean.
7. Construct the Newton's divided difference table for the following data.

x	0	1	4	5
y	0	1	40	65

8. Find a root between 0 and 1 for $\cos x = 3x - 1$ using Newton - Raphson method, correct to four decimal places.
9. Using Euler's method find $y(0.2)$ if $y' = x + y$, $y(0) = 1$, $h = 0.2$.
10. Use Runge-Kutta method of second order to find $y(0.1)$ given that $y' = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$, $h = 0.1$.

PART - B: 70 Marks (5 Qns x 14 Marks)**Answer any One full question from each module.****Module 1**

11. a. The probability mass function of a random variable X is given below

(7 Marks)

X	0	1	2	3	4	5	6
$f(x)$	k	$3k$	$5k$	$7k$	$9k$	$11k$	$13k$

Find *i*) k *ii*) $P(X < 4)$ *iii*) $E(X)$ *iv*) $V(X)$.

- b. A binomial distribution with parameters $n = 5$ satisfy $8P(X = 4) = P(X = 2)$. Find (7 Marks)
- i*) p *ii*) $P(X \geq 1)$.

OR

12. a. It is known that 2% of the bolts produced by a company are defective. The bolts are supplied in boxes of 200 bolts. (Use Poisson distribution) (7 Marks)

i) What is the probability that a randomly chosen box contains not more than 5 defective bolts ?

ii) In a consignment of 1000 such boxes, how many can be expected to have more than 5 defective bolts ?

- b. The joint probability mass function of random variables X and Y is given by (7 Marks)

$$p(x, y) = \begin{cases} \frac{x(x+y)}{70}, & x = 1, 2, 3; y = 3, 4 \\ 0, & \text{otherwise} \end{cases}.$$

Find $E(X + Y)$.

Module 2

13. a. Derive the mean and variance of exponential distribution with parameter λ . (7 Marks)

- b. The joint pdf of two continuous random variables X and Y is given by (7 Marks)

$$f(x, y) = \begin{cases} kxy, & 0 < x < 4, 1 < y < 5 \\ 0, & \text{otherwise} \end{cases}.$$

i) Find k *ii*) Examine the independence of X and Y .

OR

14. a. The weight of certain brand of shampoo packets are uniformly distributed between 9.3 gm and 10.5 gm. In a random lot of 100 packets, how many packets *i*) exceed 10 gm *ii*) are below 10.2 gm. (7 Marks)

- b. For a normally distributed population 31% of items have their values less than 45. Find the mean of the distribution if the standard deviation of the population is 10. (7 Marks)

Module 3

15. a. Intelligent tests were given to two groups of students. From the given data examine if the difference between the mean scores is significant (Use 5% level of significance). (7 Marks)

	Mean	S.D.	Size
Group1	75	8	60
Group2	73	10	100

- b. Perform the test of hypothesis indicated, using the data from independent samples drawn from normal populations having a common population variance. (7 Marks)

$$H_0 : \mu_1 - \mu_2 = 0 \text{ vs } H_1 : \mu_1 - \mu_2 < 0, \alpha = 0.01$$

$$n_1 = 8, \bar{x}_1 = 19.9, n_2 = 10, \bar{x}_2 = 16.7, \sigma^2 = 2.8, \alpha = 5\%.$$

OR

16. a. In a sample of 600 students of a certain college 400 are found to use gel pens. In another college from a sample of 900 students, 450 were found to use gel pens. Test whether the two (7 Marks)

colleges are significantly different with respect to the habit of using gel pens ($\alpha = 5\%$).

- b. The mean weight obtained from a sample of size 100 is 64 gm. The standard deviation of the weight distribution of the population is 3 gm. Test the statement that the mean weight of the population is 67 gm at 5% level of significance. (7 Marks)

Module 4

17. a. Using Newton's forward difference interpolation find the value of $\sin 52^\circ$, given that (7 Marks)
 $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$,
 $\sin 60^\circ = 0.8660$, $\sin 65^\circ = 0.9063$.
- b. Evaluate $\int_0^1 e^{-x^2} dx$ by Trapezoidal rule with $n = 10$ (7 Marks)

OR

18. a. A river is 80 m wide. The depth y in meter at a distance x meter from one bank is given in the following table. Find the approximate area of cross-section of the river using Simpson's rule (7 Marks)

x	0	10	20	30	40	50	60	70	80
y	0	5	8	10	15	12	7	3	1

- b. Compute $\cosh(0.75)$ using Newton's backward difference interpolation formula from the given set of data, (7 Marks)
 $\cosh(0.5) = 1.127626$, $\cosh(0.6) = 1.185465$, $\cosh(0.7) = 1.255169$,
 $\cosh(0.8) = 1.337435$.

Module 5

19. a. Fit a straight line to the points $(0, 2)$, $(2, 0)$, $(3, -2)$, $(5, -3)$ using method of least squares. (7 Marks)
- b. Using Runge-Kutta method of second order, solve $\frac{dy}{dx} = y - \frac{2x}{y}$, $y(0) = 1$ in the range $0 \leq x \leq 0.2$ with step size $h = 0.1$ (7 Marks)

OR

20. a. Solve the following system of equation using Gauss-Seidel iteration method correct to 4 decimal places (7 Marks)
 $10x - 5y - 2z = 3$
 $4x - 10y + 3z = 3$
 $x + 6y + 10z = 3$
- b. Using Euler's method, find the approximate value of y at $x = 1$ if (7 Marks)
 $y' = x^2 + y^2$, $y(0) = 1$ in 5 steps.
