NARULA INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT

B.TECH./IT/ODD/SEM 3/R_21/ M(IT)302/2022-2023
YEAR: 2022

NUMERICAL METHODS AND STATISTICS
M(IT)302

TIME ALLOTTED: 3 HOURS FULL MARKS: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

1. Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

SL No.	Question	Marks	Co	Blooms Taxonomy Level
(i)	In LU- factorization method, the given system of equation represented by AX=B is converted to another system LUX=B, where L is a) Lower triangular matrix b) Upper triangular matrix c) Identity matrix d) Null matrix	1	2	Remember
(ii)	Mean and variance of the Standard Normal Distribution with parameters m and $\sigma$are respectively a) 0 and 1 b) m and σ c) 1 and 1 d) m and σ^2	1	3	Understand
(iii)	One root of the equation $x^2 + 2x - 2 = 0$ lies between a) 1 and 2 b) 0 and 0.5 c) 0.5 and 1 d) 1 and 1.5	1	1	Evaluate
(iv)	If X is an unbiased estimator of the parameter A , then X^2 is a biased estimator of a) A b) A^3 c) A^2 d) A^4	1	4	Analyze
(v)	Regula-Falsi method is a) Conditionally convergent b) linearly convergent c) divergent d) none of these	1	1	Analyze
(vi)	If the correlation co-efficient between x and y is 0.5, then the	1	3	Evaluate

correlation co-efficient between $5x$ and $-3y$ would be

a) 0.5
b) -0.5
c) 1.5
d) -1.5

(vii) If $f(x)$ be a continuous function and $f(a)f(b) < 0$, then — 1 — 1 — Recall

(a) $f(x)$ has no root in (a, b)
(b) $f(x)$ may have two identical roots in (a, b)
(c) $f(x)$ has at least one root in (a, b)
$(d) f(x)$ has all roots in (a, b)

(viii) The expectation of the following distribution is: — 1 — 3 — Evaluate

x_i	0	1	2	3
f_i	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{8}$

a) $\frac{1}{2}$
b) $\frac{5}{2}$
c) 1
d) $\frac{3}{2}$

(ix) In Gauss Elimination method, the given system of equations represented by AX=B is converted to another system UX=Y where U is — 1 — 2 — Analyze

a) Diagonal matrix
b) Lower triangular matrix
c) Upper triangular matrix
d) Identity matrix

(x) If X is a Poisson variate such that $P(X = 1) = P(X = 2)$, then the variance of X is — 1 — 3 — Evaluate

a) 0
b) 2
c) $\sqrt{2}$
d) -2

(xi) The Newton-Raphson's method fails, when — 1 — 1 — Analyze

a) $f'(x) = 1$
b) $f'(x) = 0$
c) $f'(x) = -1$
d) $f''(x) = 0$

(xii) The mean of binomial distribution $B(n, p)$ (where n, p are the no. of trials and probability of success) is — 1 — 3 — Understand

a) $\frac{n}{p}$
b) 0
c) np

d) 1

GROUP – B
(Short Answer Type Questions)
(Answer any three of the following) 3 x 5 = 15

SL No.	Question	Marks	Co	Blooms Taxonomy Level
2.	Find a positive root of the equation $3x - cosx - 1 = 0$ using Newton Raphson method, correct up to three significant figures.	5	1	Evaluate
3.	If X is an unbiased estimator of A, then show that X^2 is a biased estimator of A^2	5	4	Understand
4.	Solve the following system of equations, correct upto three significant figures by Gauss-elimination method $2x + 3y + z = 9$ $x + 2y + 3z = 6$ $3x + y + 2z = 8$	5	2	Apply
5.	For a bivariate (X, Y), $\bar{x} = 45$, $\bar{y} = 60$, $\sigma_x = 2.5$, $\sigma_y = 3.2$ and $r = 0.75$; where $\bar{x}$ and $\bar{y}$ are means of X and Y, respectively; σ_x and σ_y are standard deviations of X and Y, respectively; and r is the correlation co-efficient of X and Y. (a) Obtain the regression co-efficient of Y on X. (b) Obtain the regression co-efficient of X on Y. (c) Write the regression equation of Y on X. (d) Write the regression equation of X on Y. (e) Predict the value of Y for $X = 35$.	5	3	Analyze
6.	The mean and standard deviation of marks of 70 students were found to be 65 and 5.2 respectively. Later it was found that the mark of one student was wrongly recorded as 85 instead of 58. Obtain the correct s.d.	5	3	Analyze

GROUP – C
(Long Answer Type Questions)
(Answer any three of the following) 3 x 15 = 45

SL No.		Question	Marks	Co	Blooms Taxonomy Level
7.	(i)	Solve the following system of equations by SOR method correct to four decimals places $7x + y + 2z = 10$ $x + 8y + 3z = 8$ $2x + 3y + 9z = 6$	8	2	Evaluate
	(ii)	Find a root of the equation $x^3 - 8x - 4 = 0$ that lies between 2 and 3 using Secant Method correct up to four decimal places.	7	1	Apply
8.	(i)	Find the mean, median and mode of the following grouped	8	3	Evaluate

frequency distribution:

Class	70-79	80-89	90-99	100-109	110-119	120-129	130-139
Frequency	3	5	10	2	4	6	1

(ii) A normal population has a mean 0.1 and standard deviation 2.1. Find the probability that the mean of a sample of size 900 will be negative. Given that $P(|z| < 1.43) = 0.847$. — 7 — 4 — Apply

9. (i) Solve the following system of equations by LU factorization method — 7 — 2 — Evaluate

$$2x - 3y + 4z = 8$$
$$x + y + 4z = 15$$
$$3x + 4y - z = 8$$

(ii) Find out the root of the equation $x^3 - 5x - 7 = 0$ using Regula-Falsi method that lies between 2 and 3, correct to 4 decimal places. — 8 — 1 — Apply

10. (i) Let $\{X_1, X_2, X_3, \ldots, X_n\}$ be a random sample from a normal distribution with mean μ and variance 1. Show that $\frac{1}{n}\sum_1^n {X_i}^2$ is an unbiased estimator of $\mu^2 + 1$. — 7 — 3 — Analyze

(ii) The monthly income of 175 workers in a factory were recorded. This gives sample mean as Rs. 3440.65 and the S.d. as Rs. 125.32. Find 95% confidence interval of the average monthly income. [Given $\int_{1.96}^{\infty} \varphi(x)dx = 0.025$]. — 8 — 4 — Apply

11. (i) Find a root of the equation $3x - \cos x - 1 = 0$ using Fixed Point Iteration Method correct up to four decimal places. — 7 — 1 — Apply

(ii) If $X_1, X_2, X_3, X_4, X_5, X_6$ be an independent simple random sample from a normal population with unknown variance σ^2. Find K such that $K[(X_1 - X_2)^2 + (X_3 - X_4)^2 + (X_5 - X_6)^2]$ is an unbiased estimator of σ^2. — 8 — 3 — Analyze