M.Sc. 2nd Semester Examination, 2023

APPLIED MATHEMATICS

(Statistical and Numerical Methods)

PAPER – MTM-204(CBCS)

Full Marks : 40

Time : 2 hours

The figures in the right hand margin indicate marks

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

Illustrate the answers wherever necessary

1. Answer any *four* questions : 2×4

(*a*) Define the terms 'empirical' and 'procedural' error.

(*b*) If $f(x) = 4\cos x - 6x$, find the relative percentage error in $f(x)$ at $x = 0$ when error in x is 0.005.

(*c*) Find the median of 33, 86, 68, 32, 80, 48, 70, 64.

(*d*) Find the interval in which of a positive real root of $3x - \cos x - 1 = 0$ lies.

(*e*) Write the physical significance of the correlation co-efficient.

(*f*) Define null hypothesis.

2. Answer any *four* questions : 4×4

(*a*) The value of function f(x) are given for certain values of x :

x :	1.00	1.10	1.20	1.30
$f(x)$	0.8415	0.8912	0.9320	0.9636

Estimate the value of $f(x)$ for $x = 1.02$ correct to four decimal places.

(*b*) Compute $f(2)$ from the following table :

x :	0	1	3	4
$f(x)$:	5	6	50	105

(*c*) Describe the bisection method for computing a real root of an equation $f(x) = 0$.

(*d*) Evaluate

$$\int_0^1 \frac{dx}{1+x^2}$$

by Simpson's-1/3 rule, taking 6 equal sub-intervals.

(*e*) Solve by Gauss-elimination method, correct up to two significant figures.

$$8x + 2y - 2z = 8$$
$$x - 8y + 3z = -4$$
$$2x + y + 9z = 12$$

(*f*) Find $y(0.15)$, from the equation

$\frac{dy}{dx} = x^2 + y^2$, $y(0) = 0$, taking step length $h = 0.05$, by Euler's method, correct up to *four* decimal places.

3. Answer any *two* questions : 8×2

(*a*) Describe Newton-Raphson method to find a real root of the equation $f(x) = 0$, where $f(x)$ is continuous function of x. Give geometrically interpretation of this method. Write the convergence criteria of this method. $5 + 2 + 1$

(*b*) Compute $y(0.3)$, from the equation

$$\frac{dy}{dx} = x - y, \quad y(0) = 1,$$

taking step length $h = 0.1$, by 4th order Runge-Kutta method, correct up to five decimal places. 8

(*c*) Deduce the equation of regression lines for a set of n bivariate data. If a linear relation exists between the variables x and y, then prove that $r = \pm 1$. $5 + 3$

(*d*) Describe Chi-square distribution and Student's t-distribution. $4 + 4$
