2022

M.Sc.

2nd Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MTM-204

STATISTICAL AND NUMERICAL METHODS

Full Marks : 50

Time : 2 Hours

The figures in the margin indicate full marks.

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

1. Answer any *four* questions : 4×2

(a) Define the terms numerical error and data error.

(b) If $f(x) = 4x^6 - 5x$, find the percentage error in computing $f(x)$ at $x = 1$ if the error in x is 0.04.

(c) Define null hypothesis.

(d) What is the regression curve in a set of bivariate data ?

(e) Find the position of a real root of

$$10^x + \sin x + 2x = 0.$$

(f) Write down the physical significance of the correlation co-efficient.

2. Answer any *four* questions : 4×4

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

x	1.1	1.2	1.3	1.4
f(x)	7.831	8.728	9.697	10.744

Estimate the value of f(x) for x = 1.38 correct to three decimal places.

(b) Find the interpolation polynomial using Lagrange's formula for the following table :

x	−1	0	2	5
f(x)	9	5	3	15

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

(d) Evaluate $\int_0^1 \frac{x\,dx}{1+x^2}$ by Simpson's 1/3 rule, taking 6 equal subintervals.

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

$$9x + 7y + 12z = 35$$
$$5x + 3y - 6z = 27$$
$$12x - 10y + z = 15$$

(f) Find $y(0.02)$, from the equation $\frac{dy}{dx} = 2x^3 + 3y$, $y(0) = 1$, taking step length $h = 0.01$, by Euler's method, correct up to four decimal places.

3. Answer any *two* questions : 2×8

(a) Deduce the equation of regression lines for a set of n bivariate data. Prove that correlation coefficient of two variables is the geometric mean of the two regression coefficients.

(b) Compute y(0.6), from the equation $\frac{dy}{dx} = xy$, y(0) = 2, taking step length h = 0.2, by fourth order Runge-Kutta method, correct up to five decimal places.

(c) Describe Newton-Raphson method to find a real root of the equation f(x) = 0, where f(x) is continuous function of x. Give geometrical interpretation of this method. Write down the convergence criteria of this method.

(d) Describe Chi-square distribution and Student's t-distribution.

[Internal Assessment – 10]

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