# 2022

## APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

## [P.G.]

## (M.Sc. Second Semester End Examination-2022)

### PAPER-MTM 204

### Statistical and Numerical Methods

***Full Marks: 50*** ***Time: 02 Hrs***

*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*

**Attempt Question No. 1 and any four from rest:**

**1.** Attempt any **four** questions: **2 × 4 = 8**

a) What are the advantages and disadvantages of Newton's forward interpolation formula?

b) How the error propagates in a single valued function?

c) If $f(x) = 4 - 6x + \sin^2 x$, find the relative percentage error in $f(x)$ for $x = 0$ when error in x is 0.004.

d) Find the position of a positive real root of $x^2 - 2x - 2 = 0$

e) Are these two lines $2x + 3y = 7$ and $3y - 7x = 2$ as the regression lines? Give reasons.

f) Define null hypothesis.

g) Sho0w that the simpson's 1/3 rule gives exact result for the function $f(x)=x^3$

2. a) Compute $f(2)$ from the following table:

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

b) Prove that sum of Lagrangian functions is unity 4+4

3. a) Show that Bisection method surely converge to a root of $f(x)=0$

b) A function $f(x)$ defined on the interval [0,1] in such that $f(0)=0$. $f(y_2)=-1, f(1)=0$

Find the quadratic polynomial p(x) which agrees with f(x) for x=0, ½,1.

If

$$\left|\frac{d^3 f}{dx^3}\right| \le 1 \text{ for } 0 \le x \le 1, \text{ show that } |f(x)-p(x)| \le \frac{1}{12} \text{ for } 0 \le x \le 1$$

4+4

4. a) Prove that Newton Raphson has quadratic rate of convergence.

b) Solve by Gauss-elimination method, correct up to two significant figures

$$x + 2y + 3z = 10$$
$$x + 3y - 2z = 7$$
$$2x - y + z = 5$$

4+4



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

b) If two variables $x$ and $y$ satisfy the relationship $y=-5+6x$, find the correlation coefficient between $x$ and $y$ 4+4

6. a) Prove that $-1 \le r \le 1$ for the bivariate sample $(x_i, y_i), i = 1, 2, .....n$

b) Calculate the correlation coefficient from the bivariate samples

| x: | 8 | 10 | 5 | 8 | 9 |
|---|---|---|---|---|---|
| y: | 1 | 3 | 1 | 2 | 3 |

7. a) Find the values of a,b,c such that the formula $\int_0^h f(x)dx = h[af(0) + hf(h/3) + cf(h)]$ is exact for polynomial of as high order as possible.

b) The main life time of a sample of 100 tube lights produced by a company is computed to be 1570 hours with a S.D. of 120 hours. The company claims that the average life of the tubes produced by a company is 1600 hours. Is the claim is acceptable for 5% level of significance?

**[Internal Assssment-10]**