2019

MSc

2nd Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER – MTM-202

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

(Numerical Analysis)

1. Answer any ***FOUR*** questions: (2x4)

a) Compare Newton-Cote's quadrature and Gausian quadrature.

b) The iterative methods are better than direct methods to solve a system of linear equations. Explain.

c) Write the sufficient conditions for the convergence of Newton-Raphson method to solve a system of nonlinear equations containing two variables and three variables.

d) What are the advantages to approximate a function using orthogonal polynomials?

e) Write down the steps to evaluate $\int_a^b f(x)dx$ by Monte-Carlo method.

f) Is the following function a cubic spline? Justify.

$$P(x) = \begin{cases} x^3-4x^2+5x-2, & 1\le x \le 3 \\ x^3+x^2+25x+43, & 3\le x \le 4 \end{cases}$$

g) Write down the expressions of zeros of the chebyshev polynomial of degree n.

h) What does mean by absolute and relative stable of

$\frac{dy}{dt} = \lambda y,\ y(0) = y_0$

2. Answer any ***FOUR*** questions: 4x4

a) Discuss Gauss-Jordan method to find the inverse of a square matrix by partial pivoting method.

b) Explain a suitable method to solve a system of tri-diagonal linear equation.

c) Find the least squares solution of the system of equations x + y=3.0; 2x - y=0.03, x + 3y = 7.03 and 3x + y = 4.97.

d) Define Chebyshev polynomial. Show that it is even under certain conditions to be stated by you. Express x^4 in terms of Chebyshev polynomials.

e) Describe approximation of a continuous function using orthogonal polynomials.

f) Evaluate the value of the integration $\int_1^2 \frac{1}{1+x}\,dx$ by Gauss Legendre four points quadrature formula.

g) Discuss the stability of Euler's method of the ODE $\frac{dy}{dt} = \lambda y,\ y(0) = y_0$.

h) Solve the following BVP, $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 10x$ with boundary conditions y(0)=0 and y(1)=0, at the points x=0.25, 0.50, 0.75.

3. Answer any ***TWO*** questions: 8x2

a) Describe LU-decomposition method to solve a system of linear equations. 8

b) Describe an implicit method to solve the following equation:

$$\frac{\partial u}{\partial t} = \alpha \frac{\partial^2 u}{\partial x^2}$$

Subject to the boundary conditions $u(0,t) = f_1(t)$, $u(1,t) = f_2(t)$ and initial condition $u(x,o) = g(x)$ 8

c) Find all the eigen values and corresponding eigen vectors of the symmetric matrix $\begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$ using Jacobi's method. 8

d) What do you mean by spline interpolation. Describe natural cubic spline interpolation. 1+7

[Internal Assessment: 10 Marks]