2016

M.Sc. 2nd Seme. Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MTM-202

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.

Illustrate the answers wherever necessary.

(*Numerical Analysis*)

Answer Q. No. *1* and any *two* from the rest.

1. Answer any *four* questions : 2×4

(a) Let f(x, y) = 0 and g(x, y) = 0 be two non-linear equations. Among fixed point iteraction and Newton-Raphson methods, which method is better to solve these equations and why ?

(b) Compare direct and iteration method to solve a system of linear equations.

(c) What is the multi-step method to solve an ODE ? What is the advantage of this method ?

(d) Explain the need of stability analysis of a numerical method to solve a differential equation (ODE or PDE).

(e) Define Cubic spline.

(f) Compare Newton-Cotes and Gaussian quadrature formulae.

2. (a) Describe Lagrange's bivariate interpolation method.

(b) Given that $f(0, 0) = 1$, $f(0, 1) = 1.414214$, $f(1, 0) = 1.732051$ and $f(1, 1) = 2$.

Find the Lagrange's bivariate interpolating polynomial and hence find the approximate value of $f(0.25, 0.50)$.

(c) Describe Jacobi's method to find all eigen values and eigen vector of a real symmetric matrix.

4+4+8

3. (a) Describe finite difference method to solve the following boundary value problem

$$\frac{d^2y}{dx^2} + p(x)\frac{dy}{dx} + q(x)y = r(x),\ a < x < b$$

with boundary conditions $y(a) = \alpha$ and $y(b) = \beta$, where α and β are two given numbers.

(b) Use finite difference method to find the value of y(0.25), y(0.50) and y(0.75) from the following B∨P

$$\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 1 = 0,\ \text{where } y(0) = 0,\ y(1) = 0.$$

(c) Describe least square method to solve the following inconsistent system of equations :

$$Ax = B$$

where A, x and B are of order $m \times n$, $n \times 1$ and $m \times 1$ respectively.

(d) Use least square method to solve the following equations :

$x + y = 3.0$, $2x - y = 0.03$, $x + 3y = 7.03$ and $3x + y = 4.97$.

5+3+5+3

4. (a) Describe standard five-point and diagonal five-point formulae to solve the following Poisson's equation

$$\frac{\partial^2 y}{\partial x^2} + x\frac{\partial^2 u}{\partial y^2} = g(x, y) \text{ with the region R}$$

and $u = f(x, y)$ on the boundary C of R.

(b) Explain Bairstow method to find all roots of a polynomial equation.

(c) Explain 3-point Gauss-Chebyshev quadrature formula.

4+8+4

[Internal Assessment —10]

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