2017

M.Sc. 2nd Semester 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) Consider the function

$$f(x) = \begin{cases} -\frac{11}{2}x^3 + 26x^2 - \frac{75}{2}x + 18, & 1 \le x \le 2 \\ \frac{11}{2}x^3 - 40x^2 + \frac{189}{2}x - 70, & 2 \le x \le 3 \end{cases}$$

Show that f(x) is a cubic spline.

(Turn Over)

(b) Compare Gausian quadrature and Monte-Carlo method to find integration.

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

(d) Explain the importance of weighted curve fitting.

(e) Discuss the merits and demerits of finite difference method to solve an ordinary differential equation.

(f) What is the advantage of successive over relaxation method over Gauss-Seidal iteration method to solve a system of linear equations ?

2. (a) Suppose a table of values (x_i, y_i), $i = 0, 1, 2, \ldots, n$, is given. Describe natural cubic spline method to fit this set of data. 10

(b) Economize the power series

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \cdots$$

correct up to four significant figures. 6

3. Answer any *two* equations :

(a) Describe power method to find largest eigenvalue and corresponding eigen vector of a matrix. When does the method fail ? 7+1

(b) Describe Milne's method to solve the following differential equation :

$$\frac{dy}{dx} = f(x, y), \quad y(x_0) = y_0 .$$ 8

(c) Describe 3-point Gauss-Legendre quadrature formula. Use this formula to find the value of

$$\int_0^2 \left(x^5 + 2x^2 + 3x\right) dx$$ 4+4

4. (a) Describe the Crank-Nicolson 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 the initial condition $u(x, 0) = g(x)$. 8

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

[Internal Assessment — 10]