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MCA

SCM 2006

Second Semester Examination – 2008

NUMERICAL METHODS

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory
and any **five** from the rest.

The figures in the right-hand margin
indicate marks.

1. Answer the following questions : 2×10
- (a) What is an error ? What are the different characteristics and types of error ?
 - ✓(b) State the rules of rounding off decimal number correct upto n significant digits.

P.T.O.

- (c) Write -4.268106 and 0.00518789 in floating point form with 4 significant digits with round off.
- (d) State the basic difference between Secant method and method of false position in solving an equation.
- (e) What is the geometrical interpretation of Newton-Raphson method to solve an equation?
- (f) What is ill conditioning of a system of linear equations? How can you overcome this problem?
- (g) What is an eigen value of a matrix? Why are eigen value problems important?
- (h) Is Euler method to solve a differential equation accurate enough for practical problems? Can it be improved?
- (i) What do you mean by single step and multi-step method to find the solution of a

differential equation? Give one example in each case.

- (f) How to calculate error in Simpson's $1/3$ rule in evaluating an integral?

2. (a) Determine a real root of the equation $x^{3.5} = 80$ using method of false position, correct upto three decimal places. 5

- (b) What do you mean by the rate of convergence of an iterative method? Determine the rate of convergence of Newton-Raphson method to find the solution of an equation.

5

3. (a) Solve the following system of linear equations by Gauss elimination using partial pivoting: 5

$$2x + y + z = 1$$

$$5x + 2y + 2z = -4$$

$$3x + y + z = 5$$

- (b) Solve the following system of linear equations by Gauss-Seidel method correct upto two decimal places : 5

$$10x + 2y - z = 27$$

$$-3x - 6y + 2z = -61.5$$

$$x + y + 5z = -21.5$$

4. (a) Using least square regression, find a straight line to the following given data : 5

x : 1 2 3 4 5 6 7 8 9

y : 1 1.5 2 3 4 5 8 10 13

- (b) Using centered difference approximation, estimate the first and second order derivative of $y = e^x$ at $x = 2$ for the step size $h = 0.1$. 5

5. (a) Derive and estimate the error of Trapezoidal rule for numerical integration of a function f in the range $[a, b]$. 5

- (b) Using Simpson's 3/8 rule evaluate the following integral by using 9 sub-intervals of equal width : 5

$$\int_0^{\frac{\pi}{2}} \sin x \, dx.$$

6. (a) Solve the following differential equation by using modified Euler's method for $y(4.1)$ and $y(4.2)$, taking $h = 0.1$ 5

$$5x \frac{dy}{dx} + y^2 - 2 = 0.$$

- (b) Solve the following differential equation for $y(0.1)$ and $y(0.2)$ using Runge-Kutta method of fourth order. 5

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

7. (a) Find all eigen values and eigen vectors of the matrix 5

$$\begin{bmatrix} 2 & 3 & 1 \\ 3 & 2 & 2 \\ 1 & 2 & 1 \end{bmatrix}.$$

- (b) Find the inverse of the following matrix by using LU decomposition. 5

$$\begin{bmatrix} 3.0 & -0.1 & -0.2 \\ 0.1 & 7.0 & -0.3 \\ 0.3 & -0.2 & 10.0 \end{bmatrix}$$

8. (a) Evaluate the polynomial $y = x^3 - 7x^2 + 8x - 0.35$ at $x = 1.37$. Use 3-digit arithmetic with chopping. Also evaluate the percent relative error. 5

- (b) Discuss about stability and condition of a mathematical problem. Also compute and interpret the condition number for

$$f(x) = \tan x \quad \text{for } x = \frac{\pi}{2} + 0.1 \left(\frac{\pi}{2} \right), \quad 5$$