Total number of printed pages – 6 **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.

   (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.

(j) 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 = 01 5

$$5x\frac{dy}{dx} \quad y^2 \quad 2 \quad 0.$$

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

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

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

$f(x) = \tan x$ for $x \quad \frac{\pi}{2} \quad 0.1\left[\frac{\pi}{2}\right]$. 5