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.

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- (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

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- 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

$$2x + y + z = 1$$
  
 $5x + 2y + 2z = -4$ 

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

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

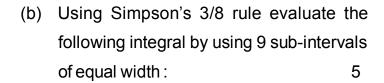
$$10x + 2y - z = 27$$

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

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

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

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$$\sin x \, dx \, .$$

6. (a) Solve the following differential equation by using modified Euler's method for y(4.1) and y(4.2), taking h = 01

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

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

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

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

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

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

$$f(x) = \tan x$$
 for  $x = \frac{1}{2}$  0.1 2. 5

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