BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
M.E. 1ST SEMESTER (CE) FINAL EXAMINATIONS, 2013
Advanced Numerical Methods and Computer Programming (CE 920)

Full Marks: 70 **Time: 3 hrs**

Answer any __five__ questions.

1. a) Write a program for the solution of ordinary first order differential equation using the fourth-order Runge-Kutta method. Assume a suitable form of the first order differential equation. (7)

b) Find the expression for the Lagrange interpolation polynomial to fit the following data. Then use the polynomial to estimate the value of $e^{1.2}$.

i	0	1	2	3
x_i	2	3	4	5
e^{x_i-1}	6.39	19.09	53.60	148.41

(7)

2. a) Solve the following system of equations using Gauss elimination with partial pivoting.

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

(6)

b) Write a program that solves a system of linear equations using Dolittle LU decomposition. (8)

3. a) During an experiment a metal strip was heated and the temperature was heated at various time intervals. The recorded data is given in the table below.

Time (t) in min	1	2	3	4
Temp (P) in °C	64	82	96	117

If the relation between 'P' and 't' is of the form $P = ae^{t/4} + b$ estimate the temperature of the metal strip at $t = 5$ *min*.

(6)

b) What is an eigenvalue problem?
Explain what are characteristic equation, eigenvalues and eigenvectors.
Also describe the Polynomial Method of finding the eigenvalues and eigenvectors of large matrices.

(8)

4. a) Write a program to implement the Gauss-Seidal iteration method for the solution of linear equations. Indicate the statements which are different from the program for the Jacobi iteration method.

(8)

b) Derive the three-point backward difference formula to obtain the first derivative of a tabulated function.

(6)

5. Perform four iterations each of (a) Bisection Method and (b) False Position Method to find a root of the equation $2x^3 + 4x - 15 = 0$
in the interval (1,2). Comment on the root obtained by each method.

(14)

6. a) What is the basic difference between Newton-Cotes integration methods and Gaussian integration methods? Explain with the help of a sketch why the latter result in greater accuracy.

(6)

b) Use Gauss-Legendre three point formula to evaluate $\int_3^7 (x^3 + 3x + 5)dx$

Given $w_1 = w_3 = 0.55556$; $w_2 = 0.88889$
$z_1 = -0.77460$; $z_2 = 0$; $z_3 = 0.77460$

(8)

7. Write short notes on:
a) Process of Numerical Computing
b) Errors in Numerical Computing
c) Monte Carlo Simulation

(4+5x 2 =14)