CS-71 (S)

BACHELOR IN COMPUTER APPLICATIONS

Term-End Examination

June, 2007

CS-71 (S) : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 hours *Maximum Marks : 75*

Note : *Question number 1 is* ***compulsory****. Answer any* ***three*** *questions from the rest. In total you have to answer* ***four*** *questions.*

1. (a) If the number $x^* = 8{\cdot}7$ approximates the number $x = 8{\cdot}695$ correct upto n significant decimal digits, then calculate the value of n. 5

(b) If $u = \frac{3xy^3}{z^2}$ and errors in x, y, z be 0·01 in each, compute the relative maximum error in u at the point (1, 1, 1). 5

(c) (i) Prove that $\Delta \equiv E\nabla$.

(ii) Evaluate $\nabla^3 [(a + bx)^2]$, where a, b, c are real constants. 7

(d) Find Lagrange Interpolating Polynomial for the following data : 5

x	0	1	6
f(x)	1	3	2

(e) Find a real root of the equation $x^3 = x + 1$ using Bisection method correct to three decimal places. 5

(f) To solve the equation $x^3 + x^2 - 1 = 0$ for real roots using Iteration method, you need to rewrite it in the form $x = \phi(x)$. Obtain a suitable $\phi(x)$ such that the method converges. 3

2. (a) Given that $2^2 = 4$, $3^2 = 9$, $5^2 = 25$ and $10^2 = 100$. From these data compute 4^2 using a suitable interpolation formula. 5

(b) Find a real root, correct upto three decimal places, of $x^3 = 2x + 5$ using : 5+5=10

(i) Newton-Raphson method

(ii) Regula-Falsi method

3. (a) Find the iteration function and interval I = [a, b] which satisfy the conditions of the theorem of fixed point to find the smallest positive root of $x = \tan x$. 5

(b) Solve by Gauss Elimination method : 5

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

$$3x + 2y + 3z = 18$$

$$x + 4y + 9z = 16$$

(c) Evaluate $\int_0^1 \frac{dx}{1+x}$ with four subintervals using Trapezoidal rule. From the result obtained, above compute approximate values of $\log_e 2$. 5

4. (a) Let f(x) be a polynomial of degree m. It is given that for any interval [a, b], the Simpson's $\frac{1}{3}$ rule gives the exact result of the integral

$$\int_a^b f(x)\, dx$$

irrespective of the number of subintervals. Compute the set of possible values of m. 5

(b) Solve by Gauss Seidel method upto third iteration 7

$$10x + 2y + z = 9$$

$$2x + 20y - 2z = -44$$

$$-2x + 3y + 10z = 22$$

(c) Find the relative propagated error in a function of two variables for addition and multiplication operation. 3

5. (a) Solve the IVP

$$\frac{dy}{dx} - y + x = 0, \quad y(0) = 2$$

at $x = 0{\cdot}2$, with $h = 0{\cdot}1$, using RKM of fourth order. 8

(b) Construct Newton's forward difference table for the data

x	3	5	7	9
f(x)	6	24	38	108

Hence approximate f'(4) from Newton's forward difference interpolating polynomial. 7