BACHELOR IN COMPUTER APPLICATIONS

Term-End Examination

December, 2007

CS-71 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 hours | *Maximum Marks : 75*

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

1. (a) Evaluate Relative error of the function $f = xy^2z^3$, if $x = 37{\cdot}1$, $y = 9{\cdot}87$, $z = 6{\cdot}052$ and $\Delta x = 0{\cdot}3$, $\Delta y = 0{\cdot}11$, $\Delta z = 0{\cdot}016$. 5

   (b) Perform three iterations of the Newton – Raphson method to obtain the approximate value of $(17)^{1/3}$ starting with the initial approximation $x_0 = 2$. 5

   (c) (i) Prove that $\Delta\nabla = \Delta - \nabla$. 2

   (ii) Evaluate $\frac{\Delta^2}{E}(x^3)$. 3

(d) Use fixed point iteration method to evaluate $\sqrt[3]{48}$, correct to four decimal places. 5

(e) Find the root of the equation $xe^x = \cos x$ using the secant method, correct to four decimal places. Do three iterations. 5

(f) Using the data $\sin(0 \cdot 1) = 0 \cdot 09983$ and $\sin(0 \cdot 2) = 0 \cdot 19867$, find an approximate value of $\sin(0 \cdot 15)$ by Lagrange interpolation. Obtain on the truncation error. 5

2. (a) Given the values

x :	5	7	11	13	17
f(x) :	150	392	1452	2366	5202

Evaluate f(9), using

(i) Lagrange's formula.

(ii) Newton's divided difference formula. 5+5

(b) Solve the initial value problem

$$u^1 = -2tu^2, \; u(0) = 1$$

with $h = 0 \cdot 2$ on the interval $[0, 0 \cdot 4]$ using the fourth order classical Runge – Kutta method. Compare with the exact solution. 5

3. (a) A real root of the equation $f(x) = x^3 - 5x + 1 = 0$ lies in the interval (0, 1). Perform three iterations using Regula – Falsi method to obtain this root. 5

(b) Apply Gauss – Seidel iteration method to solve the equations

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Perform three iterations. 5

(c) Evaluate $\int_{1}^{2} \log x \, dx$ by Trapezoidal rule. 5

4. (a) Find the cubic polynomial using Newton's forward interpolation formula, which takes the following values :

x :	0	1	2	3
f(x) :	1	2	1	10

Hence evaluate f(4). 5

(b) Use Simpson's $\frac{1}{3^{rd}}$ rule to find $\int_{0}^{0 \cdot 6} e^{-x^2} dx$ by taking seven ordinates. 5

(c) Solve the following differential equation by Euler's method

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

Find y approximately for $x = 0 \cdot 1$ in five steps. 5

5. (a) Solve the equations :

$$x_1 + x_2 + x_3 = 6$$
$$3x_1 + 3x_2 + 4x_3 = 20$$
$$2x_1 + x_2 + 3x_3 = 13$$

using Gauss – Elimination method with partial pivoting. 3

(b) By using the Bisection method, find an approximate root of the equation $\sin x = \frac{1}{x}$ that lies between $x = 1$ and $x = 1 \cdot 5$ (measured in radians). Carry out computations upto the 3rd stage. 5

(c) Form a backward difference table for $y = \log x$ given that

x :	10	20	30	40	50
y :	1·0000	1·3010	1·4771	1·6021	1·6990

Also find $\nabla^3 y_{40}$. 7