2015

(3rd Semester)

BACHELOR OF COMPUTER APPLICATION

Paper : BCA-302

[Mathematics—III (Numerical Analysis)]

(New Course)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. What is the relation between E and Δ? 1

2. Write the statement of bisection method. 2

3. Express $f(x) = 3x^3 - 4x^2 + 3x + 11$ into factorial polynomial and hence show that $\Delta^3 f(x) = 18$. 4

4. *(a)* Find a real root of the equation

$$\sin x = 10(x-1)$$

using iteration method. 7

Or

(b) Using regula falsi method, find the real root of the equation

$$x^3 - 2x - 5 = 0$$ 7

5. *(a)* Solve the system of equations by Crout's method : 8

$$x_1 + x_2 - 2x_3 = 2 \cdot 5$$
$$4x_1 - 2x_2 + x_3 = 5 \cdot 5$$
$$3x_1 - x_2 + 3x_3 = 9$$

Or

(b) Use Gauss elimination method to solve : 8

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

6. *(a)* Compute the values of e^x at $x = 0 \cdot 02$ and at $x = 0 \cdot 38$, using suitable interpolation formula on the table of data given below : 8

x :	0·0	0·1	0·2	0·3	0·4
e^x :	1·0000	1·1052	1·2214	1·3499	1·4918

Or

(b) Use Gauss forward formula to find a polynomial of degree four or less which takes the following values of the formula $f(x)$: 8

x	:	1	2	3	4	5
$f(x)$	:	1	-1	1	-1	1

7. *(a)* Find the value of y at $x=5$ (using Lagrange's interpolation). Given

x	:	1	3	4	8	10
y	:	8	15	19	32	40

8

Or

(b) Given

$$\log_{10} 654 = 2\cdot 8156$$
$$\log_{10} 658 = 2\cdot 8182$$
$$\log_{10} 659 = 2\cdot 8189$$
$$\log_{10} 661 = 2\cdot 8202$$

Find the value of $\log_{10} 656$ by Newton's divided difference formula. 8

8. By dividing the interval into 6 equal parts, evaluate $\int_0^6 \frac{dx}{1+x^2}$, using—

(a) trapezoidal rule;

(b) Simpson's one-third rule;

(c) Simpson's three-eighth rule;

(d) Romberg's method. 10

9. Find $f'(1\cdot5)$ and $f''(1\cdot5)$ from the following table : 7

x :	1·5	2·0	2·5	3·0	3·5	4·0
$f(x)$:	3·375	7·000	13·625	24·000	38·875	59·000

10. *(a)* Use Picard's method of successive approximation to solve

$$\frac{dy}{dx} = x + y$$

with boundary conditions $y = 1$, when $x = 0$. 8

Or

(b) Use Runge-Kutta fourth-order method to solve

$$\frac{dy}{dx} = xy \text{ for } x = 1\cdot4$$

initially $x = 1$, $y = 2$ (take $h = 0\cdot2$). 8

11. Solve any *three* of the following differential equations : 4×3=12

(i) $x\frac{dy}{dx} + \frac{y^2}{x} = y$

(ii) $(1 - x^2)\frac{dy}{dx} - xy = 1$

(iii) $x^2 dy + y(x + y)dx = 0$

(iv) $(x^2 - x^2 y)dy + (xy^2 + y^2)dx = 0$

★ ★ ★

2015

(2nd Semester)

BACHELOR OF COMPUTER APPLICATIONS

Paper No. : BCA-202 (OC)

[Mathematics—II (Numerical Analysis)]

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. *(a)* Perform five iterations of the bisection method to obtain the negative root of the equation

$$f(x) = x^3 - 5x + 2$$ 8

Or

(b) Find the positive root of

$$x^3 = 2x + 5$$

by regula falsi method.

2. *(a)* Solve the system of equations

$$2x + 2y + z = 1$$
$$4x + 2y + 3z = 2$$
$$x + y + z = 3$$

(i) by using Cramer's rule;

(ii) by determining the inverse of the coefficient matrix. 8

Or

(b) Solve the following system of equations using Gauss elimination method :

$$2x_1 + x_2 + x_3 + 2x_4 = 2$$
$$4x_1 + 2x_3 + x_4 = 3$$
$$3x_1 + 2x_2 + 2x_3 = -1$$
$$x_1 + 3x_2 + 2x_3 = -4$$

3. *(a)* By the principle of least squares, fit a curve of the form $y = ax^b$ to the following data : 9

x	2	3	4	5	6
y	144	172·8	207·4	248·8	398·5

Or

(b) The temperature θ of a vessel of cooling time t in minutes since the beginning of observations are connected by the law of the form $\theta = ae^{bt} + c$. The corresponding values of θ are given below :

t	0	1	2	3	5	7	10	15	20
θ	52·8	48·8	46·0	43·5	39·7	36·5	33·0	28·7	26·0

Find the best values of a, b and c using the method of group averages.

4. *(a)* Estimate the value of $f(22)$ and $f(42)$ from the following data using Newton's interpolation formula : 8

x	20	25	30	35	40	45
$f(x)$	354	332	291	260	231	204

Or

(b) The following table gives the specific heat of ethanol at different temperatures :

Temperature (x °C)	0	10	20	30	40	50
Specific heat (y)	0·51	0·55	0·57	0·59	0·62	0·67

Estimate the specific heat corresponding to 15 °C and 45 °C using Gauss' interpolation formula.

5. *(a)* The amounts (A) of a substance remaining in a reacting system after an interval of time t in a certain chemical experiment are given in the following table :

t	2	5	8	14
A	94·8	87·9	81·3	68·7

Use Lagrange's interpolation formula to find the value of A when $t = 11$ and $t = 12$. 7

Or

(b) Construct the divided difference table for the following data :

x	0·5	1·5	3·0	5·0	6·5	8·0
$f(x)$	1·625	5·875	31·0	131·0	282·125	521·0

Hence, find the Newton's divided difference interpolating polynomial and approximation to the value of $f(7)$.

6. Find

$$\frac{dy}{dx} \text{ and } \frac{d^2y}{dx^2}$$

at $x = 51$ from the following data : 7

x	50	60	70	80	90
y	19·96	36·65	58·81	77·21	94·61

7. Dividing the range into 6 equal parts, find the approximate value of

$$\int_0^1 \frac{dx}{1+x}$$

using

(i) Simpson's one-third rule;

(ii) Simpson's three-eighth rule;

(iii) Weddle's rule. 8

8. Solve the differential equation

$$x\frac{dy}{dx} = y - x\tan\frac{y}{x}$$ 5

9. Solve the differential equation

$$y' = x + y^2$$

subject to the condition $y(0) = 1$ by Picard's method. 7

10. *(a)* Given

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2},\ y(1) = 1$$

Evaluate $y(1 \cdot 3)$ by modified Euler's method. 8

Or

(b) Using Runge-Kutta method of fourth order, find $y(0 \cdot 1)$, $y(0 \cdot 2)$ and $y(0 \cdot 3)$ given that

$$\frac{dy}{dx} = 1 + xy,\ y(0) = 2$$

* * *