B.C.A. (CBCS) RUSA VIth Semester Examination

4396

$10^{-5} = 10^{-4}$

NUMERICAL METHODS

Paper : BCA-0602

Time : 3 Hours] [Maximum Marks : 70

Note :– Attempt *four* questions in all, selecting *one* question from each of the Sections B, C, D and E. Question No. **1** is compulsory.

Section–A

Compulsory Question

1. (A) Answer all the following ten questions with 1 mark each on the answer sheet.

(i) The binary representation of the decimal number 109 is ....

(ii) $(0{\cdot}6372\ \mathrm{E} - 4) - (0{\cdot}7456\ \mathrm{E} - 5) =$ ....

(iii) Let x_0 be an approximation to the root of the equation $f(x) = 0$. If $x_1 = x_0 + h$ be the exact root of $f(x) = 0$, then by Newton-Raphson formula a closer approximation to the actual root x_1 is given by ....

(iv) The first three terms in Newton's forward interpolation formula are given by :

$$y = y_0 + p\Delta y_0 + \frac{p(p-1)}{2!}\Delta^2 y_0 + \text{..........},$$

where $p = \frac{x - x_0}{h}$. Then the first three terms of $\frac{dy}{dx}$ are ....

(v) The real root of the equation $x - e^{-x} = 0$ lies between :

(a) 0 and 1

(b) 1 and 2

(c) 2 and 3

(d) 3 and 4

(vi) Which of the following relations is false ?

(a) $E - 1 = \Delta$

(b) $\nabla + E^{-1} = 1$

(c) $(1 + \Delta)(1 - \nabla) = 1$

(d) $\delta^2 = E + E^{-1} + 2$

(vii) The value of $\Delta^2 x^3$ at $x = 0$ is :

(a) 0

(b) 2

(c) 4

(d) 6

(viii) In Gauss-Jordan method for solving a system of three simultaneous algebraic equations, elimination of unknowns ultimately reduces the system to :

(a) Lower Triangular matrix

(b) Upper triangular matrix

(c) Diagonal matrix

(d) Singular matrix

(ix) Of the $\frac{1}{3}$ rd-Simpson's rule and $\frac{3}{8}$ th-Simpson's rule the $\frac{1}{3}$ rd rule is better.

(True/False)

(x) If the values of x are equispaced and $\frac{dy}{dx}$ is required near the beginning of the table of values, we use Newton's Forward Interpolation Formula. (True/False)

$1 \times 10 = 10$

Short Answer Type Questions

(B) Answer all the *four* questions.

(i) If $y = 3x^7 - 6x$, find the percentage error in y at $x = 1$ if the error in $x = 0{\cdot}05$.

(ii) Express $y = 2x^3 - 3x^2 + 3x - 10$, in factorial notation.

(iii) Find the cubical polynomial which takes the following values :

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

using Newton's Forward Interportation Formula.

(iv) Find the positive root of $x^4 - x - 10 = 0$, correct to three decimal places, using Newton-Raphson method. $4 \times 5 = 20$

Section–B

2. (a) If $P = \frac{5xy^2}{z^3}$, $x = y = z = 1$, error in x, y, and z is equal to 0·001. Find relative error in P.

(b) Multiply 0·1112E6 by 0·1213E8. 5,5

3. (a) Convert the Binary number $(100110011)_2$ to decimal form.

(b) Find the number of terms in the expansion of e^x correct to 5 decimal places at $x = 1$. 5,5

Section–C

4. (a) Find a root of the equation $x^3 - x - 4 = 0$ between 1 and 2 to three decimal places using Newton-Raphson method.

(b) Find a root of $x^3 - 4x - 9 = 0$, between 2 and 3, using the Bisection method in four stages. 5,5

5. Solve the system :

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

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

and

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

using both by Jacobi's and Gauss-Seidal method. 10

Section–D

6. (a) Evaluate :

$$\Delta^2\left(\frac{5x+12}{x^2+5x+16}\right)$$

(b) Estimate the missing term in the following table :

x	0	1	2	3	4
$f(x)$	1	3	9	—	81

5,5

7. (a) Using Newton's forward interpolation formula, find the cubic polynomial which takes the following values :

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

Hence evaluate $f(4)$.

(b) Using Gauss's forward formula, evaluate y_{30}, given that $y_{21} = 18{\cdot}4708$, $y_{25} = 17{\cdot}8144$, $y_{29} = 17{\cdot}1070$, $y_{33} = 16{\cdot}3432$ and $y_{37} = 15{\cdot}5154$. 5,5

Section–E

8. (a) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds.

Find the initial acceleration using the data :

Time t (sec.)	0	5	10	15	20
Velocity v (m/sec.)	0	3	14	69	228

(b) For the following values of x and y, find $\frac{dy}{dx}$ at $x = 4$:

x	1	2	4	8	10
y	0	1	5	21	27

5,5

9. (a) Derive Newton-Cote's quadrature formula to evaluate $\int_a^b f(x)dx$, where $f(x)$ takes the values $y_0, y_1, y_2, \ldots\ldots, y_n$ for $x = x_0, x_1, x_2 \ldots\ldots x_n$ respectively. 5

(b) Using Newton-Cote's quadrature formula, write the following formulae :

(i) Trapezoidal rule

(ii) Simpson's one-third rule

(iii) Simpson's three-eighth rule 1,2,2