2016

**MCA**

MCA 2.5

**COMPUTER ORIENTED NUMERICAL METHODS**

Full Mark : 75

Time : 3 Hrs

Figures in the right hand margin indicate full marks for the question

1. Answer the following questions: $1 \times 5 = 5$

a. Numerical computing is an approach for solving complex mathematical problems using only simple basic arithmetic operations. (*T/F*).

b. Define the operator $\Delta$.

c. $E = 1+?$.

d. Define $2^{nd}$ order divided difference.

e. The bisection method of finding roots of non-linear equations falls under the category of a/an ----------------- method.

(i) Open

(ii) Bracketing

(iii) Random

(iv) Graphical

2. Answer the following questions: $2 \times 5 = 10$

a. Show that, $\mu = \frac{1}{2}(E^{\frac{1}{2}} + E^{-\frac{1}{2}})$.

b. Prove that the Bisection method is linearly convergent.

c. Evaluate, $\Delta^2(e^{ax+b})$.

d. Solve the system of equations $x - 2y$ and $2x + y = 5$ by direct method.

e. State Euler method to solve $\frac{dy}{dx} = f(x, y)$ with $y(x_0) = y_0$.

3. Answer any six questions of following: $10 \times 6 = 60$

a. Solve the following system by using the Gauss-Jordan elimination method.

$$x + 2y - 3z = 2,$$

$$6x + 3y - 9z = 6,$$

$$7x + 14y - 21z = 13.$$

b. Solve the equations using Jacobi iteration method.

$$5x_1 + 3x_2 + 7x_3 = 4,$$
$$x_1 + 5x_2 + 3x_3 = 2,$$
$$2x_1 + 2x_2 + 10x_3 = 5.$$

c. Solve the pair equations, $x_1 + 2x_2 = 5$ , $3x_1 + x_2 = 5$ applying Gauss- Seidel method

d. For the data below,

| | | | | | | |
|---|---|---|---|---|---|---|
| $x$: | $-4$ | $-2$ | 0 | 2 | 4 | 6 |
| $y = f(x)$: | $-139$ | $-21$ | 1 | 23 | 141 | 451 |



Construct forward and backward differences tables. Using the corresponding Newton's interpolation, show that the interpolating polynomial is same.

e. Using Lagrange's formula, fit a polynomial to the following data:

| | | | | |
|---|---|---|---|---|
| $x$: | 0 | 1 | 3 | 4 |
| $y$: | $-12$ | 0 | 6 | 12 |

Also find $y$ at $x = 2$.

f. Given the following values of $x$ and $f(x)$ as:

| | | | | | | |
|---|---|---|---|---|---|---|
| $x$: | 4 | 5 | 7 | 10 | 11 | 13 |
| $f(x)$: | 48 | 100 | 292 | 900 | 1210 | 2028 |

Using Newton's General interpolation for unequal intervals find $f(8)$ and $f(15)$.

g. Apply Runge-Kutta method of fourth order, to find approximate value of $y$ for $x=0.2$ in the steps of $0.1$, if $\frac{dy}{dx} = x + y^2$, given that $y=1$, where $x=0$, given $f(x, y) = x + y^2$.

h. Evaluate the integral $\int_0^1 \frac{1}{1+x} dx$ correct to three decimal places using Trapezoidal rule, take $h=0.125$ and $h=0.25$.

i. Evaluate $\int_0^2 \frac{dx}{x^3+x+1}$ by Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule with $h=0.25$.

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