Total No. of printed pages = 3

CA 132105

Roll No. of candidate | | | | | | | | | | |

25/3/22 **2022**

M.C.A. 1st Semester End-Term Examination

COMPUTER ORIENTED NUMERICAL METHODS

New Regulation (w.e.f. 2017 – 18)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer questions No. 1 and any *four* from rest.

1. Answer the following : $(10 \times 1 = 10)$

(i) The shifting operator E is equal to

(a) $1-\Delta$ (b) $\Delta-1$

(c) $1+\Delta$ (d) None of these

(ii) The root of the equation $x^3 - x - 1 = 0$ lies in the interval

(a) [0, 1] (b) [1, 2]

(c) [2, 3] (d) None of the above

(iii) Gauss elimination method is also known as

(a) Direct method (b) Indirect method

(c) Step by step method (d) Self correcting method

(iv) Number of roots of every polynomial equation of n^{th} degree is

(a) n (b) $n+1$

(c) $n-1$ (d) $n+2$

(v) The Newton-Raphson method is also known as

(a) Method of false position (b) Method of tangents

(c) Method of chord (d) None of the above

(vi) The rate of convergence of bisection method is

(a) 2 (b) 3

(c) 1.3 (d) 1

[Turn over

(vii) The Newton's backward interpolation formula is used generality for finding the values in

(a) Near the staring of the table (b) Near the middle of the table

(c) Near the end of the table (d) None of the above

(viii) The number of subintervals in Trapezoidal rule is a multiple of

(a) 1 (b) 2

(c) 3 (d) 4

(ix) $\Delta^n y_r$ is equal to

(a) $\Delta^n y_{r+n}$ (b) $\nabla^n y_{r+n}$

(c) $\nabla^n y_r$ (d) None of the above

(x) In Simpson's three-eight rule, the number of subintervals should be taken as multiple of

(a) 1 (b) 2

(c) 3 (d) 4

2. Answer the following : $(3 \times 5 = 15)$

(a) Find $f(2)$ from the following table :

x :	1	3	5	7
$f(x)$:	4	32	64	128

(b) Find the polynomial which is satisfied by (–4, 1245), (–1, 33), (0, 5), (2, 9) and (5, 1335) by using Newtown's divided difference formula.

(c) The velocity v (km / min) of a vehicle which starts from rest is given at fixed interval of time t (min) as follows :

t :	2	4	6	8	10	12	14	16	18	20
v :	10	18	25	29	32	20	11	5	2	8

Estimate approximately the distance covered in 20 minutes.

3. Answer the following : $(3 \times 5 = 15)$

(a) Apply Gauss elimination method to solve the equations $x + 4y - z = -5$; $x + y - 6z = -12$; $3x - y - z = 4$.

(b) Find a root of $x^3 - x - 11 = 0$ using bisection method up to third iteration.

(c) Using second order Runge-Kutta method, find approximate value of y when $x = 0.6$ of $\frac{dy}{dx} = 1 - 2xy$, given that $y = 0$ when $x = 0$ (take $h = 0.2$).

4. Answer the following : (3 × 5 = 15)

(a) From the following data, estimate the number of persons having incomes between 2000 and 2500 :

Income :	Below 500	500-1000	1000-2000	2000-3000	3000-4000
No. of persons :	6000	4250	3600	1500	650

(b) By means of Lagrange's formula, show that

$$y_0 = \frac{1}{2}(y_1 + y_{-1}) - \frac{1}{8}\left\{\frac{1}{2}(y_3 - y_1) - \frac{1}{2}(y_{-1} - y_{-3})\right\}$$

(c) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the initial acceleration using the entire data :

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

5. Answer the following : (3 × 5 = 15)

(a) Find the root of the equation $x e^x = \cos x$ using the regula falsi method up to third iteration.

(b) Apply Gauss-Seidal iteration method to solve the equations up to third iteration.

$20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 2z = 25$

(c) Solve the first order differential equation $\frac{dy}{dx} = x - y^2$; $y(0) = 0$ in the range $0 \le x \le 0.6$ correct to four decimal places (take $h = 0.2$) using Euler's method.

6. Answer the following : (3 × 5 = 15)

(a) Find an iterative formula to find $\sqrt{N}$, where N is a positive integer.

(b) Show that the rate of convergence of Newton-Raphson is quadratic.

(c) Using Simpson's one-third to evaluate $\int_4^8 \frac{dx}{x}$ using four equal sub-intervals.