Roll No. .....

DD-476

M. Sc. (Second Semester)
EXAMINATION, May-June, 2020

COMPUTER SCIENCE

Paper Fifth

(Numerical Analysis)

Time : Three Hours

Maximum Marks : 100

Note : Attempt any *two* parts from each question. All questions carry equal marks.

Unit—I

1. (a) Find a real root of the equation $f(x) = x^3 - 4x - 9 = 0$, using Bisection method in four stages.

   (b) Using Regula-Falsi method, find the real root of the equation $x^4 - x - 10 = 0$.

   (c) Solve the equation $2x^4 - 4x^3 + 11x^2 - 9x - 26 = 0$ one root being $\frac{1}{2} + \frac{5}{2}i$.

Unit—II

2. (a) Solve the following system by Gauss elimination method :

$$6x_1 + 3x_2 + 2x_3 = 6$$
$$6x_1 + 4x_2 + 3x_3 = 0$$
$$20x_1 + 15x_2 + 12x_3 = 0$$

(b) Factorise the matrix :

$$A = \begin{bmatrix} -2 & 4 & 8 \\ -4 & 18 & -16 \\ -6 & 2 & -20 \end{bmatrix}$$

in the form LU, where L is the units lower triangular matrix and U is the upper triangular matrix.

(c) Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and verify that it is satisfied by A and hence obtain A^{-1}.

Unit—III

3. (a) Find the first term of the series whose second and subsequence terms are 8, 3, 0, –1, 0.

(b) From the following table of values of x and $f(x)$ determine $f(0.23)$:

x	$f(x)$
0.20	1.6596
0.22	1.6698
0.24	1.6804
0.26	1.6912
0.28	1.7024
0.30	1.7139

(c) Using Lagrange's interpolation formula find the value of y for $x = 9.5$ from the following table :

x	$y = f(x)$
7	3
8	1
9	1
10	9

Unit—IV

4. (a) Calculate the first and second derivatives of the functions tabulated below, at the point $x = 1.1$:

x	$y = f(x)$
1.0	0
1.2	0.128
1.4	0.544
1.6	1.296
1.8	2.432
2.0	4.000

(b) Find the value of $\int_1^2 \frac{dx}{x}$ by Simpon's rule. Hence obtain approximate value of $\log_e 2$.

(c) Calculate $\int_0^{\pi/2} e^{\sin x} dx$ correct to four decimal places by Simpson's $\frac{3}{8}$ rule.

Unit—V

5. (a) Use Taylor's series method to find y for $x = 0.1$ correct to four places of decimal, if satisfies $\frac{dy}{dx} = x - y^2$ with $y_0 = 1$, $x_0 = 0$.

(b) Explain Euler's method of the successive approximation for the solution of $\frac{dy}{dx} = f(x, y)$ where $y = y_0$ at $x = x_0$.

(c) Solve the differential equation $\frac{dy}{dx} = x^2 + y^2 - 2$; given $y(-0.1) = 1.09$, $y(0) = 1$, $y(0.1) = 0.89$, find $y(0.2)$ by series expansion and then find $y(0.3)$ by Milne's method.