UG Even Semester Examination, September, 2023

COMPUTER SCIENCE

(2nd Semester)

Course No.: MCSCC-204

(Scientific Computation)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

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

Answer any five questions, taking one from each unit.

UNIT-I

1. (a) What do you understand by the following term? Explain each one with suitable example. 6

   (i) Absolute errors

   (ii) Relative errors and

   (iii) Percentage errors

   (b) (i) Write the Computational step of Bisection method. 4+4=8

   (ii) Find the real root of the equation $x^3 - 2x - 5 = 0$ using Bisection method.

2. (a) Write the algorithm of Newton Raphson Method. Give two advantage and disadvantages of using New Raphson Method. 5+2=7

(b) Using the Secant method, find a real root of the equation. 7

$F(x) = xe^x - 1=0$

UNIT-II

3. (i) What is interpolation, write algorithm for Lagrange interpolation formula. Find the polynomial which fits the following data : 7

(–1, 7), (1, 5) and (2, 15)

(ii) Construct Largrange Interpolation polynomial for the data. 7

X	–1	1	4	7
F(x)	–2	0	63	342

4. (i) Differentiate between Forward and Backward Difference with suitable example. 6

(ii) From the following table find y when x= 1.35 using Gauss forward central difference formula. 8

X	1	1.2	1.4	1.6	1.8	2
Y	0.0	–0.112	–0.0160	0.336	0.992	2

UNIT-V

9. (a) Using Picard's process of successive approximations, obtain a solution upto fifth approximation of the equation. 7

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

Such that y= 1 when x=0 7

Check your answer by findings exact particular solution.

(b) Apply Milne's method, to find a solution of the differential equation $y^1 = x-y^2$ in the range. 7

$0 < x < 1$ for the boundary condition y=0 at x=0

10. (a) Solve the following differential equation by Runge-Kutta method

$\frac{dy}{dx} = 2xy$

$y(0) = 0.5$

Solution for $1 > x > 0$, h= 0.2 7

(b) Solve the following initial value problem using Euler's method over the interval from x= 0 to 2 7

$\frac{dy}{dx} = yx^2 - 1.2y$

with h=0.5 and 0.25

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UNIT-III

5. (i) Use Gauss elimination method to solve the following system of equations 6

$$x + 3y + 2z = 5$$
$$2x + 4y - 6z = -4$$
$$x + 5y + 3z = 10$$

(ii) How Gauss-Jordan method is different from Gauss elimination method for solving a linear system. Justify your answer with suitable example. Solve the following system using Gauss-Jordan method. 2+6=8

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

6. (a) Write an algorithm to fit a quadratic curve through n points by least squares. 7

(b) Fit a curve of the ae^{-bx} for the data given in table 7

x	0.25	0.5	0.75	1.0	1.25	1.5
y	3.1	1.7	1.0	0.68	0.42	0.26

x	1.75	2.00	2.25	2.5
y	0.14	0.09	0.04	0.03

UNIT-IV

7. (a) A rocket is launched vertically upward from the ground. Its accelration is registered during the first 80 secods and is given in the table below : 7

t(s)	0	10	20	30	40
$a(m/s^2)$	30.00	31.62	33.44	35.47	32.75

t(s)	50	60	70	80
$a(m/s^2)$	40.33	43.29	46.69	50.67

Find the velocity and the height of the rocket at t= 80 seconds.

(b) The velocities of a particle moving in a straight line at intervals of 2 minutes are given in the table below : 7

Time (minutes)	0	2	4	6	8	10	12
Velocity (km/hr)	0	22	30	27	18	7	0

Find the distance covered by the particle using Simpson's $^1/_3$ rule. 7

8. (a) What is meant by numerical differentiation? Illustrate the necessity and importance of numerical differentiation. 7

(b) The function y= f(x) has a minimum points 0.2<x < 1.4, where the data points are shown is table below : 7

x	0.2	0.4	0.6	0.8
y	2.10022	1.99730	1.90990	1.86672

x	1.0	1.2	1.4
y	1.85937	1.88735	1.95197

Find the x-coordinate of the minimum point. 7