

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA - SEMESTER– II• EXAMINATION – SUMMER 2015

Subject Code: 620005

Date: 03/06/2015

Subject Name: Computer Oriented Numerical Methods

Time: 10:30 am - 01:00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) 1) Give reason: While working on a digital computer $(x_1 + x_2) + x_3$ is not necessarily same as $x_1 + (x_2 + x_3)$. **02**
2) Discuss how the error propagates in numerical calculation. **03**
3) What is pivoting? Why is it adopted? **02**
(b) 1) The polynomial equation $x^4 + 2x^2 - x - 1$ has two positive roots and two negative roots. [True/ False] Give reason. **02**
2) Find by Regula-Falsi method, the real root of the equation $\log x - \cos x = 0$ correct to four decimal places. **05**

- Q.2** (a) Explain least square curve fitting method. Derive normal equations if the curve $y = a + bx + cx^2$ is to be a fitted to a discrete set of points $\{x_i, y_i\}$ $i = 1, 2, \dots, n$ such that it is best fit in the least square sense. **07**
(b) Explain successive approximation method by giving diagrammatic representation for finding roots of an equation $f(x) = 0$ for the following cases (i) $0 < g'(x) < 1$ (ii) $g'(x) < -1$. Give your conclusion about convergence of iterations. **07**

OR

- (b) Illustrate Bierge Vieta method for finding roots of a polynomial by performing two iterations for the polynomial $x^3 - 4x^2 + 3x + 1$ taking initial guess as 0. **07**
Q.3 (a) Explain Interpolation. Derive Newton's forward difference interpolating polynomial. What are its limitations? **07**
(b) Fit a parabola $y = a + bx + x^2$ to the following data: **07**

x:	2	4	6	8	10
y:	3.07	12.85	31.47	57.38	91.29

OR

- Q.3** (a) Economize the power series : **07**
 $f(x) = 1 - x/2 - x^2/8 - x^3/16$ in the interval $[-1, 1]$
Using Chebyshev polynomials.
(b) What is inverse interpolation? From the following table of values estimate the value of x for which $f(x) = 0$. **07**

x	30	34	38	42
f(x)	-30	-13	3	18

- Q.4** (a) Find the first and second derivatives of $f(x)$ at $x = 1.5$ using the following table: **07**

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7.000	13.625	24.000	38.875	59.000

(b)

07

The velocity v in m/s of a particle at a time t seconds is given in the following table :

t	0	2	4	6	8	10	12
$A(t)$	4	6	16	34	60	94	136

Find the distance traveled by particle in 12 seconds using

Simpson's $1/3^{\text{rd}}$ rule.

Simpson's $3/8^{\text{th}}$ rule.

OR

Q.4

(a)

Evaluate the first derivative at $x = -3$ and $x = 0$ from the following table:

07

x :	-3	-2	-1	0	1	2	3
y :	-33	-12	-3	0	3	12	33

(b)

A rocket is launched from the ground. Its acceleration is recorded during first 80 seconds and is given in the following table :

07

$t(\text{sec})$	0	10	20	30	40	50	60	70	80
$a(\text{m/sec}^2)$	30.0	31.63	33.44	35.47	37.75	40.33	43.29	46.69	50.67

Find the velocity and the height of the rocket at time $t = 80$ seconds using Trapezoidal Rule.

Q.5

(a)

State the conditions under which the sequence of approximate solutions to the system of $n \times n$ linear equations $AX = B$ under usual notations converges to the exact solution. Using Gauss Seidel's method find the solution of the following system .

07

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

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

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

(b)

Explain predictor corrector methods for finding solutions of differential equations giving advantages and disadvantages. Compare them with Runge-Kutta methods.

07

Using Runge-Kutta method of order 4, find y for $x = 0.1, 0.2, 0.3$, given that $dy/dx = xy + y^2$, $y(0) = 1$.

OR

Q.5

(a)

Explain the nature of single step and multi step numerical methods for solving differential equations. Give examples of each type describing advantages and disadvantages.

07

(b)

Find numerically the largest eigen value and the corresponding eigen vector of the following matrix, using the Power method :

07

$$\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$
