Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER– II EXAMINATION – WINTER 2015

Subject Code: 2620004 Date:07/12/2015

Subject Name: Computer Oriented Numerical Methods

Time:02.30 PM TO 05.00 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 $\{x_i, y_i\}$ $i = 1, 2,….n$ 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 $y = a + bx + cx^2$ 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 $1/3^{rd}$ rule.
Simpson's $3/8^{th}$ rule.

OR

Q.4 **(a)** Evaluate first order derivative at x = -3 and x = 0 **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(sec)	0	10	20	30	40	50	60	70	80
a(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)** 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**

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

OR

Q.5 **(a)** State the conditions under which the sequence of approximate solutions to the system of n x n linear equations AX = B under usual notations converges to the exact solution. **07**
Using Gauss Seidel's method find the solution of the following system .
$20x + y - 2z = 17$
$3x + 20y - z = -18$,
$2x - 3y + 20z = 25$

(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 $dy/dx = xy + y^2$, $y(0) = 1$.

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