

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2018

Subject Code: 2140706

Date: 01/12/2018

Subject Name: Numerical and Statistical Methods for Computer Engineering

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) Discuss about mathematical modeling. **03**
(b) Discuss various types of errors used for numerical calculations. **04**
(c) Obtain cubic spline approximation for the function defined by the data given below for the first two subintervals. Take $M_0 = M_3 = 0$. **07**

x	0	1	2	3
$f(x)$	1	2	33	244

- Q.2** (a) Write an algorithm for Simpson's rule. **03**
(b) Using Simpson's rule, find $\int_0^{0.6} e^{-x^2} dx$ taking seven ordinates. Show the calculations up to four decimal places. **04**
(c) Define divided difference. Using Newton's divided difference interpolation, find $f(6)$ from the following table: **07**

x	1	2	7	8
$f(x)$	1	5	5	4

OR

- (c) Define interpolation. Using Lagrange interpolation, fit a second degree polynomial passing through the points (0,0), (1,1) and (2,20). **07**
- Q.3** (a) State Budan's theorem. Define diagonally dominant system with example. **03**
(b) Use Newton-Raphson method to find a positive root of $x^3 + x^2 - 1 = 0$ correct up to four decimal places taking $x_0 = 1$. **04**
(c) What do you mean by diagonally dominant system? Solve the following system of linear equations using Gauss-Seidel method: **07**
 $9x + y + z = 10$, $2x + 10y + 3z = 19$, $3x + 4y + 11z = 0$.

OR

- Q.3** (a) Explain geometrically the method of false position. **03**
(b) Using Euler's method, find $y(1)$ if $\frac{dy}{dx} = x + y$ and $y(0) = 1$. Take $n = 10$. **04**
(c) Perform one iteration of the Bairstow method to extract a quadratic factor from the polynomial $x^4 + x^3 + 2x^2 + x + 1$ with initial factor $x^2 - 0.5x - 0.5$. **07**
- Q.4** (a) Write the steps for engineering problem solving. **03**

- (b)

Determine the condition number of the matrix $\begin{bmatrix} 1 & 4 & 9 \\ 4 & 9 & 16 \\ 9 & 16 & 25 \end{bmatrix}$.

04
- (c)

State direct and iterative methods to solve system of linear equations. Solve the following system of linear equations using Gauss elimination method:
 $x + y + z = 9, 2x - 3y + 4z = 13, 3x + 4y + 5z = 40$.

07

OR

- Q.4 (a)

Write the formula for Runge-Kutta fourth order method.

03
- (b)

Fit a second degree polynomial to the following data using least square method.

04
- | | | | | | | | |
|-----|----|----|----|---|---|----|----|
| y | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| x | 12 | 4 | 1 | 2 | 7 | 15 | 30 |
- (c)

Calculate the first four moments of the following distribution about the mean.

07
- | | | | | | | | | | |
|--------|---|---|----|----|----|----|----|---|---|
| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| $f(x)$ | 1 | 8 | 28 | 56 | 70 | 56 | 28 | 8 | 1 |

- Q.5 (a)

Develop a C program to fit regression line of y on x through given set of points using the least square method.

03
- (b)

The probability distribution of a commodity is given below.

04
- | | | | | | | |
|-------------|------|------|------|------|------|------|
| Demand | 5 | 6 | 7 | 8 | 9 | 10 |
| Probability | 0.05 | 0.10 | 0.30 | 0.40 | 0.10 | 0.05 |

Find expected demand.

- (c)

For the following data, obtain trend values using five years moving average.

07
- | | | | | | | | | | | | |
|-------|------|------|------|------|------|------|------|------|------|------|------|
| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Value | 3 | 7 | 14 | 8 | 10 | 11 | 14 | 12 | 16 | 20 | 25 |

OR

- Q.5 (a)

Discuss the pitfalls of Gauss elimination.

03
- (b)

Define the following terms with examples:
1. Ill-conditioned system
2. Significant figure

04
- (c)

Obtain the correlation coefficient for the following data:

07
- | | | | | | | | |
|-----|-----|----|----|----|-----|----|----|
| x | 100 | 98 | 78 | 85 | 110 | 93 | 80 |
| y | 85 | 90 | 70 | 72 | 98 | 81 | 74 |
