



Student Name: \_\_\_\_\_

Roll No. & Section: \_\_\_\_\_

Program: BS ( CS )

Semester: Spring-2020

Time Allowed: 03 hours

Course: Numerical Computing / Numerical Methods

Examination: Final

Total Marks: 100, Weightage: 50

Date: 28 / 06 / 2020

Instructor: Osama Sohrab

## INSTRUCTIONS:

1. Attempt all questions and please strictly adhere to the instructions already shared by the academic office for solution submission .
2. Make sure to number every sheet properly and put your signature at the bottom of each sheet.
3. Late Submission will be counted as Absent.
4. All general instructions previously given to you by the university shall remain applicable.
5. The mode of calculator should be in radians.

### Question # 01

Mark = 5+5=10

(a) How can **Intermediate Value Theorem** help us to determine a root of a nonlinear equation in some interval  $[a, b]$ . Briefly explain.

(b) Is it possible for a nonlinear equation  $g(x) = 0$  to have two roots in some interval  $[a, b]$ , if yes then roughly sketch the graph of the function  $y = g(x)$ .

### Question # 02

Marks = 10

Use Intermediate Value Theorem to find an interval of length one that contains a root of the equation  $xe^x = \cos x$  and then perform three iterations to approximate the root using method of false position.

### Question # 03

Marks = 15

Consider the matrix

$$A = \begin{pmatrix} 2 & -2 & -3 \\ -2 & 5 & 4 \\ -3 & 4 & 5 \end{pmatrix}$$

(a) Find the Cholesky decomposition of the matrix  $A$  and

(b) solve the linear system  $Ax = b$ , where  $b = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ .

#### Question # 04

Marks = 10+5=15

Consider the linear system

$$\pi x_1 - ex_2 + \sqrt{2}x_3 = \sqrt{11}$$

$$\pi^2 x_1 + ex_2 - e^2 x_3 = 0$$

$$\sqrt{5}x_1 - \sqrt{6}x_2 + x_3 = \pi.$$

(a) Use Gaussian elimination and three-digit rounding arithmetic to solve the linear system.

(b) Write down the scheme for solving the linear system by using Gauss-Seidal Method.

#### Question # 05

Marks = 15

The following data gives the melting point of an alloy of lead and zinc, where  $t$  is the temperature in degrees centigrade and  $P$  is the percentage of lead in the alloy.

$P$	40	50	60	70	80	90
$t$	180	204	226	250	276	304

Find the melting point of an alloy containing 84 percent lead.

#### Question # 06

Marks = 15

Given table of values of the probability integral  $f(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$  corresponding to certain values of  $x$ ,

Find  $a$  such that  $f(a) = 0.5$ .

$x$	0.46	0.47	0.48	0.49
$f(x)$	0.4846555	0.4937452	0.5027498	0.5116683

**Question # 07****Marks =05**

Use Simpson's Rule to approximate the following definite integral

$$\int_0^6 e^{-x^2} dx$$

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**Question # 08****Marks = 15**

Use Taylor series method of order 3 to approximate  $x(0.2)$  and  $y(0.2)$  using  $h = 0.1$

$$x' = 6x + y + 6t$$

$$y' = 4x + 3y - 10t + 4$$

$$x(0) = 0.5, \quad y(0) = 0.2$$

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**The End**