

Libaz Y-

B.Sc. Engg. CSE 1<sup>st</sup> Semester  
B.Sc. in SWE 1<sup>st</sup> Semester

25 February, 2020 (Afternoon)

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**Department of Computer Science and Engineering (CSE)**

**MID SEMESTER EXAMINATION**

**WINTER SEMESTER, 2019-2020**

**DURATION: 1 Hour 30 Minutes**

**FULL MARKS:100**

**Math 4141: Geometry and Differential Calculus**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are 4(**four**) questions. Answer any 3 (**three**) of them.

Figures in the right margin indicate marks.

Draw the figure or figures where necessary.

**Section-A**

- 1 a) Find the angle for which the axes rotate to remove the  $xy$  term in the equation  $3x^2 + 2xy + 3y^2 - 18x - 22y - 50 = 0$ . Also find the transformed equation. 10
- b) Find the value of  $\lambda$ , so that the conic  $6x^2 + 2\lambda xy + 12y^2 + 22x + 31y + 20 = 0$  represent a pair of straight lines. 8
- c) Define conic sections in a plane. Write the different conditions that the general equation of second degree represents a conic. Discuss the nature of the conic  $x^2 - y^2 - 6xy - 4y + 6 = 0$ . 15.33
- 2 a) Suppose AB be any line, where  $A = (1, -1, 1)$  and  $B = (2, 1, -1)$ , Find the directions angles of this line. If CD is another line, where  $C = (-1, 0, 1)$  and  $D = (1, 2, 3)$ , then find the projection of the line AB on the line CD by using two different methods. 20
- b) Find the distance of a point  $(-2, 3, 4)$  from the line through the point  $(-1, 3, 2)$  whose direction cosines are proportional to  $(12, -3, -4)$ . 13.33

**Section-B**

- 3 a) A function is defined by the formula: 10
$$f(x) = \begin{cases} x + 2, & \text{when } x < -1 \\ x^2, & \text{when } -1 > x \geq -1 \\ x, & \text{when } x \geq 1 \end{cases}$$
Sketch graph, and determine the Domain and Range of the function.
- b) Determine whether the following functions are even, odd, or neither. 10
$$f(x) = |x| - 1 \text{ and } g(x) = 3\sqrt{x}$$
Using the graphs also state whether the functions are symmetric with respect to the y-axis or the origin.
- c) Find x - intercepts and y - intercepts of the linear functions: 13.33
$$g(x) = 3x - 1 \text{ and } h(x) = -5x + 2.$$
What are the average rate of change of the functions in the interval  $[-2, 2]$ ? Also comment whether the functions are increasing or decreasing within the interval.
- 4 a) What transformations are to be used to obtain the function  $g(x) = 2\left|\frac{1}{2}x - 1\right| + 1$  from  $f(x) = |x|$ . Explain your arguments providing graph. 10
- b) Let us consider two functions 13.33

$$f(x) = \frac{1}{1+x} \text{ and } g(x) = \frac{1}{x} + 1.$$

Determine the domains of  $f(g(x))$  and  $g(f(x))$ . Do you think the functions are inverse of each other? Find the inverse of the function  $f(x) = \ln(x-1)$  if possible.

- c) Using the concept of limit, find the horizontal asymptotes of the function

10

$$f(x) = \frac{5x^2 + 8x - 3}{3x^2 + 2}.$$