B.S
4.Sc. Engg. / HD CSE 1st Semester (106) 6 March 2017 (Afternoon)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2016-2017**

DURATION: 1 Hours 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.

---

1. a) Find the change in the coordinates of a point when the direction of axes is turned through an angle θ without changing the origin. Transform the equation $x^2 - 2xy + y^2 + 2x - 4y + 3 = 0$ after rotating the axes through an angle 45^0. 20

   b) Discuss the nature of the conic $4x^2+4xy+y^2+4x+3y+2=0$. Find the value of λ, so that the conic $2xy + 4x - 6y + \lambda = 0$ represents a pair of straight lines. 13.33

2. a) If a line makes angles α, β, and γ with x, y and z axes respectively then show that $Sin^2\alpha + Sin^2\beta + Sin^2\gamma = 2$. Test whether 0,-1, 1 and 1, 0, 0 are directions ratios or cosines of a line. What is your comment if the direction ratios of the two lines are 3, 2, 4 and 6, 4, 8? 18

   b) Find the angle between the lines AB and CD and then find the projection of a line AB on the line CD using two different methods, where the coordinates of the points A, B, C and D are given (0,1,-1), (1,2,3),(-1,0,1) and (2,-2,3) respectively. 15.33

3. a) Define domain and range of a function. Find the domain and range of the following functions: 13.33
   i. $y = \sqrt{5x + 10}$ ii. $y = \frac{2}{x^2-16}$. Draw the graph of the piecewise defined function
   $f(x) = \begin{cases} x, & 0 \le x \le 1 \\ -x + 2, & 1 < x \le 2 \end{cases}$

   b) What is exponential function? State whether the following functions are exponential or not, if not, give your reason: 8
   i. $f(x) = x^{10}$, ii. $f(x) = 10^x$, iii. $f(x) = \pi^n$, and iv. $f(x) = \pi^x$.

   c) Define increasing and decreasing functions. Write the symmetries of $y = \frac{1}{|x|}$, if any, and then specify the interval over which the function is increasing or decreasing. 12

4. a) Explain the shifting and scaling formulas for a function with examples. 8.33

   b) Suppose the average population growth rate in Bangladesh is 1.75% per year and the model for population T years from now is given by$P(T) = P_0e^{RT}$, where P_0 is the current population. How long does it take to double? 10

   c) Suppose an investment company wants to invest 2500 dollars in an account that earns 8.5% interest compounded annually. How long will it take the account to reach 7500 dollars? First derive the formula and then solve the above problem considering the logarithm at base 10. 15