B.Sc. Engg. / HD CSE 1st Semester (65)

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09 March 2015 (Afternoon)

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

MID SEMESTER EXAMINATION

DURATION: 1 Hour 30 Minutes

WINTER SEMESTER, 2014-2015

FULL MARKS:75

Math 4107: 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) If transformation equation of $ax^2+2hxy+by^2=0$ is $a'x^2+2h'xy+b'y^2=0$ when the direction of axes is turned through an angle θ without change of origin, then show that $a+b$ and $ab-h^2$ are invariant i.e. $a+b=a'+b'$ and $ab-h^2=a'b'-h'^2$. 7

b) Find the condition that the general equation of second degree $ax^2+2hxy+by^2+2gx+2fy+c=0$ may represent a pair of straight line. 8

c) Show that the equation $ax^2+2hxy+by^2+2gx+2fy+c=0$ represents two parallel lines if $\frac{a}{h}=\frac{h}{b}=\frac{g}{f}$. Also show that the distance between them is $2\sqrt{\frac{(g^2-ac)}{a(a+b)}}$. 10

2\. a) If two straight lines represented by the equation $x^2(\tan^2\phi+\cos^2\phi)-2xy\tan\phi+y^2\sin^2\phi=0$ makes angles α and β with the x-axis respectively, then show that $\tan\alpha-\tan\beta=2$. 7

b) If one of the lines $ax^2+2hxy+by^2=0$ is perpendicular to one of the lines $a'x^2+2h'xy+b'y^2=0$, prove that $(aa'-bb')^2+4(a'h+bh')(ah'+b'h)=0$ 9

c) Prove that the equation $x^2+y^2+2gx+2fy+c=0$ always represent a circle for all values of f,g and c; find its centre and radius. Also discuss real circle, imaginary circle and point circle. 9

3\. a) Define pole and polar with sketch graph. 5

b) Find the equation of the circle inscribed in the triangle formed by the lines $2x-3y+21=0$, $3x-2y-6=0$, $2x+3y+9=0$. 10

c) Define limiting points of a co-axial system of circles. Find the co-ordinates of limiting points of the co-axial system determined by the circles $x^2+y^2+2x-6y=0$ and $2x^2+2y^2+10y+5=0$. 10

4\. a) The direction cosines of two straight lines are given by the relations $al+bm+cn=0$ and $ul^2+vm^2+wn^2=0$. Prove that the straight lines will be perpendicular if $a^2(v+w)+b^2(w+u)+c^2(u+v)=0$ and parallel if $\frac{a^2}{u}+\frac{b^2}{v}+\frac{c^2}{w}=0$. 12

b) A point p moves on a fixed plane, the plane through p perpendicular to op meets the axes in A, B, C respectively. If the planes are drawn through A, B, C parallel to the co-ordinate planes, then show that the locus of the point intersection is $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{ax}+\frac{1}{by}+\frac{1}{cz}$. 13