EMBU UNIVERSITY COLLEGE

(A Constituent College of the University of Nairobi)

2015/2016 ACADEMIC YEAR

FIRST SEMESTER EXAMINATION

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (STATISTICS) AND BACHELOR OF SCIENCE

SMA 105: ANALYTICS GEOMETRY

DATE: DECEMBER 9, 2015 **TIME: 8:30-10:30**

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

QUESTION ONE

a) Find the equation of the locus of a Point P which moves such that it is always equidistant from points A $(-7,4)$ and B $(7,4)$ (2 marks)

b) A circle with center on the line 2x-y-1=0 passes through (2, -1) and (-2, 0).Find
   i) The co-ordinate of the center of the circle (3 marks)
   ii) Equation of the circle (2 marks)

c) Find the angle between the line $y = 2x + 5$ and $y = 12x - 1$ (3 marks)

d) Find the polar equation of the circle whose center has the Cartesian coordinates (5,8) and radius is 10. (3 marks)

e) Find the locus of a point which moves so that the sum of its distances from (-3,0) and (3,0) is always equal to 8. (3 marks)

f) Determine the distance between a line whose equation is 8x+15y-24=0 and a point (-2,3). (3 marks)

g) Given $x^2+4y^2+4x-24y+24=0$ is the equation of the ellipse. Find,

i. Center of the ellipse (3 marks)

ii. Eccentricity of the ellipse (2 marks)

h) Given the vectors $\vec{u}=(3,4)$ and $\vec{v}=(-8,6)$:

i. Calculate the dot product between $\vec{u}$ and $\vec{v}$ (1marks)

ii. Find the angle formed by vectors $\vec{u}$ and $\vec{v}$ (3marks)

i) Calculate the triple product of the following vectors.
$\vec{u}=(2,-1,3), \vec{v}=(0,2,-5)$ $\vec{w}=(1,-1,-2)$. (3marks)

QUESTION TWO

a) i. Find the polar equation of the circle with center $(2,30^0)$ and radius 2. (3 marks)

ii. Transform this polar equation to Cartesian form of equation. (2 marks)

b) Find the distance between the points $(1,0^0)$ and $(1,120^0)$. (4 marks)

c) Show that $(y-c_2)^2=4a(x-c_1)$ represent the equation of a parabola with a horizontal axis, directrix x=d, focus f(h,k) and vertex $v(c_1,c_2)$ (5 marks)

d) Given the parametric equation of hyperbola to be $x=7\sec\theta$, $y=2\tan\theta$ Determine the point on the directrix where the tangent at point (7sec 60, 2tan 60) passes through. (6 marks)

QUESTION THREE

a) i) Show that the equation $20x^2+36y^2+40x-108y-79=0$ represents an ellipse (3 marks)

ii) Find its eccentricity. (3 marks)

iii) Determine the coordinates of the center and foci. (2 marks)

b) Given the equation $9x^2 - 16y^2 - 18x - 64y - 199 = 0$ of the hyperbola Find:

i) Coordinates of the center. (2 marks)

ii) Find the eccentricity (2 marks)

iii) Coordinate of the foci. (2marks)

iv) Sketch the hyperbola above. (2marks)

c) Find the equation of the tangent and equation of the normal at point P(-1,2) of the eclipse $(x+1)^2 + 4(y-1)^2=4$. (4marks)

QUESTION FOUR

a) A, B and C are points (6,3), (-2,-1) and (1,1) respectively find;-

i) The equation of the perpendicular bisectors of AB and B C. (6 marks)

ii) The coordinates of the center of the circle passing through points A,B and C: (2marks)

iii) The angle between line AB and BC. (2marks)

iv) The equation of the circles passing through points ABC. (3marks)

b) Find the Cartesian equations of the curve whose polar equation is

$r = \frac{6}{1+3\cos\theta}$ (3marks)

c) Find the angle between the lines whose equations are
$ax + by + c = 0$ and $(a - b)x + (a + b)y + c = 0$ where a, b, c and d are constants.

(4 marks)

QUESTION FIVE

a) Given the vectors $\vec{u}$= (2,1,3), $\vec{v}$ =(1,2,3) and $\vec{w}$=(-1,-1,0), calculate the volume of the parallelepiped whose edges are formed by these vectors.

(3 marks)

b) Find the equation for the plane through the points (0,1,2), (2,1,3) and (3,1,0(2 marks)

c) Calculate the value of a for the points (a,0,1), (0,1,2), (1,2,3) and (7,2,1) so that they are coplanar. Also calculate the equation of the plane that contain them. (3marks)

d) Find the polar equation of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (5marks)

e) A cooling tower for a nuclear reactor is to be constructed in the shape of a hyperboloid of one sheet. The diameter at the base is 120m and the minimum diameter is 200m above the base is 80m. Find the equation centered at the origin for the tower. (5marks)

f) Given the lines

$$V = \frac{X+2}{3} = \frac{y-1}{2} = \frac{2+1}{-1}$$

$$S = \frac{X-1}{-2} = \frac{y-3}{-2} = \frac{Z}{3}$$

Determine the equation of the plane that contains the line V and is parallel to the line S.

(2 marks)

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