MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE (TELECOMMUNICATION AND INFORMATION TECHNOLOGY)
BACHELOR OF SCIENCE (MATHEMATICS AND STATISTICS)
BACHELOR OF SCIENCE (STATISTICS AND PROGRAMMING)
BACHELOR OF ECONOMICS AND STATISTICS
BACHELOR OF SCIENCE (MATHEMATICS)
BACHELOF EDUCATION (SCIENCE)
BACHELOR OF EDUCATION (ARTS)
BACHELOR OF ARTS

SMA 103: ANALYTICAL GEOMETRY

DATE: 17TH JANUARY, 2025 **TIME: 8.30 AM – 10.30 AM**

INSTRUCTIONS:
*Answer question **ONE (Compulsory)** and **any other TWO** questions*

QUESTION ONE *(COMPULSORY)* (30 MARKS)

a) Determine whether the point $P(4,5)$ lies on, inside or outside the circle $x^2 + y^2 = 35$. (5marks)

b) Calculate the distance from the point $(5, 8)$ to the circle $x^2 + y^2 + 2x + 6y + 3 = 0$ (5marks)

c) Find the equation of the tangent and normal to the circle $x^2 + y^2 + 4x - 10y = -4$ at the point (2,8) on the circumference of the circle (5marks)

d) Determine the polar equation of the circle whose center has the Cartesian coordinates $(3, 4)$and radius $r = 10cm$ (5marks)

e) Convert the Cartesian coordinates of the point $(-4, 3)$ into Polar coordinates. (5 marks)

f) Calculate the general and normal equation of the line through the point $(2,5)$ and $(3,7)$ (5marks)

QUESTION TWO (20 MARKS)

a) Determine the angle between the lines $y = 2x + 5$ and $y = 12x - 1$ (5 marks)

b) Find the center and radius of the circle given the following equation $x^2 + y^2 + 12x - 6y - 7 = 0$ (5marks)

c) Determine the polar equation of the parabola $x^2 = -12(y - 3)$ (5 marks)

d) Find the equation of the ellipse whose eccentricity is $\frac{2}{3}$ and the directrix is $y = 9$ (5marks)

QUESTION THREE (20 MARKS)

a) Find the coordinates of the foci, the eccentricity, and the length of the latus rectum and directrix of the Hyperbola $9x^2 - 16y^2 = 144$ (12marks)

b) Determine the point on the directrix of the hyperbola $x = 7sec\phi, y = 2\ tan\phi$ which the tangent at the point (7sec60,2 tan 60) passes through (8marks)

QUESTION FOUR (20 MARKS)

a) Find the eccentricity, directrix, focus, length of the latus rectum and the equation of the tangent of the normal at point (-1,2) of the ellipse $(x+1)^2 + 4(y-1)^2 = 16$ (9marks)

b) Sketch the curve and label axes, foci and vertices described by the equation $\frac{x^2}{25} - \frac{y^2}{16} = -1$ (11marks)

QUESTION FIVE (20 MARKS)

a) Find the vertex ,the focus ,the equation of the directrix and the length of Latus rectum of the parabola $y^2 - 6y - 12x + 9 = 0$ (5marks)

b) Find the equation of the tangent to the parabola $y^2 - 2y - 12x - 23 = 0$ at the point $p\left(-\frac{7}{4}, 10\right)$ (5marks)

c) Find the parametric equation of the parabola $y^2 - 12y - 20x + 76 = 0$

(5marks)

d) Consider the polar equation $r = \frac{5}{4-3cos\theta}-$ Express the equation in its standard form and state the value of e

(5marks)