



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST SEMESTER EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE IN
ELECTRICAL AND ELECTRONICS ENGINEERING

SUPPLEMENTARY EXAMINATIONS

ECU 104-ENGINEERING MATHEMATICS I

DATE: 3/8/2016

TIME: 2.00-4.00 PM

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

QUESTION ONE COMPULSORY (30 MARKS)

- a) Determine the y and the x intercepts for the line through points $(-3, -28)$ and $(7, 52)$ (3 marks)
- b) Write in Cartesian form the equation $r = 9 \cos \theta$ (3 marks)
- c) Determine whether the point $(4, 5)$ lies on, inside or outside the circle $x^2 + y^2 = 40$. (3 marks)
- d) Determine whether the points $(-7, 65)$ and $(5, 23)$ lie on the line through the point $(3, 5)$ whose slope is 9 (5 marks)
- e) Find the focus, the equation of the directrix, the length of latus rectum for the parabola $5y^2 = 24x$ (5 marks)
- f) Calculate the distance from the point $(4, -9)$ to the line $x \cos 60 + y \sin 60 + 5 = 0$ and state the position in relation to the line and the origin (5 marks)

- g) Determine the equations of the tangents at the end points of the latus rectum of the parabola $y^2 + 6y - 20x + 49 = 0$ (6 marks)

QUESTION TWO (20 MARKS)

- a) Determine the center and the radius of the circle given by the equation and state whether real, a point or imaginary (5 marks)
- b) Determine the equation of the tangent to circle $x^2 + y^2 + 10x - 6y - 66 = 0$ at the point $(3, -3)$ (5 marks)
- c) Determine the focus, the center, the eccentricity and directrix of the ellipse whose equation is $x^2 + 4y^2 + 4x - 24y + 24 = 0$. (10 marks)

QUESTION THREE (20 MARKS)

- a) Consider a parabola with a vertical axis, focus and vertex being $F(h, k)$ and $V(c_1, c_2)$ and directrix $y=d$, then show that the equation of the parabola is $(x - c_1)^2 = 4a(y - c_2)$ (10 marks)
- b) Show that the circles $x^2 + y^2 + 6x - 4y - 12 = 0$ and $x^2 + y^2 - 20x - 4y - 40 = 0$ are orthogonal. (10 marks)

QUESTION FOUR (20 MARKS)

- a) Determine the general and normal equations to the line through point $(2,5)$ and $(3,7)$ (10 marks)
- b) Analyze the hyperbola $9x^2 - 16y^2 - 18x - 64y - 199 = 0$ (10 marks)

QUESTION FIVE (20 MARKS)

- a) Consider point $P_1(a_1, b_1)$ outside the $(x - h)^2 + (y - k)^2 = r^2$. Let B_1 be a point on the circle such that it lies on the line segment P_1C , C being the center of the circle. Show that distance d from point $p(a, b)$ to the circle $(x - h)^2 + (y - k)^2 = r^2$ (10 marks)
- b) Determine the eccentricity, foci, the length of the latus rectum, equation of the asymptotes, the equation of the tangent and the normal at point $P\left(3, \frac{12}{5}\right)$ of the hyperbola

$$\frac{x^2}{25} - \frac{y^2}{9} = -1 \quad (10 \text{ marks})$$