



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECU 104: ENGINEERING MATHEMATICS 1

DATE: 13/12/2017

TIME: 8.30-10.30 AM

INSTRUCTIONS:

Attempt Question 1 and any other 2 Questions.

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Show that the triangle with vertices $A(1, -2)$, $B(-4, 2)$ and $C(1, 6)$ is isosceles. (5 marks)
- b) Find the centre and radius of the circle with the following equation $x^2 + y^2 - 4x + 2y + 5 = 0$ (5 marks)
- c) Find the focus, vertex, directrix and axis of the parabola $x^2 + 2y - 3x + 5 = 0$ (5 marks)
- d) An equation is given in polar coordinates as $x^2 + y^2 + 2x - 4y = 0$. Find an equation in polar coordinates which describes the same graph (5 marks)
- e) Find θ , the angle between $\mathbf{v} = 3\mathbf{i} - 4\mathbf{j}$ and $\mathbf{w} = 5\mathbf{i} + 12\mathbf{j}$ (5 marks)
- f) Find the cosine of the angle between the line L_1 , passing through the points $P_1(1, 4, 2)$ and $P_2(3, -1, 3)$ and the line $Q_1(3, 1, 2)$ and $Q_2(2, 1, 3)$. Find the 2 angles. (5 marks)

QUESTION TWO (20 MARKS)

- a) Find the equation of the line through $(-2, -3)$ and parallel to the line $3x - 7y + 4 = 0$ (5 marks)
- b) Find the equation of the perpendicular bisector of the line segment joining $(3, -1)$ and $(5, 2)$ (8 marks)

- c) Find the equation of the line passing through $(5, -1)$ and through the intersection of $2x + y - 3 = 0$ and $x + 4y - 7 = 0$ (7 marks)

QUESTION THREE (20 MARKS)

- a) If $L_1: 2x + 3y = 5$ and $L_2: 3x + 2y = 1$, find θ , the angle from L_1 to L_2 (6 marks)
- b) Find the equations of the two bisectors of the angles formed by the lines $2x + y + 5 = 0$ and $x + 2y - 3 = 0$ (6 marks)
- c) Find the equation of the line normal to the given circle $2x^2 + 2y^2 + 3x + 5y + 2 = 0$ at the point $p(2, -3)$ on the circle (8 marks)

QUESTION FOUR (20 MARKS)

- a) In the equation of the ellipse $9x^2 + 16y^2 = 144$, find the lengths of the major and minor axes, the coordinates of the foci, and the eccentricity. Sketch the curve. (10 marks)
- b) Given the equation of the hyperbola $4x^2 - 12xy + 9y^2 - 52x + 26y + 81 = 0$ reduce it to the standard form by eliminating B, D and E. Identify the curve and locate the principal quantities (10 marks)

QUESTION FIVE (20 MARKS)

- a) Find the area inside the circle $r = 5\cos\theta$ and outside the curve $r = 2 + \cos\theta$ (7 marks)
- b) Find θ the angle of intersection between the planes $2x - y + 3z - 5 = 0$ and $3x - 2y + 2z - 7 = 0$ (3 marks)
- c) Find the point of intersection of the line $3x - y + 2z - 5 = 0$ and the plane $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{-2}$ (3 marks)
- d) Show that $\mathbf{u} = \mathbf{i} - \mathbf{j} + \mathbf{k}$, $\mathbf{v} = -\mathbf{i} + 2\mathbf{j} - \mathbf{k}$, $\mathbf{w} = 2\mathbf{i} - \mathbf{j} + \mathbf{k}$ are linearly independent and express $\mathbf{r}$ in terms of $\mathbf{u}$, $\mathbf{v}$ and $\mathbf{w}$. (7 marks)