(Knowledge for Development)

KIBABII UNIVERSITY

MAIN EXAMINATION

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS/SCIENCE)

COURSE CODE: MAT 122

COURSE TITLE: ELEMENTARY APPLIED MATHEMATICS

DATE: 15/01/2018   **TIME:** 2 PM – 4 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One in and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE COMPULSORY (30 MARKS)

(a) Briefly explain the following terms: (4 mks)
  (i)   Momentum
  (ii)   Impulse
  (iii) Newton's first law of motion
  (iv)   Newton's second law of motion

(b) If θ is the angle between a and b prove that $a.b = \|a\|\|b\|\cos\theta$ (5 mks)

(c) Triangle ABC has vertices at A(1,-1), B(5,4) and C(7,-3). Find the equation of the median from C (4 mks)

(d) Find the equation of the straight line joining the origin to the point of intersection of $y = 2x + 3$ and $2x - 3y + 7 = 0$ (4 mks)

(e) Show that $(1,2)$, $(4,7)(-6,13)$ and $(-9,8)$ are vertices of a rectangle (6 mks)

(f) Find the centre and radius of the circle passing through the points $A(-1,1)$, $B(6,2)$ and $C(8,-2)$ (7 mks)

QUESTION TWO (20 MARKS)

(a) Convert into Cartesian coordinates $\left(5, \frac{\pi}{3}\right)$ (3 mks)

(b) If a line joins $(2,3,4)$ to $(6,5,-1)$ find
  (i)   The actual direction cosines (3 mks)
  (ii)   Direction angles (3 mks)

(c) Find the line through the points $A(-3,4,-5)$ and $B(-5,6,7)$ in parametric and symmetric forms (4 mks)

(d) Prove that $\vec{A} \times (\vec{B} \times \vec{C}) = \vec{B}(\vec{A}.\vec{C}) - \vec{C}(\vec{A}.\vec{B})$ (7 mks)

QUESTION THREE (20 MARKS)

(a) If $p = 4i - 2j + k$ and $q = -2i + j + 3k$ and $r = i - 2k$ evaluate $r.(p \times 2q)$ (5 mks)

(b) A plane is defined by 3 points as P(3,2,-2), Q(4,2,6) and R(-2,-3,5) find the vector that is orthogonal to the plane. (5 mks)

(c) Derive the equation of motion $v^2 = u^2 + 2as$ (6 mks)

(d) Write the equation of line L through A(-4,3,7) parallel to the vector $r = \langle 3, -4, 1 \rangle$ giving your answer in vector, parametric and symmetric forms (4 mks)

QUESTION FOUR (20 MARKS)

(a) Find the angle between the planes $p = 2i + 5j - 2k$ and $q = 3i - 3j + k$

(5 mks)

(b) Find the area enclosed between the curves $R_1 = 3\sin\theta$ and

$R_2 = 1 + \sin\theta$ (5mks)

(c) Sketch the graph of $r = 1 + \cos2\theta$ (6mks)

(d) A model of a car moves from a circular travel of 0.8M at 4 revolution per second what is its

(i) Period T (2 mks)

(ii) Angular velocity ω (2 mks)

QUESTION FIVE (20 MARKS)

(a) Consider the plane $P = 3x + 2y - 5z = 7$ find the point of intersection of the plane with the line $x = t$ $y = 5 - 3t$ and $z = 2t + 1$ (4 mks)

(b) A particle of mass 100g travelling horizontally at 84 m/s hits a cliff and rebounds with a speed of 56 m/s. Find the impulse exerted on the ball. (4 mks)

(c) Determine if the following vectors are parallel, orthogonal or neither $\vec{A} = \langle 3, -1, 2 \rangle$ and $\vec{B} = \langle 2, 1, -5 \rangle$ (5 mks)

(d) A ball is projected upwards with a velocity of 60 m/s from the ground. Calculate

(i) The time it takes to reach maximum height (2 mks)

(ii) Maximum height reached (2 mks)

(iii) Show that the velocity with which it lands on the ground is 60 m/s (take $g = 10/s^2$) (3 mks)