(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAT 111

COURSE TITLE: GEOMETRY AND ELEMENTARY APPLIED MATHEMATICS

DATE: 06/08/18   **TIME:** 2 PM - 4 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a) Define the following terminologies as used in applied mathematics. (5 Marks)
   - (i) Polar Coordinate
   - (ii) Relative motion
   - (iii) Momentum
   - (iv) Gradient
   - (v) Energy

b) Find the equation of a straight line joining two points A (6,0) and B (ɔ,3). (3 Marks)

c) Convert point $\left(3, -\frac{6\pi}{7}\right)$ into a Cartesian coordinate. (3 Marks)

d) Given that a circle has an equation $4x^2 + 4y^2 - 16x - 24y + 51 = 0$, find the center of the circle. (4 Marks)

e) A body at rest starts and moves with a uniform acceleration during the time interval of 5.21 seconds. Distance covered by the truck in 110 m. find the acceleration. (4 Marks)

f) Find the angle between two vectors A and B, $A = -3\hat{i} + 3\hat{j}$ and $B = 2\hat{i} + 3\hat{j}$ (4 Marks)

g) A 3.0 Kg mass undergoes an acceleration given by $(2.0\hat{i} + 5.0\hat{j})m/s^2$. Find the resultant force, F and its magnitude. (5 Marks) (2 Marks)

h) State any two laws of friction.

QUESTION TWO (20 MARKS)

a) In one model of a hydrogen atom, an electron orbits a proton in a circle of radius $5.28 \times 10^{-11} m$ with speed of $2.18 \times 10^6 m/s$. What is the acceleration of the electron in this model? (4 Marks)

b) An ice skater moving at 12 m/s coasts to halt in 95m on an ice surface. What is the coefficient of kinetic friction between ice and the skates? (12 Marks)

c) Show that $\left(\vec{A} - \vec{B}\right) \times \left(\vec{A} + \vec{B}\right) = 2\left(\vec{A} \times \vec{B}\right)$ (4 Marks)

QUESTION THREE (20 MARKS)

a) If an electron (mass $= 9.11 \times 10^{-31} Kg$) in copper near the lowest possible temperature has a kinetic energy of $6.7 \times 10^{-19} J$ what is the speed of the electron. (5 Marks)

b) A 3.00 Kg particle has a velocity of $(3.0\hat{i} - 4.0\hat{j})m/s$ find its x and y components of momentum and the magnitude of its total momentum. (9 Marks)

c) Find the equation of a circle whose center $(h,k) = (-5,12)$ and passing through point $(-2,8)$. (6 Marks)

QUESTION FOUR (20 MARKS)

a) What is the equation of a line passing through point $(1,1)$ and is perpendicular to the line $y = -2x + 2$ (3 Marks)

b) A minibus of mass 1500Kg travelling at a constant velocity of 72Km/h collides with a stationary car of mass 900kg. the impact takes 2 seconds before the two moves together at a constant velocity for 20 seconds. Calculate:
   (i) Common velocity of the two bodies after collision (4 Marks)
   (ii) Impulsive force (6 Marks)

c) Find the perimeter of a triangle whose vertices are on A(2,4), B(-3,1) and C(5,-6). (7 Marks)

QUESTION FIVE (20 MARKS)

a) A rifle is aimed horizontally at a target 30 m away. The bullet hits the target 1.9 m below the aimed point. What is the bullets time of flight? (10 Marks)

b) A car travelling at 72Km/h is uniformly retarded by application of breaks and come to rest after 8 seconds. If the car with its occupants has a mass of 1250Kg, calculate:
   (i) The breaking force (6 Marks)
   (ii) The work done by bringing it to rest. (4 Marks)