KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAT 111

COURSE TITLE: GEOMETRY AND ELEMENTARY APPLIED MATHEMATICS

DATE: 17/10/18   **TIME:** 8 AM -10 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of **3 Printed Pages**. Please Turn Over.

QUESTION ONE (30 MARKS)

a) Define the following terminologies as used in applied mathematics. (5 Marks)
   - (i) Applied Mathematics
   - (ii) Velocity
   - (iii) Cartesian Plane
   - (iv) Circle
   - (v) Force

b) For the following three vectors what is $3C \bullet (2A \times B)$ (5 Marks)

$$A = 2.00\,\hat{i} + 3.00\,\hat{j} - 4.00\,\hat{k}, \ B = 3.00\,\hat{i} + 4.00\,\hat{j} + 2.00\,\hat{k} \text{ and } C = 7.00\,\hat{i} + 8.00\,\hat{j}$$

c) An electron moving along the $x - axis$ has a position given by $x = \left(16e^{-t}\right)m$, where t is in seconds. How far is the electron from the origin when it momentarily stops? (4 Marks)

d) A 210Kg motorcycle accelerates from 0 to 55 m/h in 6 .0 seconds. What is the magnitude of the motorcycle's constant acceleration? (5 Marks)

e) If $\phi(x, y, z) = x + 2y + z^2$ find the $\overline{\nabla}\phi$ at a point $(1,1,2)$ (4 Marks)

f) Sketch a distance – time graph for a body moving with a uniform speed. (3 Marks)

g) State any four laws of friction. (4 Marks)

QUESTION TWO (20 MARKS)

a) A block of wood is placed on a plane surface included at 35^0 relative to the horizontal. If the block slides down the inclined plane with acceleration magnitude of g/3, determine the coefficient of friction forces between the plane and the block. (12 Marks)

b) A toy car moving at a constant speed completes one lap around a circular track (a distance of 200m) in 25 seconds.
   - (i) What is the average speed? (3 Marks)
   - (ii) If the mass of the car is 1.50Kg, what is the magnitude of the central force that keeps it in a circle? (5 marks)

QUESTION THREE (20 MARKS)

a) A 700N marine in basic training climbs a 10.0m vertical rope at a constant speed of 8.00 seconds. What is his power output? (9 Marks)

b) Show that $\overline{\nabla} \bullet (\phi \vec{A}) = \phi \overline{\nabla} \bullet \vec{A} + \vec{A} \bullet \overline{\nabla}\phi$ (11 Marks)

QUESTION FOUR (20 MARKS)

a) A metal cube suspended freely from the end of a spring causes it to stretch by 5.0 cm. A 500g mass suspended from the same spring stretches it by 2.0 cm. If its elastic limit is not exceeded.

(i) Find the weight of the metal cube. (5 Marks)

(ii) By what length will the spring stretch if a mass of 1.5 Kg is attached.

(5 Marks)

b) Find the equation of a circle with its center $(h, k) = (4, -2)$ and radius $r = 10$

(6 Marks)

c) What is the difference between the following

(i) Linear Velocity and Angular Velocity (2 Marks)

(ii) Molecular Force and Nuclear Force. (2 Marks)

QUESTION FIVE (20 MARKS)

a) Find the equation of the tangent line to the circle $x^2 + y^2 = 4$ at a point in the first quadrant whose $x - coordinate$ is $x = 1$ (7 Marks)

b) A bullet of mass 20g is fired horizontally with velocity of 200m/s into a suspended wooden block of 1980g. Determine the common velocity of both the bullet and the block of wood if the bullet is embedded into the block. (3 Marks)

C) A particle is launched from the ground level with speed V_0 at an angle of θ_0. Find the maximum height attained by the projectile? (10 Marks)