MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCE

DEPARTMENT OF APPLIED SCIENCE

UNIVERSITY **SUPPLEMENTARY** EXAMINATION

2017/2018 ACADEMIC YEAR

SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN MATHEMATICS AND ECONOMICS
BACHELOR OF SCIENCE IN STATISTICS WITH PROGRAMMING

AMM 2108 – ELEMENTARY APPLIED MATHEMATICS

DURATION: 2 HOURS

DATE: 17TH APRIL, 2018

TIME: 2.00 – 4.00 P.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

a) Find the equation of the line through the point (5,-1) and perpendicular to the line 4x + 2y -3 = 0 (3 marks)

b) Find the angle between the line 5y-3x=4 and the positive direction of the x-axis (2 marks)

c) Find scalars h and k such that $h\begin{pmatrix}3\\5\end{pmatrix} + k\begin{pmatrix}4\\7\end{pmatrix} = \begin{pmatrix}6\\3\end{pmatrix}$ (2 marks)

d) Find the vector equation of the line through the points A(1,2,3) and B(4,4,4), and find the coordinates of the point where this line meets the plane z=0 (4 marks)

e) Find the equation of the plane which passes through the points A(1,1,1), B(5,0,0) and C(3,2,1) (4 marks)

f) Determine the polar equation for the circle $x^2 + (y-3)^2 = 9$ (3 marks)

g) Find the centre and radius of the circle $x^2 + y^2 + 4x - 6y - 3 = 0$ (4 marks)

h) A car moving at 30 m/s slows uniformly to a speed of 10 m/s in a time of 5.0s. Determine:

i. the acceleration of the car (2 marks)

ii. the distance it moves in the third second (3 marks)

i) A particle is projected with a velocity of 19.6 ms^{-1}. Find the maximum range and the two directions of projection to give a range of 12m. (3 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) Find the gradient of the straight line 7x+4y+2=0, and its intercepts on both axes. (4 marks)

b) Calculate the area of the triangle formed by the line 3x-7y+4=0 and the axes (5 marks)

c) Find the equation of the straight line through the point P(7,5) perpendicular to the straight line AB whose equation is 3x+4y-16=0. Calculate the length of the perpendicular from P to AB. (7 marks)

d) Find the equation of the line which passes through the point of intersection of the lines x-3y=4 and 3x+y=2, and is parallel to the line 3x+4y=0 (4 marks)

QUESTION THREE

a) Find a unit vector which is parallel to the line $\frac{x-1}{3} = \frac{y-2}{4} = \frac{z-7}{12}$ (5 marks)

b) Show that the equations $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} + M\begin{pmatrix} 4 \\ 6 \\ -2 \end{pmatrix}$ and $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 10 \\ 15 \\ -3 \end{pmatrix} + n\begin{pmatrix} -2 \\ -3 \\ 1 \end{pmatrix}$ represent the same line (8 marks)

c) Given that A,B,C are the points (1,0,3), (5,1,2) and (3,2,2) respectively, find the equation which must be satisfied by the coordinates (x,y,z) of any point P, in the plane ABC (7 marks)

QUESTION FOUR

a) The driver of a car travelling at 72km/hour observes the light 300m ahead of him turning red. The traffic light is timed to remain red for 20s before it turns green. If the motorist wishes to pass the light without stopping to wait for it to turn green, determine:

i. the required uniform acceleration of the car (3 marks)

ii. the speed with which the motorist crosses the traffic light (2 marks)

b) A boy throws a ball so that it may just clear a wall 3.6m high. The boy is at a distance of 4.8m from the wall. The ball was found to hit the ground at a distance of 3.6m on the other side of the wall. Find the least velocity with which the ball can be thrown.
Take g=9.8ms^{-2} (11 marks)

c) Two particles P1 and P2 are moving with velocities
$\underline{v}_1 = 2\underline{i} - 4\underline{j} + 8\underline{k}$ and $\underline{v}_2 = 8\underline{i} + 12\underline{j} - 3\underline{k}$, and accelerations
$\underline{a}_1 = -2\underline{j} + 6\underline{k}$ and $\underline{a}_2 = 10\underline{i} + 12\underline{j}$ respectively. Find:

i. the relative velocity of the second particle with respect to the first. (2 marks)

ii. the relative acceleration of the second particle with respect to the first. (2 marks)