MURANG'A UNIVERSITY COLLEGE

(A Constituent College of Jomo Kenyatta University of Agriculture and Technology)

University Examination 2014/2015

Supplementary Examination for the Diploma in Mechanical Engineering

SEM 1107: ENGINEERING MATHEMATICS II

Date: August 2015 2 Hours

Instructions: Attempt Question **One** and any other **Two** Questions.

Question One (30 Marks)

a) Find the volume and the total surface area of a frustum of a cone given that the diameter of the ends are 10.0cm and 5.0cm while the perpendicular height is 14.0cm (5 Marks)

b) Determine the area of a triangle whose sides are 7 cm, 10 cm and 14 cm (4 Marks)

c) A machine produces 4% defective items, in a sample of 10 items selected at random, determine the probability that there will be;

(i) Exactly two defective items (3 Marks)

(ii) At least two defective items (4 Marks)

d) A ship sails from a port in the direction $N35^0W$ at an average speed of 40km/h while another ship sails at the same time and from the same port but in the direction $N42^0E$ and at 20km/h. Find their distance apart after 2 hours. (5 Marks)

e) Find the volume and the total surface area of a cone of base radius 2.5cm and perpendicular height 14 cm (5 Marks)

f) Find $\vec{A} \times \vec{B}$ given that $\vec{A} = 2\tilde{i} - 3\tilde{j} + 5\tilde{k}$ and $\vec{B} = \tilde{i} + 4\tilde{j} - 3\tilde{k}$ (4 Marks)

Question Two (20 Marks)

a) From a window, 12m above the horizontal ground, the angle of elevation of the top of a vertical tower is 30^0 and that of depression of the bottom of the tower is 15^0. Determine

i) The distance from the point p on the ground directly below the window up to the bottom of the tower.

ii) The height of the tower.

iii) The angle of elevation of the top of the tower from point p (12 Marks)

b) Solve the equation $5sin(\theta) + 12cos(\theta) = 7$ for $0 \leq \theta \leq 360^0$ (8 Marks)

Question Three (20 Marks)

a) Find the angle between the vectors $\vec{A} = 7\tilde{i} + 4\tilde{j} + \tilde{k}$ and $\vec{B} = \tilde{i} + 3\tilde{j} - 2\tilde{k}$ (7 Marks)

b) Find the projection of the vector $\vec{A} = 2\tilde{i} + 3\tilde{j} - 5\tilde{k}$ in the direction of the vector $\vec{B} = \tilde{i} + 4\tilde{j} - \tilde{k}$ (5 Marks)

c) Find the possible values of the constant b given that the vectors $\vec{A} = b\tilde{i} + 11\tilde{j} - 3\tilde{k}$ and $\vec{B} = 3b\tilde{i} - b\tilde{j} - 2\tilde{k}$ are orthogonal (8 Marks)

Question Four (20 Marks)

a) Use the Prismoidal rule to derive the expression for the volume of a sphere of radius r hence find the volume of a sphere given that $r = 7$. (8 Marks)

b) Find the area bounded by the curve $y = x^2 - 8x + 12$ and the x-axis using;

i) The mid-ordinate rule with 9 ordinates.

ii) The Simpson's rule with 9 ordinates. (12 Marks)

Question Five (20 Marks)

a) Given the data in the table below

x	3	7	10	17	22
Frequency	2	3	5	2	1

Calculate

i) The arithmetic mean

ii) The Geometric mean

iii) The standard deviation of the distribution (12 Marks)

b) Two boxes are externally alike and each contains 10 balls. One box contains 4 red balls and 6 green balls while the other box contains 7 red balls and 3 green balls. A box is chosen at random and a ball is selected at random and transferred into the second box. After thorough mixing one ball is selected at random from the second box. Find the chance that this ball is red in colour. (8 Marks)