(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2014/2015 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DIPLOMA IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: **DCE 057**

COURSE TITLE: **MATHEMATICS I**

DATE: 18TH DECEMBER 2014 **TIME: 11.00AM – 1.00PM**

INSTRUCTIONS:

1. Answer Question **ONE** and any other **THREE** questions
2. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

Question one (30 mks)

a.(i) Find the number of inversions in the permutations of; (2 mks)

1. (3 4 1 5 2)
2. (4 2 5 3 1)

Classify each of the permutations as even or odd. (2 mks)

ii. find all the values of λ for which det(A)=0,

A=$\begin{pmatrix} \lambda - 1 & -2 \\ 1 & \lambda - 4 \end{pmatrix}$ (2 mks)

b. Given that f(x) =5x+1, g(x) = $\frac{1}{x}$ and h(x) =2x-5, solve for x in the equation

$fog^{-1}(x) = h^{-1}(x)$ (4 mks)

c. If $x + \frac{1}{x} = 1$, show that $x^2 + \frac{1}{x^2} = -2$

what is the value of $x^5 + \frac{1}{x^5}$ (4 mks)

d. Solve the inequality $\frac{4-x}{1x+3} < 3$

e. If ${}^nP4$=12x${}^nP2$,

i. find n (3 mks)

ii. Solve for n in ${}^nc2$=3 (3 mks)

f. Show that A.(B+C)=A.B+A.C

g. If R(u) =x(u)j+z(u), where x,y and z are differentiable functions of a u.Show that;

$\frac{\delta R}{\delta U} = \frac{\delta x}{\delta u} I + \frac{\delta y}{\delta u} J + \frac{\delta z}{\delta u} K$ (3 mks)

h. Express in $\frac{2+3i}{1+2i}$ the form $p + iq$; hence find |p+iq| (3 mks)

Question two (10 mks)

A right circular cone has its vertex at the point (2, 1, 3) and the centre of its plane face at the point (1, -2, 2). A generator of the cone has equation r=(2i+j+3k)+(i-j-k). Find the radius of the base of the cone and hence its volume. (10 mks)

Question three (10 mks)

Given that (x+1) and (x-2) are factors of expression $f(x)=x^3+ax^2+b$ find the values of a and b. What is the other factor. (10 mks)

Question Four (10 mks)

a. Obtain the binomial expansion of $(1-2x)^5$. Use your expansion to evaluate $(0.95)^5$ correct to 5 decimal places. (4 mks)

b. If $\int_1^a 3(x+1)^2 \delta x = a^3 + 11$ find the values of a. (3 mks)

c. Differentiate from first principles

$f(x) = x^3 - 2x$ (3 mks)

Question five (10 mks)

a. Show that $\sin 3A = 3\sin A - 4sin^3 A$.

b. Solve $2\cos\theta=\sin(\theta+30^0)$ giving the general values of θ.

c. Solve the equation $2\cos 2\theta-\sin\theta=1$ for values of θ between 0 and 2π.

Question Six

a) Use Cramer's rule to solve for z without solving for x, y and w.

$4x+y+z+w=6$

$3x+7y-z+w=1$

$7x+3y-5z+8w=-3$

$x+y+z+2w=3$

b) If $\emptyset(x, y, 2)=3x^2y-y^3x^2$, find $\nabla \emptyset$ at the point (1, -2, -1)

c) Complete the formulas below

i. $\nabla (\emptyset+4)=$

ii. $\nabla (A+B)=$

iii. $\nabla (\nabla \emptyset)=$

iv. $\nabla (A+B)=$