MURANG'A UNIVERSITY COLLEGE

(A constituent college of Jomo Kenyatta University of Agriculture and Technology)

SCHOOL OF ENGINEERING	**DEPARTMENT OF BUILDING AND CIVIL**
UNIT CODE: SEB 1231	**UNIT TITLE: MATHS III**
CLASS: BC/C 14D JAN	**ACADEMIC YEAR: 2014/2015**
SUPPLEMENTARY EXAM	**DURATION: 2HOURS**
DATE: 3RD August 2015	**TIME: 8.00- 10.00AM**

Instructions

- Question ONE is compulsory Attempt any other TWO questions.
- Marks for each question are allocated at the end.

QUESTION ONE: [3O MARKS]

A i) Give the following complex numbers; Z1 = 3+ J4 , Z2 = -2+J5, Z3 = Evaluate the following,

a. $Z_1 + Z_2$, b. $Z_l - Z_2$ **4 Marks**

iii) Three forces acting on a body at one point are 10kN at 30^o, 6KN at 240^o and 12 K**N** at 300^o. All the angles are measured anti- clockwise from the positive x- axis. Determine the magnitude and direction of the resultant force on the body. **6 marks**

B) Find the maximum and minimum values of the expression

40 sin x + 9 cos x **4 marks**

C) Calculate the maximum and minimum values of the function, x3 – 4x2 – 3x + 2 and sketch the graph between x = -2 and x = +4 **6 marks**

D) Water flows at a constant rate into a tank, which is an inverted cone of depth 3m and radius 2m. If the rate at which the level of water rises in the tank is 0 .03m/s at a depth of 2m, find the rate of flow of water into the tank **10 marks**

QUESTION TWO: [20 MARKS]

A From first principles, differentiate the following $5x^3$ **5marks**

b) The rate of increase of radius of a balloon as it rises in the air is o.2mm/s at a radius of 60mm. Find the rate of increase of volume at this radius **6 marks**

c) The gas constant is calculated using the equation, R =PV/T . If the error in V is +2%, in P is 1%, and in T is 2%, find the error in the calculated value of R **9 marks**

QUESTION THREE: [20 MARKS]

a) If $Z = 3x3y + 5xy^2$. Find dy/dx, $d2y/dx^2$ **8 marks**

b) a particle starts at the origin and moves along the positive x- axis such that its distant from the origin at any time is determined by the equation $x = 2t^3 – 9t^2 +12t$. Find

I the times when the velocity is zero

Ii the acceleration when the velocity is zero

Iii the value of the minimum velocity **12 marks**

QUESTION FOUR: [20 MARKS]

a) Differentiate with respect to x

i) $(3x^2+ 4x^5)/ x^3$ iii $7x^3(x4 -2)^7$ **6 marks**

b) Find differential coefficients of

i. $5\tan(x3 +3)$ ii. $(x3+4x – 2)/ (x^2 – 4x)$ iii. $y + \tan x = \tan y + x^2$ **6 marks**

C) The area S square metres, of sheet metal used in the manufacture of a closed hollow cylindrical container, of a given fixed volume and base radius r metres, is given by

$S = 32/9r +6 r^2$. Find,

i the value of r for which the area of sheet metal used is a minimum

ii the resulting minimum area of sheet metal used **8 marks**

QUESTION FIVE: 20 MARKS

a) i) Express as a product sin 5x + sin 2x **3 marks**

ii) Express as a sum or a difference 2cos 4x sinx **3 marks**

iii) Prove (sin4x +y + sin 4x – y) /(cos2x +y + cos 2x – y) = 2sin 2x

b) A missile is fired into the air. The height h of the missile after **t** seconds is given by

$h = 19.2\ t - 4.8t^2$. Find:

i) The initial velocity of the missile when t= 0

ii) The height attained when its velocity is one half of its initial velocity **8 marks**

d) Prove that the function y= 4/x +6x has two turning points. Determine the nature of these turning points **6 marks**