EAST AFRICAN SCHOOL OF AVIATION EXAMINATION

END - TERM II

ENGINEERING SECTION

EXAMINATION FOR THE AWARD OF DIPLOMA IN AERONAUTICAL ENGINEERING

SUBJECT: MATHEMATICS

TREAM: YEAR 2 (A/ E) **Duration: 3 Hrs.**

DAY/DATE: Monday: 4 /4/2016 **TIME: 9.00 – 12.00 A.M**

INSTRUCTIONS TO CANDIDATE:

1. *This paper consists of **THREE (3)** printed pages.*
2. *All questions carry equal marks.*
3. *Maximum marks for each part of a question are as shown*
4. *Attempt any **FIVE** questions.*
5. *Cheating will lead to exam cancellation.*
6. *You should have the following:-*
   - *Mathematical Tables*
   - *Scientific Calculator.*

1. (a) The first, twelfth and last term of an arithmetic progression are 4, 31.5, and 376.5 respectively. Determine
    i. The number of terms in the series,
    ii. The sum of all the terms and
    iii. The '80'Th term. (5mks)

    (b) Find the sum of the first 9 terms of the series 72.0, 57.6, 46. 08… (5mks)

    (c) Using Maclaurin's theorem to expand ln (1+x) up to the term x^6, hence evaluate $\int_0^{0.4} x \ln(1+x)\, \mathrm{d}x$ correct to 3 decimal places. (10mks)

2. (a) Given the matrices $A = \begin{pmatrix} 1 & 2 & -1 \\ 2 & 0 & 3 \\ 0 & 1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & -1 & 1 \\ 0 & 0 & 2 \\ 4 & -3 & 2 \end{pmatrix}$ Verify the result $(A+B)^2 = A^2 + AB + BA + B^2$ (8 marks)

    (b) The current in an electrical circuit satisfy the simultaneous equations; (12 marks)

$$\begin{aligned} 3i_1 + \ 2i_2 + \ i_3 &= -3 \\ i_1 - \ i_2 + \ 3i_3 &= -7 \\ 4i_1 + \ 3i_2 + \ 5i_3 &= -7 \end{aligned}$$

    Use inverse matrix method to determine the values of the currents.

3. (a) Given that $z = \sin\frac{y}{x}$ show that $x\frac{dz}{dx} + y\frac{dz}{dy} = 0$ (6 mark)

    (b) The radius of a cone increases from10.0 cm to 10.5 cm while its height decreases from 16.0 cm to 15.8 cm. determine the approximate change in value, using partial derivative. (4marks)

    (c) Find the stationary point of the function $f(xy) = x^3 - 6xy + y^2$ (10 marks)

4. (a) If Z_1=1-j3, Z_2=-2+j5 and Z_3=-3-j4 determine in a+jb form;
    (i) $Z_1Z_2Z_3$

    (ii) $\frac{Z_1}{Z_2}$

    (iii) $\frac{Z_1Z_2}{Z_1+Z_2}$ (5mks

(b) Evaluate, in polar form $2\angle 30^\circ + 5\angle -45^\circ - 4\angle 120$ (5mks)

(c) Calculate the 5th root of $(4<21°)^{-2/5}$ in the a+bj form correct to 4 d.p (10mks)

5. (a) Evaluate $\int_0^{\pi/2}\int_0^{X} 2X\, Siny\; dy\; dx$ (5marks)

(b) Use double integration to determine the area bounded by curves $y = x^2$ and $y = 5x - x^2$ (8marks)

(c) Find the volume of the solid bounded by the planes z= 0, x= 1, x=3 y= -1,y = 2 and the surface $z = x^2 + y^2 - 4$ (7marks)

6. (a) Using Maclaurin's theorem to expand Cos3x up to the term x^6, hence evaluate $\int_0^1 \frac{\text{Cos3x}}{x^{\frac{1}{3}}}\, dx$ correct to 3 decimal places. (10mks)

(b) A company makes three types of security locks A, B, and C, each of which requires cutting, assembly, and finishing. Each unit of A requires 2 hours for cutting, 1 hour for assembly, and 3 hours for finishing. Each unit of B requires 1 hour for cutting, 2 hours for assembly, 1 hour for finishing. Each unit of C requires 1 hour for cutting, 2 hours for assembly, and 3 hours for finishing.

Available machine resources provide exactly 10 hours for cutting, 14 hours assembly and 18 hours for finishing each week.

i. Use the information provided to form a system of simultaneous linear equations.
ii. Apply Cramer's rule to calculate the number of locks of each type produced given that there is optimum utilization of machine time at the factory in a week. (10 marks)