TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

INSTITUTION BASED

DIPLOMA IN MECHANICAL, ELECTRICAL, BUILDING AND CIVIL

ENGINEERING YEAR II SEMESTER I

AMA 2250: ENGINEERING MATHEMATICS III

END OF SEMESTER EXAMINATION

SERIES: APRIL 2017

TIME: 2HOURS

DATE: Pick Date Apr 2017

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student IDMathematical table, calculator
This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question One

a) A $70N$, North force and a $40N$, east force both act on an object. Determine the magnitude and direction of the resultant force. (4 Marks)

b) Algebraically add the following vectors to determine F_R:
   $F_A = 16N$ acting at 30^0 to the horizontal.
   $F_B = 14N$ acting at 60^0 to the horizontal. (6 marks)

c) Vector $P = i + 3K$
   $q = 2i + J - K$

   Determine the angle between P and q (4 marks)

d) Determine the inverse of the matrix:

$$A = \begin{pmatrix} 1 & 2 & -1 \\ 3 & -1 & 2 \\ 5 & 1 & 2 \end{pmatrix}$$

(7 marks)

e) In a geometrical progression, the sum of second and third term is 9, the seventh term is eight times the fourth. Determine:
   (i)   The common ratio
   (ii)   First term
   (iii)   The fifth term   (4 marks)

f) Use MacLaurin's theorem to obtain the power series for $f(x) = \log_e(1 + e^x)$ (5 marks)

Question Two

a) Use the method of determinants to solve the following set of simultaneous equations:

$$AX + 9Y + 2Z = 21$$
$$13X + 5Y + 72 = 1$$
$$17X + 19Y + 8Z = 26$$

[9 marks]

b) A car seller sold 6 Toyotas, 6 Nissans and 6 Subaru's at a total of 8.4 million. In another set of sales, he sold 1 Toyota, 2 Nissans and 4 Subaru's at a total of 2.4 million. When he sold 4 Toyotas and 2 Nissans his total sales was 4 million.

Form the set of simultaneous equation arising from these sales hence solve using the method of inverse matrices to obtain the selling price of the different car models.   (11 Marks)

Question Three

a) The sum of three consecutive terms of an AP is 27. The product of the three terms is 648.

Determine:

   (i)   The first term
   (ii)   The common difference
   (iii)   The three terms.   (6 Marks)

b) For a $G.P$ series, the sum of the first and the third term is 4. The sum of the second and the fourth term is 96. Determine:

   (i)   The first term
   (ii)   The sixth term.   (6 marks)

c) Determine the sum to infinity of the series $5 + 2.5 + 1.25 + - - - - -$ (3 marks)

d) If Ksh 1.200 is invested at a compound interest of 7.5% per annum.

     (i)   Determine the value after 5 year.
     (ii)   The time current to the nearest year.
             It takes for the amount to double.   (5 Marks)

Question Four

a) Using Maclaurin's theorem obtain the first 4 terms of Maclaurin's series for:

     (i) $f(X) = (1 + x)^m$
     (ii) $f(X) = x\ Sinx$ (10 marks)

b) Determine the first four terms of the Taylor series for the following functions:

     (i) $f(x) = \log_e X$ Centred at $a = 1$
     (ii) $f(x) = Y_X$ Centred at $a = 1$ (10 marks)

Question Five

a) Simplify:

$$\frac{1+i}{1-i} - (1 + 2i)(2 + 2i) + \frac{3-i}{1+i}$$

                                                          (5 Marks)

b) Write in the form of $a + Jb$ and $Z = \dfrac{j - 4}{2i - 3}$ hence express in polar form.   (4 Marks)

c) (i) Obtain the square roots of $Z = -I - j$ leaving your answer in polar form. (5 marks)

     (ii) Obtain the Cube roots of $Z = -8$ (6 marks)

        Leaving your answer in polar form.

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