TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN MARINE ENGINEERING (DMEN)

EMR 2170: ENGINEERIGN MATHEMATICS I

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2014
TIME ALLOWED: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
      -   *Answer Booklet*
This paper consist of **FIVE** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown

This paper consists of **FOUR** printed pages

Question One (Compulsory)

a) Solve for x if:

$$_3\log_2 x = \frac{1}{27}$$

    (i)   **(2 marks)**

$$3^{2x+1} = \left(\frac{1}{81}\right)^{2-x}$$

    (ii)   **(2 marks)**

$$3^{2x} - 9^{\left(x-\frac{1}{2}\right)} = 6$$

    (iii)   **(4 marks)**

b) Use Matrix method to solve the following simultaneous equations:
$$3x + 2y = 12$$
$$4x - 2y = 5$$

                                                                       (6 marks)

c) (i) In an arithmetic progression, the first term is 6, fifth term is 202 and the last term is 447. Determine the sum of the terms in the progression. **(5 marks)**

    (ii) In a geometric progression, the second term is 6 and the fifth term, is 162. Determine the sum of first ten terms of the progression. **(5 marks)**

d) Table 1 shows the data of marks of twenty students in a class:

Table 1

Marks (x)	3	4	5	6	8	9	10	11	13
Frequency (f)	2	1	5	3	3	2	1	1	2

    Determine:
        (i) The mean mark
        (ii) The standard deviation   **(6 marks)**

Question Two

a) Determine the lowest common multiple (LCM) of 2940 and 3150   **(3 marks)**

b) Simplify the following:

$$\frac{6}{3x+3y} - \frac{x}{x^2 - xy}$$

    (i)   **(8 marks)**

$$\frac{r/4}{7/8 - r/2}$$

    (ii)

                                                                    (2 marks)

$$\frac{a^{1/2}b^{-1/2} - a^{-1/2}b^{1/2}}{a^{-1/2}b^{-1/2}}$$

(iii)

(4 marks)

$$\frac{a}{2x-3} + \frac{b}{3x+4} = \frac{x+7}{(2x-3)(3x+4)}$$

c) If   determine the values of a and b   **(5 marks)**

$$\frac{3}{3+2\sqrt{3}}$$

d) Rationalize   **(3 marks)**

Question Three

a) Evaluate without using tables the following:

$$\sqrt[5]{125} \times 5^{1.4}$$

  (i)   **(2 marks)**

$$\frac{12^{3/2} \times 16^{1/8}}{27^{1/6} \times 8^{1/2}}$$

  (ii)   **(3 marks)**

$$\log_6 81 \times \log_9 216$$

  (iii)   **(3 marks)**

$$\log_2 3 = p \qquad \log_{27} 32$$

b) (i) Given   , express   in terms of P.   **(3 marks)**

$$P = \log_{10} 2 \qquad q = \log_{10} 3, \qquad \log_{10} \sqrt{3/4}$$

(ii) If   and   express   in terms of p and q   **(3 marks)**

c) Simplify the following:

$$\frac{(x+1)^{3/2} + (x+1)^{-1/2}}{(x+1)^{-1/2}}$$

  (i)   **(4 marks)**

$$\frac{x^{p+\frac{1}{2}q} \cdot y^{2p+q}}{(xy^2)^p \cdot \sqrt{x^q}}$$

  (ii)   **(2 marks)**

Question Four

a) (i) In a geometric progression, the first term is 10 and the sixth terms is 320. Determine the sum of the first six terms of the progression.   **(4 marks)**

(ii) The sum of the first ten terms of an arithmetic progression and the tenth term of the progression both are – 5/2. Determine the first term and the common difference of the progression.**(6 marks)**

b) Table 2 shows the marks scored in a practical test by a group of students.

Table 2

Mark	10	10.5	11	11.5	12	12.5	13
Frequency	4	8	14	22	19	10	3

Using an assumed mean of 11.5 and a class width of 0.5 calculate:
- **(i)** The mean mark
- **(ii)** The standard deviation **(10 marks)**

Question Five

a) Table 3 shows soccer match results for teams A, B, C and D in a league match.

Table 3

Team	Wins	Draws	Losses
A	15	1	3
B	13	6	0
C	8	6	5
D	13	3	3

For a win a teams scores 3 points, a draw 1 point and a loss no point. By forming matrices, determine the total score for each team **(4 marks)**

b) The 1st, 12th and last term of an arithmetic progression are 4, 31½ and 376½ respectively. Determine:
- **(i)** The number of terms in the series
- **(ii)** The sum of all the terms
- **(iii)** The 80th term **(10 marks)**