



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN MARINE ENGINEERING

EMR 2107: ENGINEERING MATHEMATICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

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:

$$4^x + 2^{2x-3} = 9$$

(i) (4 marks)

$$3 \log_2 x = \frac{1}{27}$$

(ii) (2 marks)

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

(iii) (3 marks)

b) The first term of an arithmetic progression is 2, nth term is -16 and the sum of the first n terms is -49. Determine the value of n. (4 marks)

c) Use the matrix method to solve the following pairs of simultaneous equations:

$$3x + 2y = 12$$

$$4x - y = 5$$

(6 marks)

d) The 1st, 3rd and 5th terms of geometric progression form an arithmetic progression. If the first term of the progression is 3, determine the 10th term of the geometric progression. (4 marks)

e) The data in table 1 shows the number of children per family in a housing estate:

Table 1

No. of Children (x)	0	1	2	3	4	5	6
No. of Families (f)	1	5	11	27	10	4	2

Determine the mean of the data and use it to obtain the standard deviation. (7 marks)

Question Two

a) Simplify the following:

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

(i) (3 marks)

$$6^{\frac{1}{2}n} \times 12^{n+1} \times 27^{-\frac{1}{2}n} \div 32^{\frac{1}{2}n}$$

(ii) (4 marks)

b) Without using tables evaluate the following:

$$\sqrt[5]{64} \times 4^{1.4}$$

(i) (2 marks)

(ii) $\log_{\sqrt{2}} 4$ (2 marks)

c) (i) Given $\log_{10} 2 = 0.3010$ and $\log_{10} 2.5$, determine without using tables (2 marks)

(ii) If $P = \log_{10} 2$ and $q = \log_{10} 3$ express $\log_{10} \sqrt{\frac{3}{5}}$ in terms of p and q. (4 marks)

(iii) If $x^3z = 1$, $y = x^2$ and $z = y^n$ determine the value of u. (3 marks)

Question Three

- a) The sum of the first ten terms of an arithmetic progression and the 10th term of the progression both are $-\frac{5}{2}$. Determine the 1st term and the common difference of the arithmetic progression. (7 marks)
- b) The sum of the first two terms of a geometric progression is 7 and the sum to infinity is 16. Determine the two possible values of the common ratio. (7 marks)
- c) The 1st, 5th and 8th terms of an arithmetic progression form consecutive terms of a geometric progression. If the first term is 16, determine the common difference of the arithmetic progression and the common ratio of the geometric progression. (6 marks)

Question Four

- a) Determine the greatest common factor (GCF) and lowest common multiple (LCM) of 2940 and 3150. (4 marks)
- b) (i) Evaluate $(3^2 - 2 \times 7) + (5 \times 2 - 2^2)$ (2 marks)
- (ii) Simplify $\frac{x+1}{5y+10} \times \frac{y+2}{x^2+2x+1}$ (2 marks)
- (iii) Rationalize $\frac{3}{3+2\sqrt{3}}$ (3 marks)
- c) Simply the following: $\frac{ax - ay + bx - by}{a + b}$ (2 marks)
- (i) $\frac{r/4}{7/8 - r/2}$ (3 marks)
- (ii)

d) Part d missing please add.

Question Five

a) Table 2 shows the distribution of length to the nearest mm of 40 bolts.

Table 2

Height (mm)	145 – 149	150 – 154	155 – 159	160 – 164	165 – 169	170 – 174	175 – 179
Frequency	2	5	16	9	5	2	1

Calculate:

- (i) The median length
- (ii) The lower and upper quartile
- (iii) 80th percentile

(13 marks)

b) Table 3 shows the distribution of marks of 40 candidates in a test:

Table 3

Marks	1 – 10	11 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 – 90	91 - 100
Frequency	2	2	3	9	12	5	2	3	1	1

Using an assumed mean of 55.5, calculate:

- (i) The mean mark
- (ii) The standard deviation

(7 marks)