



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**DIPLOMA IN MARINE ENGINEERING**

**EMR 2201 : ENGINEERING MATH 3**

**END OF SEMESTER EXAMINATION**

**SERIES: DECEMBER 2016**

**TIME: 2 HOURS**

**DATE:** Pick Date Select Month Pick Year

## Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of Choose No questions. Attempt Choose instruction.

**Do not write on the question paper.**

## Question ONE

a). Find the sum of the first 7 terms of the series 2, 5, 12, 12, ... (correct to 4 significant figures) (3 marks)

b) Evaluate:  $6P2$  (2 marks)

c.) Evaluate, in polar form:  $2 \angle 30^\circ + 5 \angle -45^\circ - 4 \angle 120^\circ$   
(6 marks)

d.) Determine the value of  $(3.039)^4$ , correct to 6 significant figures using the binomial theorem (5 marks)

e)  $\frac{1}{x+y} = \frac{4}{27}$   
 $\frac{1}{2x-y} = \frac{4}{33}$  (5 marks)

f) Solve the logarithmic equation  $\log_5(x+2) - \log_5 x = \log_5(2x-1) - \log_5(3x-12)$  (5 marks)

g) Express  $(-5, -12)$  in polar coordinates (4 marks)

## Question TWO

a) Solve the simultaneous equation (7marks)

$$5x - 3y - 2z = 31$$

$$2x + 6y + 3z = 4$$

$$4x + y - z = 30$$

b) Which term of the series 2187, 729, 243, ..... is  $\frac{1}{9}$  (3marks)

c) Use binomial theorem to determine  $(0.98)^7$  correct to 5 significant figures (6marks)

d) Determine the modulus and argument of  $Z = 2 + j3$  and express in polar form (4marks)

## Question THREE

a) The second moment of area of rectangle through its centroid is given by  $\frac{bl^3}{12}$ . Determine the approximate change in second moment of area if  $b$  is increased by 3.5% and  $l$  is reduced by 2.5% (5marks)

b) Given  $Z_1 = 1 - j3$  and  $Z_2 = -2 + j5$  determine  $Z_1 Z_2$

$$Z_1 + Z_2$$

c) Express  $(4.5, 5.16\text{rad})$  in Cartesian coordinates (3marks)

d) Prove that  $\frac{1 + \cot \theta}{1 + \tan \theta} = \cot \theta$  (5marks)

e) Evaluate  $\frac{10}{c^3}$  (3marks)

## Question FOUR

a) The first, 12<sup>th</sup> and last term of an arithmetic progression are 4, 31.5, and 376.5 respectively. Determine

i) number of terms in the series

ii) sum of all the terms in the series (6mks)

b) Determine the value of  $(-7 + j5)^4$  and give your answer in rectangular form (7mks)

c) Find the sum to infinity of the series  $3, 1, \frac{1}{3}$  (3marks)

d) Solve the logarithmic equation  $\log_4 x + \frac{4}{\log_4 x} = 5$  (4mks)

### Question FIVE

- a) Given  $Z = X + jy$  find the locus defined as  $\arg Z = \frac{\pi}{4}$  (5marks)
- b) Evaluate  $\sinh^{-1} 2.364$  (6marks)
- c) Find the four fourth roots of  $Z = 6(\cos 288^\circ + j\sin 288^\circ)$  (5marks)
- d) Determine the sum of the series 6.5, 8, 9.5, 11.....32 (4marks)

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