



# MURANG'A UNIVERSITY OF TECHNOLOGY

## SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

**FIRST YEAR SECOND SEMESTER EXAMINATION FOR**

AMM 118 – ENGINEERING MATHEMATICS II

DURATION: 2 HOURS

DATE: 23/04/2019

TIME: 9-11am

**Instructions to candidates:**

1. Answer question One and Any Other Two questions
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

**SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION**

**QUESTION ONE (30 MARKS)**

a) The sum of the first  $n$  terms of a series is  $2n + 3n^2$ . Show that the series is an arithmetic progression and find the sum of the first  $n$  terms occupying even places in the series 5mks

b) Find the values of  $a$  and  $b$  for which

$$\frac{5}{2\sqrt{2}+3} - \sqrt{2} = a + b\sqrt{2} \quad 4\text{mks}$$

c) Let  $U$  be the universal set and  $A$  its subset where

$$U = \{x : x \in \mathbb{N} \text{ and } x \leq 10\}$$

$$A = \{y : y \text{ is a prime number less than } 10\}$$

Find

i.  $A^c$  2mks

ii. Represent  $A^c$  in Venn diagram 2mks

d) Find the full binomial expansion of  $(1 - 2x)^5$ , giving each coefficient as an integer. Hence using a suitable substitution approximate  $(1.02)^5$  correct to 5 S.F 4mks.

e) Solve the system of equations with three variables by Cramer's rule 5mks.

$$x - 8y + z = 4$$

$$-x + 2y + z = 2$$

$$x - y + 2z = 1$$

f) If  $A$  and  $B$  are 2 sets and  $A \times B$  consists of 6 elements; if 3 elements of  $A \times B$  are  $(2,5)$   $(3,7)$   $(4,7)$ , find  $A \times B$ . 4mks

g) Write each of the following in standard form.

i)  $\frac{8i}{1+2i}$  2mks

ii)  $\frac{6-9i}{2i}$  2mks

**SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION**

**QUESTION TWO (20 MARKS)**

a) A committee of four is to be selected from a number of people, two of whom are women. If the number of ways both women can be in the committee is twice that of neither being on it, find the number of people available. 7mks

b) The first three terms of a convergent geometric progression are

$$\frac{1}{2-x}, \quad \frac{x}{(2-x)^2}, \quad \frac{x^2}{(2-x)^3}, \dots \quad -1 < x < 1$$

Show that the sum of all the other terms is

$$\frac{x^3}{2(1-x)(2-x)^3} \quad \text{8mks}$$

C) Given that  $\beta = 8 + 3\sqrt{7}$ , find  $\beta + \frac{1}{\beta}$  in the form  $a + b\sqrt{c}$  where  $a, b$  and  $c$  are rational 5mks

**QUESTION THREE (20 MARKS)**

a) Solve the given system of equations using Cramer's rule. 5mks

$$\begin{aligned}x + 3y + 3z &= 5 \\3x + y - 3z &= 4 \\-3x + 4y + 7z &= -7\end{aligned}$$

b) Multiply the following and write the answer in standard form 3mks

$$(2 - \sqrt{-100})(1 + \sqrt{-36})$$

c) Let  $A = \{a, b, c\}$ ,  $B = \{d, e\}$ ,  $C = \{a, d\}$

Find

- i.  $A \times B$  2mks
- ii.  $B \times A$  2mks
- iii.  $A \times (B \cup C)$  2mks
- iv.  $(A \cap C) \times B$  2mks

- v.  $(A \cap B) \times C$  2mks  
vi.  $A \times (B - C)$  2mks

**QUESTION FOUR (20 MARKS)**

- a) Find the square root of  $32 - 6\sqrt{15}$  8mks  
b) If  $z = 2 - i$  find  $\bar{z}$  3mks  
c) If  $z = a + ib$ , show  $|z|^2 = z\bar{z}$  3mks  
d) Write down the polar form of each of the following complex numbers  
i)  $Z = -1 + i\sqrt{3}$  2mks  
ii)  $Z = -9$  2mks  
iii)  $Z = 12i$  2mks