

Autumn Semester Examination 2018
Paro College of Education
Royal University of Bhutan
Paro

Module: MAT 203 (Algebra and Trigonometry)

Programme: B.Ed(S)

Level: II

Writing Time: Three Hours

Full Marks: 100

Instructions: Do not write during the first 15 minutes. Use this time for reading the questions. You will get three hours for answering the questions. Write the answers to all the questions in the answer sheets provided. Read the directions to each section and to each question carefully before answering the questions. You are allowed to carry a scientific calculator of **fx-82 or fx-100** beside other writing materials.

SECTION A
One Question - 40 marks

Question 1

Instructions: Attempt all the sub-questions in this question. Each sub-question carry equal marks.

- a. Define 'complement set' and provide an appropriate example to support your definition.
- b. Draw AND and OR switching circuits diagrams with truth tables.
- c. Define factorials using any two practical examples.
- d. Verify the identity: $2 \tan x \sec x = \frac{1}{1 - \sin x} - \frac{1}{1 + \sin x}$
- e. What is Boolean algebra? How is it Boolean numbers different from binary numbers? State at least one example to differentiate them from each other.
- f. Tashi Namgyal Resort offers 5 choices of drinks, 5 choices of main meal and 3 choices of dessert. A customer can choose to eat just one course, or two different courses, or all three courses. Assuming all choices are available, how many different possible meals does the restaurant offer?
- g. Prove that $(x - 2)^3 = x^3 - 6x^2 + 2x - 8$ using binomial theorem expansion.
- h. Define the subset and list all the subsets of P, if $P = \{a, b, c, d\}$.
- i. What are the different operations used in Boolean algebra? Describe the relation of each operation with appropriate logic gates.
- j. How many three-letter logo can be made from the letters in the word 'HAPPINESS' if:
 - i. Repetition is not allowed?
 - ii. Repetition is allowed?

SECTION B
SIX Questions - 60 Marks

Instructions: There are SIX questions in this section. Attempt any FIVE. Each question carries 12 marks. You must show all working steps for each question.

Question 2

- a. What is binomial and why binomial theorem? Solve the following using binomial theorem: [6]
- i. $(a + b)^3 = ?$
- ii. $(a + b)^4 = ?$
- b. Find the Cartesian product of the following sets. Identify which Cartesian product property does this product matches. [6]

$R = \{\text{yellow, red, green}\}$ and

$S = \{\text{cup, plate, mug}\}$

Question 3

- a. Prove that $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{7\pi}{8} = \frac{3}{2}$ [6]
- b. Prove that $\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$. [6]

Question 4

- a. What are the properties of binomial expansion? Describe each of them in brief along with an appropriate example to support your explanation. [6]
- b. What are the basic Boolean algebraic identities? List and describe in terms of both additive and multiplicative ways. [6]

Question 5

- a. List the elements of the following sets and answer the questions accordingly [6]

Universal set = {Natural numbers less than 19}

$A = \{\text{Triangular number less than 19}\}$

$B = \{\text{Prime numbers less than 19}\}$

$C = \{\text{Odd numbers less than 19}\}$

$D = \{\text{Composite number less than 19}\}$

Find:

i. $n(A \cup B)$

ii. $(B \cup C')$

iii. $(C \cap D)'$

- b. Use information (elements of sets A, B, C and D) from Q. 5a (above) and show the following relationship with the help of Venn diagram: [6]
- Elements of A, B and C
 - Elements of A, C and D

Question 6

- What is permutation? How is it different from combination? State at least two prominent key ideas to differentiate between the two with appropriate examples. [6]
- Define each of the following concepts with appropriate example to support your statements: [6]
 - Subsets
 - Complement of sets
 - Union of sets

Question 7

- What do you understand by the principle of mathematical induction? Explain with the help of an appropriate example to prove your statement. [6]
- Using the diagram below, prove the statement $A + AB = A$. [6]

$$\mathbf{A + AB = A}$$

