MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCE

DEPARTMENT OF APPLIED SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

FIRST YEAR **FIRST** SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN BUSINESS INFORMATION TECHNOLOGY

AMM101 – BASIC MATHEMATICS

DURATION: 2 HOURS

DATE: 7TH DECEMBER 2017

TIME: 2.00PM – 4.00PM

Instructions to Candidates:

1. Answer **Question 1** 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 (COMPULSORY)

QUESTION ONE

a) Define the following terms as used in set theory

i. The intersection of sets A and B

ii. An empty set

iii. The difference of sets A and B (3 Marks)

b) Let $F: A \to B$ where $A = \{1,2,3,4\}$ and $B\{a, b, c, d\}$ such that $f(1) = C, f(2) = b$, $f(3) = d\ f(4) = a$. Check whether F is a bijection. (3 Marks)

c) Construct a truth table for the following compound proposition. $\rho \wedge r \leftrightarrow (\neg(p \vee q) \to r$ (4 Marks)

d) If x and y are even integers, apply direct proof to show that $x + y$ is even. (3 Marks)

e) i) Determine the 4 terms between 4 and 128 which together form a geometric sequence. (3 Marks)

ii) Evaluate; $\sum_{n=1}^{10} \left({}^{3}/_{4}\right)^{n}$ (3 marks)

f) Verify the identity $\frac{1+\sin x}{\cos x} + \frac{\cos x}{1+\sin x} = 2\sec x$ (3 Marks)

g) How many different four figure number can be formed from the digits 0,1,2,3,4,5,6 if repetition is not allowed. (2 Marks)

h) Given that $f(x) = 3x^3 - 2x^2 + kx + 9$ and when $f(x)$ is divided by $x + 2$, the remainder is -35. Find the value k. (3 Marks)

i) Determine the constant term in the binomial expansion $\left(2a - {}^{3}/_{a}\right)^{8}$ (3 Marks)

SECTION B (ANSWER ANY TWO QUESTIONS)

QUESTION TWO

a) Use mathematical induction to show that

$1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{1}{6}n(n+1)(2n+1) \forall n \in \mathbb{N}$ (7 Marks)

b) Prove that if x is an even integer then x^2 is even (3 Marks)

c) Let $A = \{p, q, r, s, t\}$and $B = \{x, y, z, w\}$. Define $F \vdots A \to B\ by\ f(p) = x, f(q) = y$, $f(r) = z, f(s) = w, f(t) = y$. Find the domain, codomain and the image of F. (4 Marks)

d) Given that $f(x) = \frac{4-5x}{-6x+3}\ and\ g(x) = \frac{2-4x}{8x-7}$ find;

i. $(fog)(x)$ and state the domain. (4 Marks)

ii. $(fog)(-1)$ (2 Marks)

QUESTION THREE

a) A survey of 500 students showed that 300 of them have been to Nairobi city, 50 to Mombasa city and 200 to Kisumu city; 40 to Mombasa and Kisumu, 10 to Nairobi and Mombasa, 150 to Kisumu and Nairobi and 8 have been to all the cities. Determine how many of the students have been to;

   i. None of the three cities (3 Marks)

   ii. Exactly one of the cities (3 Marks)

   iii. At least two cities (3 Marks)

   iv. Nairobi only. (1 Marks)

b) Let $A = \{1,2,3\}$ and $B = \{e, f, g, h\}$.Find $|A \times B|$ (2 Marks)

c) The number of bacteria in a colony was originally 3 million. The number doubled itself after every one hour. Calculate the number of bacteria generated by the colony during the 7th hour. (2 Marks)

d) Find the least number of terms of the geometric progression $2 + 6 + 18 + 54 + \cdots$ that must be taken in order that the sum exceeds 125,000. (6 Marks)

QUESTION FOUR (20 Marks)

a) i) Solve for P in the equation $^{p}C_2 = 28$ (3 Marks)

   ii) Omondi has five teachers. In how many ways can he invite at most three of his teachers to his graduation party? (3 Marks)

b) Construct the truth table for the following propositions, stating whether a fallacy, tautology or an indeterminate

   i. $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$ (4 Marks)

   ii. $\neg|p \rightarrow (p \vee \neg q)$ (2 Marks)

   iii. $\neg[p \rightarrow (p \vee q)]$ (2 Marks)

c) Solve $\sin\theta + 5\cos\theta = 2$ (6 Marks)

QUESTION FIVE

a) i) Simplify the expression $\dfrac{1}{\sqrt{x^2 - a^2}}$ in terms of $\tan\theta, if\ x = acosec\theta$ (4 Marks)

   ii) Prove that $\frac{1+tan^2\theta}{sec^2\theta} = cos2\theta$ (4 Marks)

b) Use analytic method to prove that if $\mathcal{E}$ is the universal set, A and B are sets in $\mathcal{E}$ then

$(A \cup B)^c = A^c \cap B^c$ (4 marks)

c) In a triangle ABC, $a = 3.5cm, b = 4cm\ and\ c = 5cm$. Calculate the size of angle A and hence calculate the area of the triangle. (5 Marks)

d) A mixed hockey team containing five men and six women is to be chosen from seven men and nine women. In how many ways can this be done? (3 Marks)