JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTUARIAL

1^{ST} YEAR 1^{ST} SEMESTER 2022/2023 ACADEMIC YEAR

(MAIN/SIAYA/ONLINE/KISUMU) NAIROBI

COURSE CODE: WMB 9101

COURSE TITLE: MATHEMATICS I

EXAM VENUE: **STREAM: (BSc. Actuarial)**

DATE: 19/12/2022 **EXAM SESSION: 9.00-11.00AM**

TIME: 2.00 HOURS

(MAIN/SIAYA)

<u>Instructions:</u>

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (30 marks)COMPULSORY

a) Define the following terms:
   i) A bijective function
   ii) A singleton set. (4mks)

b) Given that $A = \{1,2\}$, $B = \{x, y, z\}$ and $C = \{\emptyset\}$. Determine

   i) The cardinality of power set of B. (2mks)
   ii) The power set of C. (2mks)
   iii) The Cartesian product of $A \times B$ (2mks)

c) Solve the Quadratic equation $3x^2$+ 5x+2=0 (4mks)

d) Given that $\frac{3+\sqrt{2}}{4-2\sqrt{2}} = a + b\sqrt{c}$. Find the values of $a, b$and c. (4mks)

e) Given that X and Y are two non-empty sets, draw the Venn diagram of
   $(P \cap R) \cap Q^C$. (3mks)

f) Find the value of t given that $\log_{243} t = -\frac{1}{5}$. (3mks)

g) Evaluate P (20, 5) and C (50, 15) using the concept of permutation and combination. (4mks)

h) Convert $\frac{3\pi}{5}$ radians into degrees. (2mks)

QUESTION TWO (20 marks)

a) Write the following as a single logarithm
   $\log_a 7 + 4\log_a 3$(3mks)

b) Let $U = \{1,2, \dots, 9\}$, $A = \{2.5.7.9\}$, $\boldsymbol{B} = \{\boldsymbol{x}: \mathbf{1} < x \leq 7 \text{ and } x \text{ is an integer}\}$ and $C = \{x: x \text{ is an odd number between } 2 \text{ and } 8\}$. Find
   i) $(A \cup B)^c$ (2mks)
   ii) $A \backslash B$(1mk)
   iii) $A \cap B^c$ (2mks)

c) A research conducted on the games played among 1050 students in JOOUST. It was found out that:

238 students play volleyball,
245 students play basketball,
270 students play hockey,
78 students play both volleyball and basketball,
105 students play both hockey and basketball,
95 students play both hockey and volleyball,
45 students play all the three types of games.

I) Present the above information on a Venn diagram. (5mks)

II) Find the total number of students who

i) play two types of games only. (2mks)

ii) who play one type of game only. (2mks)

iii) who do not play any of the three types of games. (3mks)

QUESTION THREE (20 marks)

a) Solve the triangle XYZ given that $XY = 12cm, YZ = 8cm$and $XZ = 9cm.$ (5mks)

b) Let f(x) = 2x+1 and g(x) =$\underline{\boldsymbol{x^3}}$and $h(x) = \frac{5+2x}{4}$.

i) Show that $f \circ g \neq g \circ f$. (6mks)

ii) Find $f \circ g(2)$. (2mks)

iii) Find the inverse of $h(x)$. (3mks)

c) Prove the identity $\frac{1+\tan\theta}{1+cot\theta} = tan\theta$. (4mks)

QUESTION FOUR (20 marks)

a) Find the 9th term of the sequence: 10, 9,$\frac{81}{10}$, $\frac{729}{100}$, ...(5mks)

b) Find the sum: 60+64+68+72+…+120 (4mks)

c) In a hospital, the number of patients treated n a year are indicated as below according to their ages:

Age of Patients	**Number of Patients**
10 - 19	8
20 - 29	16
30 - 39	21
40 - 49	11
50 - 59	3

Find

(i) The median (3mks)
(ii) The Modal class (1mk)
(iii) The Mean (3mks)
(iv) The standard deviation (4mks)

QUESTION FIVE (20 marks)

a) Solve the equation $\log(10x - 4) + \log(x + 1) = \log(9x)$. (8mks)

b) A person takes part in a medical trial that tests the effect of a medicine on a disease. Half the people are given medicine and the other half are given a sugar pill, which has no effect on the disease. The medicine has a 70% chance of curing someone. But, people who do not get the medicine still have a 20% chance of getting well. There are 50 people in the trial and they all have the disease. Draw a tree diagram of all the possible cases. What is the probability that a person gets cured? (12mks)