MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEERING, APPLIED SCIENCES & TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION SYSTEMS

MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

CODE: BCOS 115

SESSIONAL EXAMINATIONS

APRIL 2023

DURATION: 3 HOURS

EXAMINER: MR I. ZVAWANDA

INSTRUCTIONS

1. *Answer **ALL** questions from Section A*
2. *Answer any **three** questions from Section B*

REQUIREMENTS

Non-programmable scientific calculator

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

A1. Define the following terms as used in mathematical foundations

i) Combination

ii) proposition

iii) Intersection of a Set

iv) Analogue

b) Distinguish between disjunction and conjunction

[2, 2, 2, 2, 2]

A2. Let p be the statement 'She studied Computer Science at the Manicaland State University of Applied Sciences" and let q be "She lives in Mutare".

i) Find the disjunction of the composite statement and construct the truth table.

ii) What do you understand by the term "negation of a statement'

[6,5]

A3

i) State and explain the three types of functions

ii) Let p be "roses are red " and q be "violets are blue". Find the conjugation $p \wedge q$ of the original statement and construct the truth table.

[9,4]

A4

Verify that ¬(p ^ q.). = ¬ p ∨¬ q { Apply the De Morgan's law. **[6]**

SECTION B: ANSWER ANY THREE (3) QUESTIONS IN THIS SECTION

B5

a) Determine whether the propositions $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent

b) Prove that if $A \subseteq B$ and $B \subseteq C$ then $A \subseteq C$

c) Show that two sets A and B are equal if they contain the same elements

[7, 7, 6]

B6

a) Relations can be divided into four types. State and explain the four types of relations.

b) Show that

i. a*a =a

ii. a+a=a

[14,3,3]

B7

a) Find the inverses of the following functions

i) **y=** e^{6x}

ii) $Y = \text{In}\,(2x - 2)$

iii) $Y = \frac{2x}{x+3a}$

b) Prove that $\sqrt{2}$ is not a rational number

c) Construct a truth table of the following switching circuit

$A \wedge (B \vee A^c)$

[2, 3, 3, 6, 6]

B8

a)

i. Negate the statement $\forall\ x \in R,\ \exists\ \ y\ \in R, : x \geq y$

ii. If R ={(c,4), (c,6), (5, d)} is a relation from A to B. Find the inverse relation of R?

b) Find $f_o g$ of each of the following

i) $f(x)= x+2$, $g(x)= x^2-4$

ii) $f(x)=x^2$, $g(x)=x^3$

iii) $f(x)=\sqrt{x^2-1}$ $g(x)= \sqrt{x^2+1}$

[6, 6, 2, 3, 3]

END OF QUESTION PAPER