



PAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY
FACULTY OF HEALTH AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BAMS	LEVEL: 6
COURSE CODE: MAS501S	COURSE NAME: MATHEMATICAL STRUCTURES
SESSION: JUNE 2019	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 94

FIRST OPPORTUNITY QUESTION PAPER	
EXAMINERS	MR. B.E OBABUEKI
MODERATOR:	PROF. S.A REJU

INSTRUCTIONS	
1.	Answer ALL the questions in the booklet provided.
2.	Show clearly all the steps used in the calculations.
3.	All written work must be done in blue or black ink and sketches must be done in pencil.
4.	Start each of questions 1, 2, 3, 4, 5 and 6 on a new page.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 4 PAGES (including this front page)

QUESTION 1 (Number systems) [24 marks]

1.1 Perform the following addition and subtraction.

1.1.1 $2342.32_6 + 25533.023_6 + 4531.33_6 + 2311.214_6$ (4)

1.1.2 $AC62.0D6_{16} - 4FCD.0F0C_{16}$ (4)

1.2 Perform the following conversions

1.2.1 Convert 46295.425_{10} to hexadecimal, correct to four hexadecimal places. (7)

1.2.2 Convert 1100110110.10101_2 **directly** to base 16 (3)

1.2.3 Convert $A6B.0C_{16}$ to base ten. (6)

QUESTION 2 (Logic and truth tables) [18 marks]

2.1 Copy and complete the following truth table (8)

q	r	s	$\sim q \vee \sim s$	$\sim (q \vee r) \wedge r$	$(\sim r \wedge s) \Rightarrow q$	$\sim (r \vee s) \Rightarrow \sim q$
T	F	T				
F	T	F				
F	F	T				
T	T	F				

2.2 Consider the following statements:

Statement A: Peter goes to school and the rain does not fall if the sun does not shine and Mary does not play.

Statement B: If Mary plays and the sun does shine, then either the rain will not fall or Peter goes to school.

2.2.1 Declare four variables p, r, s, m to represent each of the four primary statements respectively. (4)

2.2.2 Write statements A and B in logic symbolic form. (6)

QUESTION 3 (Algorithm design) ([12 marks])

Draw a flowchart that reads 500 numbers, identifies only the even numbers, counts how many even numbers are read, and outputs the number of even numbers and their average. (12)

QUESTION 4 (Boolean Algebra) [17 marks]

Consider the Boolean expression $E(x, y, z)$

4.1 Draw the logic circuit for $E(A, B, C) = \overline{AB} + \overline{A+B} + \overline{A(B+C)}$ (5)

4.2 Simplify E into an s-o-p form. Call this F (5)

4.3 Draw the logic circuit for F (3)

4.4 Copy and complete the following truth table. (4)

A	B	C	E	F
1	0	1		
0	1	0		
1	1	0		
0	0	1		

QUESTION 5 (Partial fractions) [18 marks]

Express each of the following fractions as a sum of its partial fractions

5.1 $\frac{5x^2 + 4x - 2}{(x^2 - 4)(x + 3)}$ (7)

5.2 $\frac{2x^2 - x + 1}{(x^2 + 3)(x + 3)}$ (11)

QUESTION 6 (Methods of proof) [17 marks]

6.1 Prove that the sum of four even numbers is even. (8)

6.2 Use mathematical induction to prove that the sum of the squares of the first n natural numbers is $\frac{n}{6}(n+1)(2n+1)$. (9)

End of paper

Total marks: 94