



PANJAB 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: JULY 2019	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SUPPLEMENTARY / SECOND OPPORTUNITY QUESTION PAPER	
EXAMINERS	MR. B.E OBABUEKI
MODERATOR:	PROF. S.A REJU

INSTRUCTIONS
<ol style="list-style-type: none">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) [23 marks]

1.1 Perform the following additions and subtractions

1.1.1 $2342.362_7 + 25533.023_7 + 6531.33_7 + 2306.213_7$ (4)

1.1.2 $3AC62.0D6_{16} + 14FCD.0F0C_{16} + ABCD.EF75_{16}$ (5)

1.1.3 $44202.32_5 - 24330.442_5$ (4)

1.2 Perform the following conversions

1.2.1 Convert 295.425_{10} to octal, correct to four octal places. (6)

1.2.2 Convert $A602.2C_{16}$ **directly** to binary (4)

QUESTION 2 (Logic and truth tables) [15 marks]

2.1 Copy and complete the following truth table (8)

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

2.2 Construct a truth table to verify whether the following statements are equivalent or not.

The statements are:

Statement A: All short men are brave

Statement B: A man who is not brave is not short.

(Use the variable p for "man is short" and the variable q for "man is brave".) (7)

Use this table as your table format:

p	q				
T	T				
T	F				
F	T				
F	F				

QUESTION 3 (Algorithm design) ([13 marks]

Write a do-while pseudocode that reads 500 numbers, identifies only the odd numbers, counts how many odd numbers are read, and outputs the number of odd numbers and their average. (Note that the numbers to be read can be any type of numbers.) (13)

QUESTION 4 (Boolean Algebra) [20 marks]

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

4.1 Draw the logic circuit for $E(A, B, C) = \overline{\overline{A} + B} + \overline{AB} + \overline{\overline{\overline{B} + C}}$ (7)

4.2 Show that E simplifies to an s-o-p form $F = \overline{A} + \overline{B} + C$ (6)

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) [15 marks]

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

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

5.2 $\frac{2x^2 - x + 1}{(x^2 + 1)^2(x - 3)}$ (8)

QUESTION 6 (Methods of proof) [14 marks]

6.1 Prove that the sum of two odd numbers is even. (7)

6.2 Use mathematical induction to prove that

$$1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + n \cdot (n+1) = \frac{n}{3}(n+1)(n+2). \quad (7)$$

End of paper

Total marks: 100