QUESTION ONE 30 MARKS (COMPULSORY)

a. By use of operator tables to form a truth table, prove the given Boolean equation

29	B 34 590	I down
- 1 fro + 7	$1 = (x \circ v)$	+ (X 2)
The last of the	$=(x\cdot y)$	CONTRACTOR STATE
Law The Same	specialists (III) and	

4 Marks

a. With

b. With

gate.

State

QU

app

a. Wh

b. lm

c. W

b. Solve

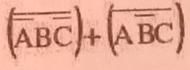
3 Marks 35₁₀ - 72₁₀ using two's complement format with 8-bit numbers.

3 Marks 65₁₀ – 25₁₀ using one's complement format with 8-bit numbers.

c. Design and implement a circuit that counts the number of 1's present in 3 inputs A, B and C. Its output is a two-bit number X1X0, representing that count in binary. Using a K-map, find the minimized logic equations for outputs X1 and X0. Assume active-HIGH logic. 7 Marks

3 Marks

d. Simplify the given Boolean equation



Simplify the Boolean expression F = C(B + C)(A + B + C). 3 Marks

Simplify the following expression into sum of products using Karnaugh map F(A,B,C,D)

$$= \sum (1,3,4,5,6,7,9,12,13)$$

7 Marks

QUESTION TWO 20 MARKS

a. By use of the postulates learnt in class, prove the following: i. x + x = x and ii. $x \cdot x = x$

5 Marks

b. Express the Boolean function F = xy + x'z as a product of maxterms.

6 Marks

c. Simplify the Boolean function

5 Marks

d. Implement the following Boolean function with NAND gates: F(x.y. z)= (1.2.3.4.5.7)

4 Marks

QUESTION THREE 20 MARKS

a. Use K-map to find the minimum-cost SOP expression for the function 4 Marks

Write the expression for Boolean function F (A, B, C) = $\sum m (1,4,5,6,7)$ in standard POS 4 Marks

form. 4 Marks Implement the following function using a 3 line to 8 line decoder.

$$S(A,B,C) = \sum m(1,2,4,7)$$

 $C(A,B,C) = \sum m(3,5,6,7)$

What are universal gates? Construct a logic circuit using NAND gates only for the 5 Marks

expression X = A.(B + C). 3 Marks Compare and contrast combinational and sequential digital circuits

QUESTION FOUR 20 MARKS

a. With relevant logic diagram and truth table explain the working of a two input EX-OR gate.
b. With relevant diagram explain the working of master-slave JK flip flop.
8 Marks

c. State and prove Demorgan's laws.

5 Marks

QUESTION FIVE 20 MARKS

a. What is a flip-flop? State the difference between a latch and a flip-flop and list out the applications of flip-flop.
 4 Marks

b. Implement $f_1(X_2; X_1) = \sum m(0; 3)$; $f_2(X_2; X_1) = x_2 + x_1$; $f_3(X_2; X_1) = \pi M(1)$ with a 4 x 3 ROM

9 Marks

With the help of a truth table explain the working of a half Subtractor. Draw the logic diagram using gates.
 7 Marks