

GM²

Question One

- ✓ a) Briefly explain the meaning of an encoder circuit. (2 marks)
- ✓ b) Design a 2-line to 4-line decoder circuit and implement it using logic gate. (8 marks)
- ✓ c) i) State one application of flipflops (1-mark)
- ✓ ii) What is the difference between a flipflop and a latch? (2marks)
- ✓ iii) Name four types of flipflops. (4 marks)
- ✓ iv) Draw a symbol for each flipflop named in (iii) above. (4 marks)
- ✓ d) i) What is meant by a shift register? (2 marks)
- ✓ ii) State one application of shift register. (1 mark)
- ✓ iii) Use a block diagram to show how a serial-in parallel-out (SIPO) shift register is designed. (6 marks)
- ✓ e) Distinguish between:
 - i) Combinational and Sequential circuits. (4 marks)
 - ii) Multiplexer and De-multiplexer.
- ✓ f) Use the rules of Boolean Algebra to simplify the following expressions. (7 marks)
 - ✓ i) $(A + B)(A + C)$
 - ✓ ii) $\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$

$$\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$$
 Associate with ABC

$$BC(\bar{A} + A) + A\bar{C}(B + \bar{B}) + AB(\bar{C} + C)$$

$$= BC + A\bar{C} + AB$$

Question Two

✓ a) Convert the following Binary Numbers into Decimal without the use of calculator

- (i) 1101
- (ii) 111000
- (iii) 1001101
- (iv) 1011010

(3 marks each)

✓ b) Convert the following to Binary

- (i) 600_{10}
- (ii) $(2AF5)_{16}$

(4 marks each)

Question Three

✓ a) Find the Boolean expression for the logic circuit shown in the figure 1 below (8 marks)

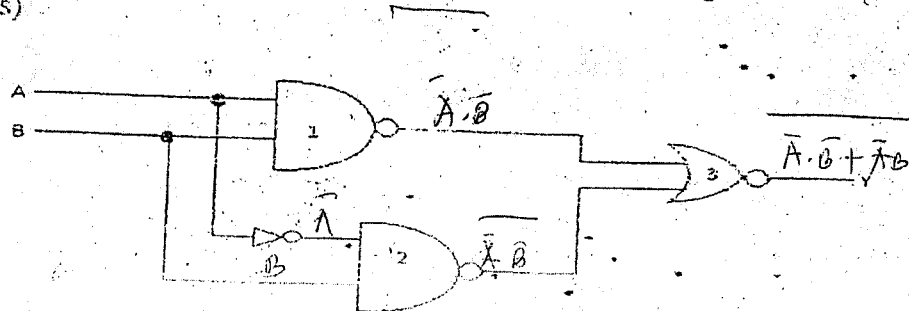
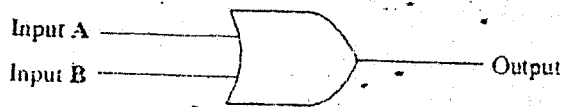
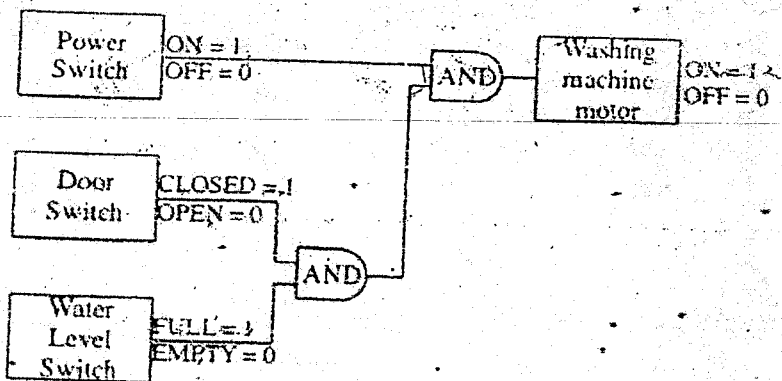


Figure 1

(b) The diagram shows the symbol for one type of logic gate.



- i) Name the type of gate used. (1 mark)
- ii) Draw and complete the truth table of this gate. (3 marks)
- c) The diagram shows a control system which may be fitted in an automatic washing machine.



- i) Draw and complete a truth table for this control system. (3 marks)
- ii) What conditions will stop the washing machine working? (3 marks)

Question Four

a) Draw the Karnaugh map and use it to simplify the logic function (9 marks)

$$Z = \bar{A}B + \bar{A}\bar{B} + AB$$

$\bar{A} \cdot B + \bar{A} \cdot \bar{B} + A \cdot B$
 as associative in AB
 $\bar{A} \cdot B + AB + \bar{A} \cdot \bar{B} + AB$

b) Distinguish between a static and dynamic memories (4 marks)

c) i) Convert the following into bits; (3 marks)

- a) 28 bytes
- b) 23 kilobyte
- c) 3 Megabyte

ii) Distinguish between ROM and RAM (4 marks)

Question Five

(a) An industrial process receives inputs from four sensors A, B and C. The output of the process is HIGH when at least two of the inputs are HIGH.

i) Design a logic expression for this system and obtain the minimized expression. (5 marks)

ii) Implement the logic expression of (i) above using logic gates. (3 marks)

b) i) Draw a block diagram of a full-adder, showing all inputs and output signals (2 marks)

ii) Draw and fill its truth table (4 marks)

iii) Design a logic circuit for a full-adder. (6 marks)