

Ex/SC/PHY/UG/CORE/TH/07/2025/OLD

BACHELOR OF SCIENCE EXAMINATION, 2025

(2nd Year, 1st Semester)

PHYSICS (Honours)

PAPER : CORE-7

(Digital Systems and Applications)

Time : Two Hours

Full Marks : 40

Answer one question from each CO.

[CO1]

1. (a) Add the signed binary number (1) 010011·11 with (0) 010111·11 and write down the answer in decimal and hexadecimal number systems.
- (b) If $(\sqrt{44})_r = 6_{10}$ is a correct arithmetic operation, then find the value of radix r .
- (c) Reduce the Boolean expressions :
 - (i) $A + A'B + A'B'C + A'B'C'D + \dots$
 - (ii) $(X + Y + Z)(\bar{X} + \bar{Y} + \bar{Z})X$into minimal form.

PHY-1268

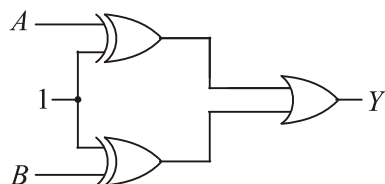
[Turn Over]

(2)

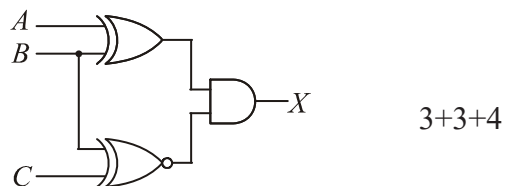
- (d) Draw the circuit diagram of 2-input NAND gate using transistor-resistor logic. 2+2+(2+2)+2

2. (a) Given that $X = A'B + AB'$ and $Y = A'B' + AB$. Show that $X \oplus Y$ is a constant.

- (b) Show that the circuit given below is a universal gate and implement AND gate using the same.



- (c) For the circuit given below, find the input conditions for which output $X = 1$.



(5)

- (c) Convert the shift register into a ring counter by making appropriate connection and show the count sequence if initially it is loaded with number 3. 4+2+4

6. Explain with a circuit diagram the operation of a 4-bit synchronous counter. Discuss its main difference and advantage over ripple counter. 5+5

[CO4]

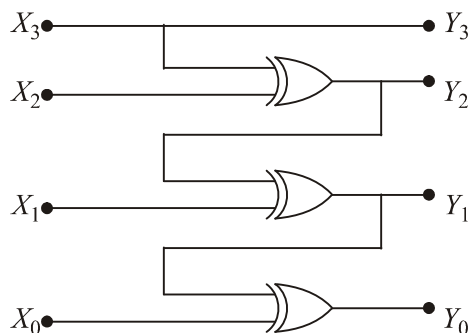
7. (a) Write the sizes of address bus, data bus and memory space of 8085 microprocessor.
- (b) Write the names and sizes of registers of 8085 P. Which registers can be used as register pairs?
- (c) What are the main functions of PC and SP? 2+4+4
8. (a) Write the syntax of instructions MOV, LDA, ADD and ADC for 8085 P. Explain their operations with simple examples.
- (b) Which of the above instructions affects flag register? 8+2

★ ★ ★

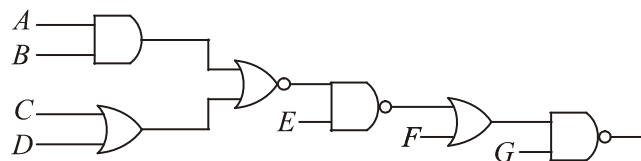
(3)

[CO2]

3. (a) The binary inputs 1011 have been applied at $X_3 X_2 X_1 X_0$ inputs in the shown logic circuit made of XOR gates. Find the binary output $Y_3 Y_2 Y_1 Y_0$ of the circuit.



- (b) Find out the output of the circuit given below for
(i) $A = 0, B = 1, C = 0, D = 0, E = 1, F = 1, G = 0$; and
(ii) $A = 1, B = 1, C = 1, D = 0, E = 0, F = 0, G = 0$.



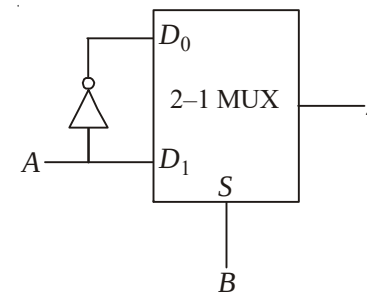
- (c) For a three input (A, B, C) digital circuit output Y is HIGH when inputs are 011, 101, 110 and 111 and LOW for all other combination of inputs. Design the circuit.

PHY-1268

[Turn Over]

(4)

- (d) A logic circuit has been implemented by using a 2 to 1 multiplexer as shown in the figure below. Find the Boolean expression for output F in terms of A and B .



2+3+3+2

- 4.(a) A four variable switching functions (F) is given
 $F(A, B, C, D) = \sum m(1, 3, 5, 7, 8, 9)$. Reduce it into a minimal expression in SOP and implement it in AOI (using AND, OR, NOT gates) and NAND logic.

- (b) What is decoder (MUX)? Write the intended performance of octal to binary decoder, hence obtain its truth table and determine the logic expression for its outputs. Draw its circuit diagram.

2+3+5

[CO3]

5. (a) Draw the circuit diagram of a 4-bit shift register using JK flip-flop and explain its operation.
(b) How a 4-bit number can be divided by 4 using the shift register?

PHY-1268

[Continued]