

1 (Sem-6/FYUGP) PHY 62 MJ

2026

PHYSICS

(Major)

Paper : PHY0600204

(Digital Electronics)

Full Marks : 45

Time : 2 hours

*The figures in the margin indicate full marks
for the questions.*

1. Answer the following as directed : 1×5=5

(a) In an IC, silicon dioxide (SiO_2) acts as

(i) a substrate layer

(ii) an insulating layer

(iii) a transistor

(iv) a resistor

(Choose the correct option)

(2)

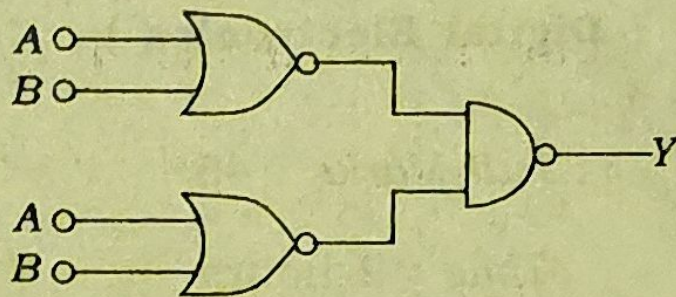
(b) BCD code is also called _____ code.

(Fill in the blank)

(c) Sequential circuits are slower than the combinational circuits.

(State True or False)

(d) For the given circuit diagram



the output Y is

(i) $A + B$

(ii) AB

(iii) $\overline{A + B}$

(iv) $\overline{A \cdot B}$

(Choose the correct option)

(e) The storage capacity of each stage in a shift register is _____ bits.

(Fill in the blank)

2. Answer any *five* of the following questions :

2×5=10

~~(a)~~ Convert the following hexadecimal numbers to binary :

(i) D45

(ii) AC3.6

~~(b)~~ Obtain the SOP form of the function

$$Y = AB + ACD$$

(c) Simplify the following expression with the help of Boolean algebra rules :

$$Y = ABC[AB + \bar{C}(BC + AC)]$$

~~(d)~~ Using 2's complement, perform the subtraction

$$(19)_{10} - (25)_{10}$$

~~(e)~~ Draw the external circuit diagram of an IC 555 used as an astable multivibrator.

(f) Draw the logic diagram of a clocked S-R flip-flop. Write the characteristic equations of S-R flip-flop.

- (g) What are shift registers? What are the basic types of shift registers?
- (h) Mention two differences between active and passive components of IC.
- (i) What are low- and high-level languages? Give examples.
- (j) Draw the logic symbol of XOR gate and construct the truth table.

3. Answer any four of the following questions :

5×4=20

- (a) Using NAND gates only, realize the following gates :

(i) AND

(ii) OR

(iii) NOT

- (b) Draw the logic circuit for the following function using NOR gates :

$$(A + B)(B + C)(A + C)$$

- (c) Simplify the Boolean function

$$F(A, B, C, D) = \sum m(7, 9, 10, 11, 12, 13, 14, 15)$$

with the help of K-maps.

- (d) Express the function $Y = A + \overline{B}C$ in
(i) canonical SOP and (ii) canonical POS forms.

- (e) Explain the function of a D flip-flop using a suitable diagram. Write the characteristic table of a D flip-flop.

- (f) What is half adder? Draw the logic diagram and write the truth table of a half adder.

- (g) Distinguish between static RAM and dynamic RAM. What is a cache memory? What is its function?

- (h) Distinguish between combinational and sequential logic circuits. What do you mean by latch? Draw the circuit diagram of a bistable multivibrator or a flip-flop.

4. Answer any one of the following questions : 10

- (a) Draw the block diagram and truth table of a full subtractor. Design a full subtractor logic circuit by using K-map.

5+5=10

- (b) (i) Draw the logic diagram of a master-slave J - K flip-flop and explain its operation with the help of a truth table.

6

- (ii) What is race-around condition of a J - K flip-flop? How is the race-around condition eliminated?

4

- (c) Draw the pinout diagram of IC 555. Explain the working of an astable multivibrator with duty cycle more than 50% using IC 555 timer and draw the relevant waveforms.

2+8=10

(7)

(d) Write short notes on any *two* of the following : 5×2=10

- (i) Full Adder
- (ii) CPU and ALU
- (iii) Serial-In Serial-Out Shift Register
- (iv) MAR and MDR

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