

1 (Sem-6/FYUGP) PHY 62 MJ

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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 : $1 \times 5 = 5$

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

(i) a substrate layer

(ii) an insulating layer

(iii) a transistor

(iv) a resistor

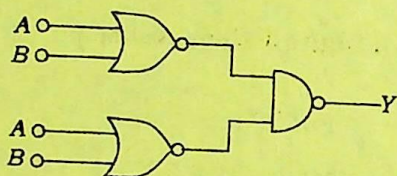
(Choose the correct option)

(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)

(3)

2. Answer any *five* of the following questions :
 $2 \times 5 = 10$

(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 :

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

(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.

(4)

(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

(5)

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

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

(c) Simplify the Boolean function

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

with the help of K-maps.

(d) Express the function $Y = A + \bar{B}C$ 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 of 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

- (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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