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# 2021

### (Held in 2022)

## PHYSICS

( Honours )

Paper : PHY-HC-3036

### *( Digital Systems and Applications )*

*Full Marks : 60*

Time : Three hours

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

1.  Answer the following as directed :    1×7=7

    (i)   The active components of an IC are
          _____.                      *(Fill in the blank)*

(ii) Which of the following gates cannot be used as an inverter ?

    (a) NOR

    (b) NAND

    (c) X-NOR

    (d) AND

                   *(Choose the correct option)*

(iii) The intensity of the spot in a cathode ray tube can be controlled by changing the positive potential on the control grid.     *(State True **or** False)*

(iv) 8421 code is _____ code.

                        *(Fill in the blank)*

(v) A flip-flop can store —

    (a) one bit of data

    (b) two bits of data

    (c) three bits of data

    (d) any number of bits of data

                   *(Choose the correct option)*

(vi) Each term in the standard SOP form is called a _____.     *(Fill in the blank)*

(vii) How many buses are connected as part of the 8085 A microprocessor ?

    (a) 3

    (b) 4

    (c) 5

    (d) 6

2. Answer the following questions is brief :     2×4=8

    (i) What are linear and digital ICs ? Give examples of them.

    (ii) Convert the following decimal numbers into BCD code :

        (a) 2579

        (b) 29·6

    (iii) Write down the Boolean expression for 4 to 1 multiplexer and draw the function table for it.

    (iv) What are low and high level languages ? Give examples.

3. Answer **any three** questions from the following : 5×3=15

(i) Convert the following as directed :

(a) Octal 526 to decimal

(b) Octal 356·52 to binary

(c) Hexadecimal 12A to decimal

(ii) Distinguish between combinational circuits and sequential circuits with examples.

(iii) Design a circuit that gives an output $A\overline{B} + \overline{A}B$ using discrete electronic circuits.

(iv) What is race around condition of a JK flip-flop ? How can it be eliminated ?

(v) State De Morgan's theorem. Apply De Morgan's theorem to the following expressions :

(a) $\overline{(A + \overline{B})(\overline{C} + D)}$

(b) $\overline{(\overline{AB} + \overline{CD})(CD + \overline{EF})}$

4. Answer **any three** of the following questions: 10×3=30

(i) Draw the block diagram and truth table of a full subtractor. Design a full subtractor logic circuit by using K-map. 5+5=10

(ii) (a) Use the K-map to minimise the following expressions : 6

i. $X = A\overline{B} + B\overline{C} + \overline{A}C + AB$

ii. $X = \overline{A}\overline{B}\overline{C} + \overline{A}BC + A\overline{B}C + ABC$

(b) Express the Boolean function $F = BC + \overline{B}A$ in a product of maxterms (POS). 4

(iii) (a) Draw the logic diagram of a master-slave JK flip-flop and explain its operation with the help of a truth table. 6

(b) Distinguish between an encoder and a decoder.      4

(iv) (a) Write down the function of CPU and ALU of a computer.

(b) Distinguish between dynamic RAM and static RAM.

(c) What is a cache memory ? What is its function ?

4+3+3=10

(v) (a) Draw the block diagram of a microprocessor.

(b) Explain the function of a program counter in a 8085 microprocessor.

(c) Write different flag registers of a 8085 microprocessor.

(d) What are different types of addressing mode in 8085 microprocessor ?

(e) Give an example of a 3-byte instruction.

2+3+2+2+1=10

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