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3 (Sem-3/CBCS) PHY HC 3

2024

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.

Answer the following questions as directed :

1×7=7

- (i) Both transistors and resistors are active components. **(State True or False)**
- (ii) The symbolic code for each instruction of a microprocessor is called _____.
(Fill in the blank)

Contd.

(iii) Subtract 1100 from 1101 using 2's complement.

(iv) The fastest serial register is _____.
(Fill in the blank)

(v) A cathode ray oscilloscope is analog/digital instrument.

(Choose the correct option)

(vi) A string of four bits is called a _____.
(Fill in the blank)

(vii) It is required to momentarily store binary information appearing at the output of an encoding matrix. Which of the following digital circuit would perform the operation?

(a) Register

(b) Counter

(c) Multiplexer

(d) Encoder

(Choose the correct option)

Answer the following questions in short :

2×4=8

(i) What are the Scales of Integration of Integrated Circuits (IC) ?

(ii) What is the maxterm and minterm of the Boolean function ?

$$F = \overline{A}\overline{B}\overline{C} + \overline{A}B\overline{C}$$

(iii) What are different types of Shift Registers ?

(iv) How does a monostable multivibrator differ from astable multivibrator ?

Answer the following questions : 3×5=15

(i) Convert the following as directed :

(a) Decimal 23 to Binary

(b) Binary 101.101 to Decimal

(c) Decimal 109 to Octal

(ii) Design a circuit that gives an output \overline{AB} using discrete electronic circuits.

(iii) Use the Karnaugh map to minimize the following expression :

$$X = \overline{A}C + B\overline{C} + \overline{B}\overline{C} + AC$$

(iv) Compare asynchronous and synchronous counters.

(v) Design an Astable multivibrator using IC 555 that has a free-running frequency of 1kHz. What is the duty cycle of the circuit?

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

(i) (a) What is flip-flop ?

(b) Draw the symbols and truth tables of SR, D and JK flip-flop.

(c) What is the advantage of JK flip-flop over SR flip-flop ?

(d) Explain the working of SR flip-flop.

$$1+3+1+5=10$$

(ii) Define and explain Multiplexer, Demultiplexer, Decoder and Encoder used in digital circuits with the help of block diagram. Give examples where these can be used. $2+2+2+2+2=10$

(iii) (a) What is a stack pointer in microprocessor?

(b) Explain the functions of a stack pointer.

(c) What are buses in microprocessor?

(d) Explain the function of buses.

(e) Explain with examples, what are 1 byte and 2 byte instructions in Assembly language.

$$1+2+1+3+3=10$$

(iv) Give short explanations of the following
 $2 \times 5 = 10$

(a) NAND and NOR gates are called Universal Gates.

(b) A sawtooth wave is applied in the horizontal plate of a CRO.

(c) The heart and soul of many digital circuits is the clock signal.

(d) RAM is used to boost up processor power.

(e) A larger deflection angle is allowed for magnetic deflection than electrical deflection in CRO.

(v) (a) Draw the Block diagram to add two binary numbers 101 and 101 using required half- and full-adders.

(b) Explain the working of the half adder and full-adder.

$5 + 5 = 10$

- (vi) (a) What is memory ?
- (b) What are the categories of memory in computers ? Give examples.
- (c) Discuss in brief, memory organization in computers.

1+4+5=10
