U.G. 3rd Semester Examination - 2022

PHYSICS

[HONOURS]

Course Code : PHY-H-CC-T-07

(Digital Systems and Applications)

Full Marks : 40 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP-A

1. Answer any **five** questions: $2\times5=10$

   a) What is time~base signal of a CRO? Show its typical waveform.

   b) Write down two advantages and two drawbacks of ICs.

   c) Convert the hexadecimal number $(AF4.D6)_{16}$ into its binary equivalent.

   d) "EX-OR gate acts as inequality cheeker."— explain this statement.

   e) Express the Boolean expression $Y = AB + \overline{B}C$ in terms of minterms and maxterms.

[Turn over]

f) Subtract $(1110)_2$ from $(1011)_2$ using 2's complement method.

g) Distinguish between ROM and RAM.

h) What do you mean by assembly language and high level language?

GROUP-B

2. Answer any **two** questions: 5×2=10

a) i) Explain how CRO is used to determine the frequency of an AC signal and the phase difference between two signals with same frequency.

ii) Mention the function of stack pointer and program counter in 8085 microprocessor. Write down the different types of flags used in it. 2+(2+1)

b) i) What are linear and digital ICs?

ii) What is binary-coded-decimal? Explain with an example. State and explain De Morgan's theorems of Boolean algebra. 2+(1+2)

c) i) Simplify the Boolean expression $Y = A\bar{B}C + \bar{A}\bar{B}C + BC + \bar{B}\bar{C}$ using Karnaugh map.

ii) Write down the truth tables for difference and borrow parts of a half-suhtractor. Realize it using basic gates. 2+(1+2)

d) i) How sequential logic system differ from combinational logic system?— Give examples for the both.

ii) Construct a SR flip—flop using NAND gates. Explain its operation with truth table. How can it be converted into a clocked SR flip-flop? 2+(1+1+1)

GROUP-C

3. Answer any **two** questions: 10×2=20

a) i) Prove the Boolean identity A+BC=(A+B)(A+C). Realize the Boolean expression $Y = \bar{A}B + A\bar{B}C$ using two input NAND gates only. What is multiplexer?

ii) Draw the circuit realization of JK flip—flop and explain its operation with truth table. What is race-around condition? How it is avoided using master-slave JK filip-flop? (1+3+1)+(2+1+2)

b) i) Draw the circuit diagram of 4-bit adder/ subtractor that realize 2's complement method. Explain its operation.

ii) Using basic gates, construct a decoder that decodes BCD as decimal digits 0 to 9.

iii) Explain the operation of a 4-bit shift register using JK flip-flops. Mention some uses of registers. $(1\frac{1}{2}+1\frac{1}{2})+3+(3+1)$

c) i) Draw the circuit diagram of a decade ripple counter and explain its operation with timing diagram. Write some applications of such counters.

ii) What are the different types of memories used in computer systems? Why cache memory is used there? Name the registers used in 8085 microprocessor.

$(4+1)+(2+1+2)$

d) i) How synchronous counters differ from the asynchronous one? Construct a three bit synchronous counter and explain its operation with timing diagram.

ii) What do you mean by computer bus and bus width? Write down the functions of different buses used in 8085 microprocessor.

$(1+4)+(2+3)$
