U.G. 3rd Semester Examination - 2023

PHYSICS

[HONOURS]

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

(Digital Systems and Applications)

[Old Syllabus]

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: 2×5=10

a) Why binary number system is used in digital computation?

b) Distinguish between sequential and combinational logic systems.

c) Construct a single bit comparator using basic logic gates.

d) Explain the given instruction for 8085 μP "STA E029H".

e) What do you mean by BCD? Explain with an example.

f) Design an Ex-OR gate using NAND gates only.

g) Prove the Boolean identity $AB+\overline{A}B+\overline{A}\overline{B}=\overline{A}+B$.

h) Which features of electrical signals can be measured by a CRO?

GROUP-B

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

a) i) Convert the Boolean expression $Y=A.B.\overline{C}+A.\overline{BC}+\overline{ABC}$ into sum of products (SOP) form.

ii) Using a Karnaugh map, simplify the above Boolean expression for Y. Implement the simplified expression for Y using basic logic gates. 2+(2+1)

b) i) Distinguish between a flip-flop and a latch.

ii) Draw the circuit diagram of a 4-bit parallel-in serial-out shift register and explain its operation. 1+4

c) i) What do you mean by 8-bit microprocessor?

ii) Explain the functions of accumulator, stack-pointer, program counter and interrupt of 8085 microprocessor. 1+4

d) i) Describe the main features that differentiate synchronous from asynchronous sequential logic system.

ii) Explain the operation of decade counter and sketch its timing diagram. 1+(3+1)

GROUP-C

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

a) i) Distinguish between RAM and ROM. What is memory mapping in computer architecture?

ii) Sketch the circuit realization of a clocked SR flip-flop with NAND gates. Explain its operation with truth table.

iii) How a JK flip-flop is converted into D-type and T-type flip—flop? (2+2)+(2+2)+2

b) i) Define deflection sensitivity of a CRO. Derive an expression for the same.

ii) Write down the truth table of a full adder. How will you arrange two half adders to construct a full adder? Explain. (1+4)+(2+3)

c) i) What is multiplexer? Construct a 4:1 multiplexer with basic logic gates and explain its operation. How many selection inputs are required for 32:1 multiplexer?

ii) Consider, there are three doors in a room. You want to set an electrical alarm that will buzz if anyone opens more than one door simultaneously. Construct a truth table and a Boolean expression for that logic. Implement that in a logic circuit.

(1+3+1)+(1+1+3)

d) i) What is assembly language for a microprocessor? Draw the timing diagram for the instruction MOV A,B in 8085 μP.

ii) Simplify the Boolean expression $\overline{\overline{A}+B}+\overline{\overline{A}+\overline{B}}$. What is inequality detector in digital electronics? Explain its operation with logic circuit. (2+3)+(2+1+2)
