

596/Phs.

UG/4th Sem./PHY-H-CC-T-10(A&B)/24

U.G. 4th Semester Examination - 2024

PHYSICS

[HONOURS]

Course Code : PHY-H-CC-T-10(A&B)

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.*

Answer all the questions from Selected Option.

OPTION-A

PHY-H-CC-T-10A

(Digital System and Applications)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$
- a) Convert $(3F9A)_{16}$ to its binary equivalent.
 - b) What do you mean by bit and byte?
 - c) What are encoder and decoder?
 - d) Distinguish between ROM and RAM.
 - e) Implement AND gate using OR and NOT gate.
 - f) What is meant by race-round condition? How it can be avoided?
 - g) What are 'flags' in a microprocessor? Where are they used?

[Turn over]

- h) How sequential logic system differ from combinational logic system? – Give examples for both.

GROUP-B

2. Answer any **two** questions: $5 \times 2 = 10$

- a) i) What are meant by 'Min terms' and 'Max terms'?
- ii) Simplify the expression, $F(A,B,C,D) = \sum m(0,1,2,5,7,8,9,10,13,15)$ by 'Karnaugh map'.
- iii) Draw the final expression using basic gates. $1+3+1$
- b) i) What are volatile and non-volatile memories? What do you mean by PROM and EPROM?
- ii) Subtract $(1101)_2$ from $(10101)_2$ by 2's complement method and convert the result into the corresponding decimal number. $(1+2)+2$
- c) Draw the circuit of XNOR gate and make a truth table. If you have to determine the inequality input, what gate should you use? Draw its circuit and make a truth table.

$$2\frac{1}{2} + 2\frac{1}{2}$$

- d) What is multiplexer and demultiplexer? Draw a circuit diagram of a 1 line to 4 line demultiplexer using basic gates. $2+3$

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$

- a) i) What are 'deflection sensitivity' of a CRT? Derive an expression for the deflection sensitivity for electrostatic deflection of an electron beam in CRT.
- ii) Can you determine the phase difference between two ac signals of same frequency by CRO? If yes, explain the procedure.
- iii) The deflection sensitivity of a CRT is 0.02 mm/Volt. When an unknown voltage is applied to the horizontal plates, the spot shifts horizontally by 2 mm. Find the value of the unknown voltage. $(1+4)+2+3$
- b) i) What is monostable multivibrator? How monostable multivibrator differ from the astable multivibrator?
- ii) Draw the circuit diagram of a monostable multivibrator using IC-555 timer and explain its working principle.
- iii) Why this IC known as IC-555? $1+2+5+2$

c) i) How many different instructions are possible in an 8-bit microprocessor? Write their names.

ii) Give a schematic logic diagram of 8085 microprocessor unit. What are three most basic functional elements of CPU? Briefly explain their function in CPU.

iii) Can you calculate 7^3 in 8-bit (Intel 8085) microprocessor? Justify your answer.

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

d) i) Draw the circuit of a positive edge triggered JK flip flop and make a truth table. Also explain its RESET, SET and Toggle operation.

ii) Give the classification of shift register depending upon the mode of data shifting in digital computers. Construct a 4-bit shift register using D-type flip flops and using a state table show how a 4-bit number 0110 is entered serially in a shift register.

iii) How many clock pulses are needed to enter this 4-bit number?

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

OPTION-B
PHY-H-CC-T-10B

(Analog Systems and Applications)

GROUP-A

1. Answer any five questions: $2 \times 5 = 10$

- Draw energy level diagram of PN Junction with forward bias. Explain the current flow mechanism from it.
- Define ripple factor and rectification efficiency of a rectifier.
- How a transistor is used as a switch? – Explain.
- "Negative feedback reduces the gain of an amplifier." Still, what for it is widely used in electronics?
- What are the basic requisites of sustained oscillation in an oscillator?
- What do you mean by slew rate of an OP-AMP?
- Graphically distinguish between static and dynamic resistances of a PN junction diode.
- Draw the circuit diagram of a R-C coupled amplifier. Discuss about the functions of different capacitors used here.

GROUP-B

2. Answer any two questions: $5 \times 2 = 10$
- a) What do you mean by drift velocity of electrons in semiconductor? State the law of mass action in semiconductor. Write down I-V relation of PN diode. Explain the mechanism of current flow in a reversed biased PN diode.
 $1+1+1+2$
 - b) What do you mean by load line of a transistor in CE configuration? How a transistor work as an amplifier? – Explain it graphically. $2+3$
 - c) Compare the characteristics between an ideal and a practical OP-AMP. Define CMRR of an OP-AMP. Why it is called figure of merit of OP-AMP? Show the typical frequency response characteristics of a practical OP-AMP.
 $2+2+1$
 - d) Why analog to digital conversion is important in electronics? Explain the operation of successive approximation analog to digital converter.
 $1+4$

GROUP-C

3. Answer any two questions: $10 \times 2 = 20$
- a) What are the advantages of a CE amplifier over the CB? What do you mean by biasing of a transistor? Explain the phenomena of thermal runaway in transistor. Determine the stability factors (temperature stability, β stability and V_{BE} stability) for fixed bias arrangement in a CE amplifier.
 $2+1+2+5$
 - b) Distinguish between zener diode and rectifier diode. Explain the working principle of light emitting diode. Show that, voltage gain of RC-coupled amplifier decreases in high frequency range with the increase in input signal frequency.
 $2+3+5$
 - c) State Barkhausen's criterion for self-sustained oscillations. Draw the circuit diagram of RC phase shift oscillator. Determine its frequency of oscillation. What is logarithmic amplifier? Determine its voltage gain.
 $1+1+4+1+3$

- d) Draw the circuit diagram of a full wave rectifier with centre-tapped transformer. Determine its maximum efficiency for conversion of AC into DC. What is two port network? How a transistor can be represented with h-parameter equivalent model? Write down the advantages of this model.

1+3+1+2+3