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: $2\times5=10$

    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: $5\times2=10$

a) i) What are meant by 'Min terms' and 'Max terms'?

ii) Simplify the expression, $F(A,B,C,D) = \Sigma\, m(0,1,2,5,7,8,9,10,13,15)$ 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)

3. Ans

a)

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: 10×2=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 sport 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 cálculate 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 resister depending upon the mode of data shifting in digital computers. Construct a 4-bit shift resister using D-type flip flops and using a state table show how a 4-bit number 0110 is entered serially in a shift resister.

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: 2×5=10

   a) Draw energy level diagram of PN Junction with forward bias. Explain the current flow mechanism from it.

   b) Define ripple factor and rectification efficiency of a rectifier.

   c) How a transistor is used as a switch? – Explain.

   d) "Negative feedback reduces the gain of an amplifier." Still, what for it is widely used in electronics?

   e) What are the basic requisites of sustained oscillation in an oscillator?

   f) What do you mean by slew rate of an OP-AMP?

   g) Graphically distinguish between static and dynamic resistances of a PN junction diode.

   h) 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: 5×2=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

3. Answ

   a)

   b)

   c

596/Phs

59

GROUP-C

3. Answer any **two** questions:

   10×2=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 runway 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

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