2023

PHYSICS

(Honours Elective)

Paper : PHY–HE–5046

(Physics of Device and Instruments)

Full Marks : 60

Time : Three hours

**The figures in the margin indicate
full marks for the questions.**

1. Answer the following questions : 1×7=7

    (i)   Why silicon is used in IC fabrication ?

    (ii) What is the maximum length of GPIB bus ?

    (iii) A field-effect transistor is basically a _____ resistor. *(Fill in the blank)*

    (iv) If f_c is the frequency of the carrier wave and f_m that of modulating wave then

    (a) $f_c < f_m$ (b) $f_c = f_m$ and (c) $f_c > f_m$

    (Choose the correct answer)

(v) If m_a is the modulation index of an AM wave, then for distortionless transmission,

(a) $m_a > 1$ (b) $m_a = 1$ and (c) $m_a < 1$

(Choose the correct answer)

(vi) What is a phase-locked loop (PLL) ?

(vii) What is an active filter ?

2. Answer the following questions :   2×4=8

(i) Why is modulation necessary in communication system ?

(ii) What is the difference between JFET and MOSFET ?

(iii) What are the applications of phase locked loop (PLL) ?

(iv) What are *four* types of integrated circuit (IC) ?

3. Answer *any three* questions of the following :   5×3=15

(i) Mention some of the applications of RS-232 communication. State advantages and disadvantages of RS-232 communication.   2+3=5

(ii) Draw the circuit diagram of amplitude modulating system and discuss the operation of the circuit.   2+3=5

(iii) Diffusion and Implementation technique in semiconductor. Explain.

(iv) What is digital modulation technique ? Explain the three digital modulation ASK, FSK and PSK with graph.

$$1+4=5$$

(v) Write short notes on **any two** of the following : $2\frac{1}{2}+2\frac{1}{2}=5$

    (a) Tunnel Diode

    (b) Diode Detector

    (c) Line and Load regulation of power supply.

4. Answer **any three** questions : $10\times3=30$

(i) Show that an AM wave can be represented by a carrier and two side frequency bands on the either side of the carrier frequency.

Draw the amplitude modulated waveform showing $m_a > 1$, $m_a = 1$ and $m_a < 1$. $5+5=10$

(ii) Draw the circuit symbol of MOSFET. Draw a typical set of drain characteristics of a P-channel enhancement type MOSFET. What is a transfer characteristics ? $3+4+3=10$

(iii) What is multivibrator? Draw the circuit diagram of a bistable multivibrator and explain its principle of action, showing the collector voltage waveform.

$$2+3+5=10$$

(iv) What is a universal serial bus (USB)? What are its different types explain? Discuss the advantages and disadvantages of USB. $2+4+4=10$

(v) Explain block diagram of regulated power supply with neat diagram. What are different types of IC voltage regulators? Draw their circuit diagram.

$$5+2+3=10$$

(vi) What are the basic steps of IC fabrication? What is electronic grade silicon used for? Explain optical and electron lithography. What is the difference between them?

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

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