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3 (Sem-5/CBCS) PHY HE 4

2024

**PHYSICS**

(Honours Elective)

Paper : PHY-HE-5046



**(Physics of Devices and Instruments)**

Full Marks : 60

Time : Three hours

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

1. Fill in the blanks :  $1 \times 7 = 7$

(i) Junction Field Effect Transistor (JFET) is a \_\_\_\_\_ controlled device.

(ii) Rectifier of a DC power supply converts a \_\_\_\_\_ input from mains to a DC output.

(iii) \_\_\_\_\_ filter is a passive electronic device has higher cut of frequency.

(iv)  $\text{SiO}_2$  layer in an Integrated Circuit (IC) acts as a \_\_\_\_\_.

(v) The full form of GPIB is \_\_\_\_\_.

Contd.

(vi) The maximum value of a modulation index of an Amplitude-Modulated waveform is \_\_\_\_\_.

(vii) The process of separating message signal from the carrier signal is known as \_\_\_\_\_.

2. Give very short answers to the following questions :  $2 \times 4 = 8$

(i) Give a comparison between a JFET and MOSFET device.

(ii) What is a multivibrator circuit? How many stable states exist in an astable multivibrator?

(iii) What is the role of a rectifier in a DC-regulated power supply? What are different types of rectifiers used in a regulated power supply?

(iv) What is frequency modulation? Draw a frequency-modulated waveform.

3. Answer **any three** questions from the following :  $5 \times 3 = 15$

(i) What is a depletion-type MOSFET? Discuss the operation of a Depletion-type MOSFET with its input-output characteristic curve.  $2+3=5$

(ii) What are load regulation and line regulation in a DC-regulated power supply?

(iii) What is lithography technique? Distinguish between optical lithography and electron-beam lithography.  $2+3=5$

(iv) Discuss briefly about working principle of a phase-locked loop (PLL)

(v) Discuss the operation of a 1st order band-pass filter circuit.

(vi) What is the modulation index of an AM wave? Draw an AM wave with modulation index 0.5 and 1.0.  $3+2=5$

4. Answer **any three** questions from the following :  $10 \times 3 = 30$

(i) Explain RS232 communication standards. Discuss briefly about universal serial BUS and its applications.  $5+5=10$

(ii) Draw the basic block diagram of a wireless communication system and discuss briefly about different blocks of the system. What is the need of modulation in a wireless communication system? Discuss briefly.  $3+4+3=10$



(iii) Discuss briefly about different steps involved in the fabrication of an integrated circuit (IC). What is the importance of metallization technique used in IC fabrication and packaging?  
 $6+4=10$

(iv) Write short notes on **any two** of the following:  $5 \times 2 = 10$

(a) Voltage Controlled Oscillator (VCO)

(b) Parallel Communication

(c) Digital Modulation techniques

(v) Derive the expression of a drain current in an enhancement-type MOSFET.

(vi) Discuss the circuit operation for generation of an amplitude-modulated wave for a wireless communication system. What is the importance of side band frequency in AM wave? Discuss briefly about single and double side band AM-modulated waveforms.  
 $5+2+3=10$