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 :  1×7=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)*  $SiO_2$ layer in an Integrated Circuit (IC)
       acts as a _____.

   *(v)*  The full form of GPIB is _____.

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    acts as a _____.

    *(v)*  The full form of GPIB is _____.

*(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 : 2×4=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 : 5×3=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 : 10×3=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 : 5×2=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.

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