3 (Sem–5/CBCS) PHY HE 4

2025

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. Answer the following questions : 1×7=7

   (a) At critical frequency at which the response drop from the pass band is

   (i) $-20\,dB$

   (ii) $-3\,dB$

   (iii) $20\,dB$

   (b) Mention *two* advantages of CMOS technology.

(c) What happens when the modulation index is greater than 1 ?

(d) What is the difference between an astable multivibrator and a monostable multivibrator ?

(i) The astable is free running

(ii) The astable needs to be clocked

(iii) The monostable is free running

(e) What does the USB stand for ?

(f) Capacitor is a

(i) high-pass filter

(ii) low-pass filter

(iii) both high and low-pass filters

(g) Write the full form of MOSFET.

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

(a) Calculate the carrier frequency of an AM wave when its highest frequency component is 850 *Hz* and the bandwidth of the signal is 50 *Hz*.

(b) What is RS232 communication ?

(c) Explain active and passive filter. Give an example of each.

(d) Give *two* differences between MOSFET and JFET.

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

(a) What is a tunnel diode ? Explain its V-I characteristics.

(b) What do you mean by USB standard ? Give details of the USB 2.0.

(c) Give a short note on short-circuit protection.

(d) Explain the I-V characteristic of UJT. Explain its use as a relaxation oscillator.

(e) Give the circuit diagram and explain the working of a dc power supply using bridge rectifier and L-section filter.

4. Answer ***any three*** of the following questions :

(a) What is amplitude modulation ? Show that the amplitude modulation wave consists of a carrier and two sidebands. 3+7=10

Or

Draw the circuit of a CE amplitude modulation and derive the expression for its output. 10

(b) Discuss the working of an exclusive-OR phase detector. Give the schematic diagram of PLL and explain its working. 5+5=10

(c) What is an IC circuit? What are the basic steps of IC fabrication? Explain etching and masking in case of IC fabrication. 5+5=10

(d) With a neat sketch, describe the construction of an *n*-channel JFET. Explain the principle of operation. 5+5=10

Or

Explain with neat sketch the structure and working of *p*-channel enhancement type MOSFET. 10

(e) Define low-pass filter and high-pass filter. Write the differences between them. 5+5=10

(f) What is a sequential logic circuit? Draw the circuit diagram of a monostable multivibrator and explain its operation. 2+(2+6)=10