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3 (Sem–5/CBCS) PHY HE 4

2021
(Held in 2022)

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

 (a) Write the full form of MOSFET.

 (b) Capacitor is a

    (i)   high-pass filter

    (ii) low-pass filter

    (iii) both high and low-pass filters

(c) What does the USB stand for?

(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 happens when the modulation index is greater than 1?

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

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

(i) $-20\,dB$

(ii) $-3\,dB$

(iii) $20\,dB$

2. Answer the following questions briefly :

$2 \times 4 = 8$

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

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

(c) What is RS232 communication?

(d) Calculate the carrier frequency of an AM wave when its highest frequency component is $850\,Hz$ and the bandwidth of the signal is $50\,Hz$.

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

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

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

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

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

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

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

(a) What is a sequential logic circuit? Draw the circuit diagram of a monostable multivibrator and explain its operation.

$2+(2+6)=10$

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

(c) 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

(d) 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

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

(f) 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