

Total number of printed pages-7

3 (Sem-5/CBCS) PHY HE 4

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 **any seven** questions of the following : 1×7=7

(i) Give an example of negative resistance device.

(ii) What is a C filter in power supply ?

(iii) How can you get band reject filter with a low pass and high pass filters ?

Contd.

- (iv) What do you mean by defects in a lattice?
 - (v) If you have both pMOS and nMOS embedded in the same substrate, what will you get?
 - (vi) Name one technique used for fabrication of integrated circuit MOSFET.
 - (vii) What is handshaking in digital communication?
 - (viii) Name one advantage of FM transmission.
 - (ix) Name the two types of FET.
 - (x) State one use of phase locked loop.
 - (xi) What is a varactor?
 - (xii) What is phase modulation?
2. Answer **any four** questions of the following: (2×4=8)
- (i) What is the basic principle of a charge coupled device?

- (ii) How short circuit protection is achieved in power supply?
 - (iii) Draw the block diagram of a phase locked loop.
 - (iv) Draw the graphical representation of 100% modulated AM wave.
 - (v) What are positive and negative mask in fabrication of IC?
 - (vi) A wireless transmitter radiates 4kW with an unmodulated carrier wave and 5.2kW modulated wave. Neglecting distortion, calculate percentage of modulation.
 - (vii) State two satisfactory condition of detection of envelope diode detector.
 - (viii) Explain the operation of NMOS enhancement transistor.
3. Answer **any three** questions of the following: (3×3=9)
- (i) Draw the equivalent circuit of an UJT and explain its working.

(ii) Draw the energy band diagram of an ideal MOS capacitor and define depletion and accumulation mode. What is flat band voltage? $2+2+1=5$

(iii) Draw the block diagram of a power supply. What are line and load regulation? $3+2=5$

(iv) Draw the pin out diagram of IC 565. How can it be used as VCO? $3+2=5$

(v) Write the disadvantages of XOR frequency detector circuit. Explain how it can be removed in phase frequency detector. $1+4=5$

(vi) What is the main purpose of UART? Briefly describe the UART communication. Write two advantages of UART communication. $1+3+1=5$

(vii) Explain with diagram the generation of sawtooth wave using UJT. $2+1=3$

(viii) What is a loop filter? How does it work? $2+3=5$

4. Answer any three questions : $10 \times 3 = 30$

(i) Explain with circuit diagram how to produce AM wave with transistor. Show that for 100% modulation power of the modulated wave is 150% of the unmodulated wave. $6+4=10$

(ii) Show that in FM wave, maximum frequency deviation is proportional to the amplitude of modulating signal but in PM wave it is dependent on both amplitude and frequency of signal. $5+5=10$

(iii) How does a diode envelope detector work? If a capacitor C is connected across load R in the detector, what is the condition for the product of RC to detect 100% modulated wave? $3+7=10$

(iv) With a circuit diagram, explain the working of an astable multivibrator. What is the frequency of this vibrator? What should be minimum value of current gain β to ensure oscillations? $8+1+1=10$

(v) Draw a low pass active filter and a high pass active filter. Also draw the frequency response curves of both the filters showing 20dB/decade line. What are their cut-off frequencies?

2+2+2+2+2=10

(vi) Write short notes on **any two** of the following:

5×2=10

(a) Crystal plane and orientation

(b) Optical lithography

(c) Electron lithography

(d) General Purpose Interface Bus and Signals

(e) Metallisation Technique in IC fabrication

(vii) What is RS-232 protocol? Explain RS-232 communication in terms of protocol format? Specify the function of each pin of DB9 connectors;

1+4+5=10

(viii) Explain the working principle of a VCO. What is free running frequency? Draw schematically the capture and lock range in reference to free running frequency.

5+1+2+2=10