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 ?

(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 $5{\cdot}2kW$ 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 : 5×3=15

(i) Draw the equivalent circuit of an UJT and explain its working. 2+3=5

(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.

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

4. Answer ***any three*** questions : 10×3=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 20*dB*/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

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