

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1902

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Unique Paper Code : 2223012004

Name of the Paper : Physics of Devices

Name of the Course : **B.Sc. Hons. (Physics) NEP UGCF-2022**

Semester : IV – (DSE Paper)

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all. Question No. **1** is compulsory.
3. **All** questions carry equal marks.
4. Scientific (non-programmable) calculators are allowed.

Question 1 Answer any *five* of the following questions:

(5 x 3 = 15)

- (a) Describe in brief the SSI, LSI and VLSI.
- (b) Sketch the circuit of a positive biased clamper. Show the input and output waveforms.
- (c) Draw the band diagrams for a MOS capacitor under accumulation and depletion conditions.
- (d) What is the basic working principle of the piezoelectric transducer?
- (e) Calculate the wavelength of the emitted radiation by the diode when the energy band gap of the material is $E_g = 2.1 \text{ eV}$. Mention the colour of the emitted radiation. Given $h = 6.6 \times 10^{-34} \text{ Joules sec}$, $c = 3 \times 10^8 \text{ m/sec}$.
- (f) Differentiate between Ohmic and Schottky junctions.

Question 2

- (a) Explain with the help of a diagram the ion implantation technique. (10)
- (b) What is photolithography? Explain the main steps involved in the photolithography process. (5)

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Question 3

- (a) Derive an expression for the barrier potential and barrier width of a p-n junction diode. (10)
- (b) In a Ge sample a donor type impurity is added to the extent of 1 atom per 10^8 Ge atoms. Find the concentration of electrons and holes in the sample. Given $N_i = 2.5 \times 10^{13} \text{ cm}^{-3}$ and number of Ge atoms is $4.41 \times 10^{22} \text{ cm}^{-3}$. (5)

Question 4

- (a) Draw the circuit diagram and frequency response of the active first order low pass Butterworth filter. Obtain an expression for the high cutoff frequency and gain of the filter. (10)
- (b) Explain the working of a UJT with a suitable schematic diagram and draw its I-V characteristic curve. (5)

Question 5

- (a) Differentiate between DIAC and TRIAC. Sketch and explain the output characteristic curve of DIAC. (5)
- (b) Explain with appropriate diagrams the static and transfer characteristics of metal oxide semiconductor field effect transistor (MOSFET). (5)
- (c) Find the voltage gain magnitude of the wide band-pass filter for the given total pass band gain, input frequency, low cut-off frequency, and high cut-off frequency of 6, 750 Hz, 200 Hz and 1 kHz respectively. (5)