

FE SEM II NEP 2020 Summer - 2025 Date - 22/05/2025

Duration: $1\frac{1}{2}$ hour

Max. Marks: 45

- Note: 1. Question No. 1 is compulsory.
 2. Solve any two questions from the remaining.
 3. Draw diagrams where ever necessary.

Q.1. Solve any five from the following.

(3×5)

- The resistivity of Cu is 1.72×10^{-8} ohm-m. Calculate the mobility of electrons in Cu. Given that Number of electrons per unit volume is $10.41 \times 10^{28}/\text{m}^3$.
- How does biasing influence the operation of a BJT in its different regions?
- Determine the value of R_s required to self-bias a p-channel JFET with $I_{DSS} = 25$ mA, $V_{GS(OFF)} = 15$ V and $V_{GS} = 5$ V.
- Explain the importance of surface to volume ratio in nano-technology.
- Calculate the junction capacitance of a Ge diode whose area is $1 \text{ mm} \times 1 \text{ mm}$ and depletion region width is $2 \mu\text{m}$. The relative permittivity of Ge is 16. Permittivity of free space is 8.54×10^{-12} F/m.
- Differentiate between Enhancement Type and Depletion Type MOSFET.
- Determine the wavelength and colour of light emitted by GaP LED of $E_g = 2.25$ eV.

Q.2.

(5×3)

- Deduce the expression for collector current and characteristics of NPN transistor in CB mode.
- A sample of n-type of silicon has a donor density of $10^{20}/\text{m}^3$. It is used in the Hall effect experiment. If the sample of the width 4.5 mm is kept in a magnetic field of 0.55 T with current density of 500 A/m^2 , find (i) Hall voltage developed in it (ii) Hall Coefficient (iii) Hall angle mobility of electrons is $0.17 \text{ m}^2/\text{V-sec}$.
- Illustrate the working and advantages of Photodiode.

Q.3.

(5×3)

- Derive the expression for barrier potential of a p-n junction diode.
- Explain working principle and output characteristics of the N-channel Enhancement type MOSFET.
- Explain the effect of particle size on photoluminescence and electrical properties of nano materials.

Q.4.

(5×3)

- Define Fermi level. Explain and locate the shifts in Fermi level with increase in temperature in n- type semiconductor.
- Silicon diode is subjected to a forward voltage of 0.7 V at room temperature 27°C with a saturation current of 10^{-12} A. Calculate the forward current assuming and ideality factor of 1.
- Compare between FET and BJT.

Q.5.

(5×3)

- Explain the application of Transistor as a switch in cut-off and saturation action.
- Explain the working of a Zener diode and its application.
- Explain electron beam lithography with key steps involved in the process and give its applications.