JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

B.Tech-V Semester (EE VLSI)

COURSE CODE (CREDITS):25B11EC516 (3) MAX. MARKS: 15

COURSE NAME: Semiconductor Materials Synthesis and Characterization

COURSE INSTRUCTOR: Dr. Shruti Jain MAX. TIME: 1 Hour

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is allowed

Q.No	Question	CO	Marks
Q1	i. A silicon sample is doped with phosphorus at: $N_D = 5\times10^{16}cm^{-3}$. Assume complete ionization and $n_i = 10^{10}cm^{-3}$. Calculate electron and hole concentrations. ii. An n-type silicon sample has: $n = 10^{16}cm^{-3}$ and $\mu_n = 1350cm^2/Vs$. Assuming hole conductivity is negligible, calculate the resistivity. iii. A semiconductor has a band gap of 1.42eV. Calculate the wavelength corresponding to the band-gap transition.	CO1	2 + 2 + 1
Q2	i. An EV manufacturer needs a semiconductor for a high-power inverter. Which material would you recommend and why? ii. A company wants to manufacture a high-frequency RF amplifier. Which semiconductor materials could be considered and why? iii. A semiconductor has a direct band gap of 2eV, while another has an indirect band gap of 1.1eV. Which is more suitable for an efficient LED and why? iv. Why can two semiconductor devices fabricated from the same material have different performance? v. A semiconductor company wants to manufacture (i) a large Si wafer, (ii) a thin dielectric layer for a MOSFET, and (iii) semiconductor nanoparticles for a sensor. Which synthesis method would you select for each application? Give one reason for each choice.	CO1	1 × 5
Q3	A research team wants to develop a low-cost transparent protective coating for a solar-panel glass surface. The coating should be uniform, thin, and capable of being deposited over a large area. They decide to use the sol-gel method. Answer the following: i. Why is the sol-gel method suitable for this application? ii. What are the main stages involved in preparing the coating? iii. What is the role of drying and heat treatment? iv. Mention one factor that can be controlled to obtain a uniform coating. v. Explain any other synthesis technique too.	CO2	1 × 5