

B.Tech. DEGREE EXAMINATION, JUNE 2023

First and Second Semester

18PYB103J - PHYSICS: SEMICONDUCTOR PHYSICS

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

Note:

- Part - A should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40 minutes.
- Part - B and Part - C should be answered in answer booklet.

Time: 3 Hours

Max. Marks: 100

Part - A (20 × 1 Marks = 20 Marks)

Answer All Questions

Marks BL CO

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|--|---|---|---|---|
| 1. Quantum free electron theory assumes electrons are charged particles and obey.....principle
(A) Pauli's Exclusion
(C) Aufbau | (B) Hund'
(D) Bernoulli's | 1 | 1 | 1 |
| 2. Bloch's theorem is about the wave function of an electron in a _____ potential.
(A) Non periodic
(C) Irregular | (B) Periodic
(D) Randomly varying | 1 | 1 | 1 |
| 3. At zero Kelvin, F (E) takes the value _____ for any energy level above Fermi level
(A) 1
(C) 0 | (B) 0.5
(D) 0.25 | 1 | 1 | 1 |
| 4. Identify the donor impurity given below.
(A) Boron
(C) Arsenic | (B) Gallium
(D) Aluminium | 1 | 2 | 1 |
| 5. In PN junction forward bias, the potential barrier is _____,
(A) Lowered
(C) No Change | (B) Raised
(D) Standard | 1 | 2 | 2 |
| 6. The Fermi level in a n-type semiconductor lies close to -----
(A) The top of the valence band
(C) The bottom of the valence band | (B) The top of the conduction band
(D) The bottom of the conduction band | 1 | 2 | 2 |
| 7. Drift current produced in the semiconductor is due to.....
(A) External Electric field
(C) Density gradient | (B) Doping material
(D) Internal field | 1 | 2 | 2 |
| 8. The rectifying semiconductor junction is also known as.....
(A) Photodiode
(C) Heterojunction | (B) Schottky diode
(D) Ohmic contact | 1 | 2 | 2 |
| 9.converts light energy into electrical energy.
(A) Solar cell
(C) Photodiode | (B) Light Emitting diode
(D) Photodetector | 1 | 1 | 3 |
| 10.is a process where free electron and holes are generated in pair for semiconductor by absorbing light energy or raising temperature.
(A) Generation
(C) Absorption | (B) Recombination
(D) Emission | 1 | 2 | 3 |

11. The light loss coefficient $\alpha(\omega)$ for optical loss is..... (A) Negative (B) Positive (C) Infinity (D) Zero	1	2	3
12. In the.....processes electron itself transit from conduction band to valence band spontaneously by releasing a photon. (A) Spontaneous emission (B) Stimulated emission (C) Stimulated absorption (D) Hole emission	1	2	3
13. Two Probe technique is suitable for measuring electrical resistivity of _____ samples. (A) Low resistivity (B) Magnetic (C) High resistivity (D) Biological	1	2	4
14. C-V measurements are capable of yielding information about the _____ and concentration of charge carriers. (A) Drift potential (B) Diffusion potential (C) Bonding (D) Crystal structure	1	2	4
15. In linear four-probe method the tip of probe diameter is usually _____ than the probe spacing. (A) Larger (B) Cooler (C) Hotter (D) Smaller	1	2	4
16. In a _____ the electrons are ejected from the photosensitive surface and are amplified within the cell. (A) Photodiode (B) Photocatalyst (C) Solar cell (D) Photomultiplier tube	1	2	4
17. Nanostructures have sizes in between _____. (A) 1 – 1000 nm (B) 1 – 100 nm (C) 200-300 nm (D) 500-1000 nm	1	2	5
18. In CVD chamber, the precursors are introduced to the reaction chamber in the _____ state. (A) Liquid (B) Solid (C) Gaseous (D) Semi solid	1	2	5
19. is an example for hetero junction materials. (A) Ge (B) Ga (C) Si (D) GaAlAs	1	1	5
20. Carbon nanotubes can be synthesized by _____ method. (A) Hydrothermal (B) Melt spinning (C) Zone melting (D) Chemical Vapour Deposition	1	2	5

Part - B (5 × 4 Marks = 20 Marks)

Answer any 5 Questions

Marks BL CO

21. Write the classification of electronic materials on the basis of band theory.	4	1	1
22. Explain probability of occupation in a given energy level using Fermi-Dirac distribution.	4	2	1
23. What is intrinsic semiconductor? Obtain the expression for Fermi level for intrinsic semiconductor.	4	2	2
24. Write a short note on diffusion current.	4	1	2
25. Using the relation $N_1 Q_{B12} = N_2 A_{21} + N_2 Q_{B21}$, derive the expression for ratio between spontaneous and stimulated coefficient.	4	2	3
26. Explain the working principle of hot point probe method.	4	1	4

27. How will you synthesize CNT by Laser ablation? Give any 2 Applications of CNT.	4	2	5
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Part - C (5 × 12 Marks = 60 Marks)

Answer All Questions

Marks BL CO

28. a. What are the postulates of classical free electron theory? Write the success and failures of classical free electron theory (OR) b. What is effective mass? Obtain the expression for effective mass of electron.	12	2	1
29. a. What is P-type semiconductor? Explain the variation of Fermi level with temperature of P-type semiconductor with necessary diagrams. (OR) b. Explain the construction and working of Organic light emitting diode with necessary theory and diagram.	12	2	2
30. a. What is optical joint density of states? Obtain the expression for finding optical joint density of states and state how it is relates with energy band gap of materials. (OR) b. What is photovoltaic effect? Briefly explain the theory of calculating the efficiency of solar cell. What are the applications of Photovoltaic effect.	12	2	3
31. a. Explain forward biasing and reverse biasing of p-n junction diode. Write a short note on I-V characteristics of p-n junction diode in reverse bias. (OR) b. State Hall Effect with diagram. Derive the expression for the Hall coefficient of p type semiconductor. Write any three applications of Hall Effect.	12	2	4
32. a. Brief on the working of PVD. What are the four 4 processes in PVD? What are the applications of PVD. (OR) b. What is the principle of TEM? How does unscattered, elastically scattered and inelastically scattered electrons provide information in TEM?	12	2	5

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