

B.E./ B.Tech./M.Tech - DEGREE EXAMINATIONS, NOV / DEC 2025

Second Semester

Computer Science and Engineering

(Common to Information Technology , Computer Science and Engineering (Cyber Security) & M.Tech Computer Science and Engineering)

20BSPH203 - PHYSICS FOR INFORMATION SCIENCE

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	Marks	K- Level	CO
1. The classical free electron theory of metals assumes that (a) electrons obey Maxwell–Boltzmann statistics (b) Electrons are bound to atoms (c) The potential energy of electrons varies periodically in space (d) scattering time is zero	1	K1	CO1
2. At absolute zero temperature (0 K), the Fermi–Dirac distribution function $f(E)$ is (a) unity for all energy values (b) zero for all energy values (c) one for $E < E_F$ and zero for $E > E_F$ (d) half for all energy values	1	K1	CO1
3. In an intrinsic semiconductor, the number of thermally generated electrons in the conduction band is (a) greater than the number of holes in the valence band (b) less than the number of holes in the valence band (c) equal to the number of holes in the valence band (d) independent of temperature	1	K1	CO2
4. For n-type semiconductor at 0 K, Fermi level lies closer to _____ band. (a) conduction (b) valence (c) convection (d) covalent	1	K1	CO2
5. The atomic magnetic moment in an atom arises mainly due to (a) motion of the nucleus (b) motion of electrons in closed shells (c) orbital and spin angular momentum of unpaired electrons (d) vibration of the atomic lattice	1	K1	CO3
6. Hall effect is used to find the _____ of charge carries. (a) Mobility (b) Inertia (c) Torque (d) Moment	1	K2	CO3
7. Which of the following materials is an optically active (non-linear) material? (a) Glass (b) Quartz (SiO ₂) (c) Silicon (d) Polyethylene	1	K1	CO4
8. Superconductors are ----- magnetic materials. (a) para (b) dia (c) ferro (d) antiferro	1	K1	CO4
9. Photodiode works under the ----- bias. (a) forward (b) reverse (c) neutral (d) none	1	K1	CO5
10. Quantum tunneling allows an electron to (a) pass through a potential barrier higher than its energy (b) lose all energy while crossing a barrier (c) stop moving when barrier height equals its energy (d) move only under classical forces	1	K2	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. State the Wiedemann–Franz law and give its mathematical form.	2	K1	CO1
12. Define degenerate state with an example in a 3D potential box.	2	K1	CO1

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| 13. Distinguish between intrinsic and extrinsic semiconductors. | 2 | K2 | CO2 |
| 14. What happens to the Fermi level of an n-type semiconductor when temperature increases? | 2 | K2 | CO2 |
| 15. List out the applications of Hall effect. | 2 | K1 | CO3 |
| 16. Define magnetic susceptibility and permeability. | 2 | K1 | CO3 |
| 17. Distinguish between Type-I and Type-II superconductors. | 2 | K2 | CO4 |
| 18. What is the Meissner effect in superconductors? | 2 | K2 | CO4 |
| 19. Write short note on optical data storage devices. | 2 | K2 | CO5 |
| 20. Give an account on magnetic levitation. | 2 | K2 | CO5 |
| 21. How does Fermi energy vary with size? | 2 | K2 | CO6 |
| 22. Define a quantum dot and give one application. | 2 | K2 | CO6 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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| 23. a) | Derive an expression for the density of states based on quantum theory. | 11 | K2 | CO1 |
| OR | | | | |
| b) | Derive the expression for electrical conductivity using the Drude–Lorentz model. | 11 | K2 | CO1 |
| 24. a) | Derive the expressions for carrier concentration of electrons in intrinsic semiconductors. | 11 | K2 | CO2 |
| OR | | | | |
| b) | Derive an expression for the carrier concentration in P type semiconductor. | 11 | K2 | CO2 |
| 25. a) | Explain: Hall effect and derive the expression for Hall coefficient. Mention its applications. | 11 | K2 | CO3 |
| OR | | | | |
| b) | Describe the Domain Theory of ferromagnetism and explain the B–H hysteresis behaviour of magnetic materials. | 11 | K2 | CO3 |
| 26. a) | Explain briefly about carrier generation and recombination in optical materials. | 11 | K2 | CO4 |
| OR | | | | |
| b) | Explain briefly about the following phenomenon in superconductors.
(i) Isotope effect
(ii) Effect of magnetic field
(iii) Effect of current | 11 | K2 | CO4 |
| 27. a) | Explain the principle, construction and working of LED. | 11 | K2 | CO5 |
| OR | | | | |
| b) | Describe the principle, construction and working of solar cell. | 11 | K2 | CO5 |
| 28. a) | Derive the density of states for a quantum well, quantum wire, and quantum dot structure. | 11 | K2 | CO6 |
| OR | | | | |
| b) | Describe the structure, properties, and applications of carbon nanotubes. | 11 | K2 | CO6 |