

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

Second Semester

Computer Science and Engineering

(Common to Information Technology, Artificial Intelligences and Data Science & Computer Science and Engineering (AIML))

24BSPH203 – PHYSICS FOR INFORMATION SCIENCE

Regulations - 2024

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. The classical free electron theory of metals is used to verify ----- (a) periodic potential (b) Band theory (c) Ohms law (d) Quantum theory	1	K1	CO1
2. The probability of the number of electrons occupying in a given energy state based on the Fermi distribution function is (a) 0 (b) 1 (c) between 0 and 1 (d) greater than 1	1	K1	CO1
3. The maximum energy of the valence band and minimum energy of the conduction band have different values of momentum in (a) conductors (b) direct band gap semiconductors (c) Indirect band gap semiconductors (d) Insulator	1	K1	CO2
4. When a trivalent atom is added to an intrinsic semiconductor, then it is said to be ----- semiconductor. (a) Pure (b) n-type (c) p-type (d) none of these	1	K1	CO2
5. The magnetic materials in which the magnetic spins are aligned in an antiparallel direction with unequal magnitude called ____ materials. (a) diamagnetic (b) paramagnetic (c) antiferromagnetic (d) ferrimagnetic	1	K1	CO3
6. If $H=0$ and $B \neq 0$, then it is known as ----- (a) coercivity (b) retentivity (c) dipole strength (d) dipole moment	1	K2	CO3
7. LED works under ----- bias condition. (a) forward (b) neutral (c) reverse bias (d) both forward and reverse	1	K1	CO4
8. If the energy of the incident photon is greater than the bandgap of a given semiconductor, then the light gets (a) reflected (b) transmitted (c) absorbed (d) attenuated	1	K2	CO4
9. As the size of the particle is reduced to a nanometer, the absorption shifts to a shorter wavelength causing ----- the band gap energy. (a) remains same (b) increase (c) decrease (d) disappear	1	K2	CO5
10. The ability to simultaneously be in multiple states is called ----- (a) superposition (b) subposition (c) entanglement (d) superstition	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. The thermal and electrical conductivities of Cu at 20 °C are $390 \text{ Wm}^{-1}\text{K}^{-1}$ and $5.87 \times 10^7 \Omega^{-1}\text{m}^{-1}$ respectively. Find its Lorentz number.	2	K3	CO1
12. What is periodic potential?	2	K1	CO1
13. Compare direct and indirect band gap semiconductors.	2	K2	CO2
14. List out any three Hall devices.	2	K1	CO2
15. Write down the classification of magnetic materials based magnetic moment.	2	K1	CO3
16. Define magnetic susceptibility.	2	K1	CO3
17. What is superconductivity?	2	K1	CO4
18. Calculate the wavelength emitted by a semiconductor whose band gap energy is 1.55 eV.	2	K3	CO4

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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|-------------------------------------------------------|---|----|-----|
| 19. Explain quantum confinement. | 2 | K2 | CO5 |
| 20. Give the types of structures in carbon nanotubes. | 2 | K1 | CO5 |
| 21. Explain quantum entanglement. | 2 | K2 | CO6 |
| 22. Compare classical bit with qubit. | 2 | K2 | CO6 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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| 23. a) Deduce a mathematical expressions for electrical and thermal conductivity of a metal using classical free electron theory of solids. | 11 | K3 | CO1 |
| OR | | | |
| b) Derive an expression for the density of states using quantum free electron theory of solids. | 11 | K3 | CO1 |
| 24. a) Derive an expression for the density of electrons in the conduction band for an intrinsic semiconductor. | 11 | K3 | CO2 |
| OR | | | |
| b) Apply the Hall effect principle to derive the Hall coefficient and Hall voltage in n-type semiconductor. | 11 | K3 | CO2 |
| 25. a) Explain the domain theory of ferromagnetism. | 11 | K2 | CO3 |
| OR | | | |
| b) (i) Compare hard and soft magnetic materials. | 5 | K2 | CO3 |
| (ii) Explain the phenomenon of hysteresis in ferromagnetic materials. | 6 | K2 | CO3 |
| 26. a) Explain the following properties of superconductors:
(i) Meissner effect (ii) Effect of magnetic field (iii) Isotope effect | 11 | K2 | CO4 |
| OR | | | |
| b) Explain the principle, construction and working of LED. | 11 | K2 | CO4 |
| 27. a) Derive an expression for the density of states of quantum well and quantum wire. | 11 | K3 | CO5 |
| OR | | | |
| b) Apply the principle of quantum tunneling to explain the working of single electron transistor with different ON and OFF states. | 11 | K3 | CO5 |
| 28. a) Outline any three single qubit quantum gates with the necessary truth table and diagram. | 11 | K2 | CO6 |
| OR | | | |
| b) Show how the CNOT gate operates on control and target inputs using truth tables and matrix representation. | 11 | K2 | CO6 |