Parul University NAAC A++	**Parul University** **Faculty of Engineering and Technology** **Parul Institute of Engineering and Technology** **Department of Applied Sciences and Humanities**

Subject Name	**Physics for Semiconductors**	**A.Y**	**2025-26**
Subject Code	**03019201BS01**	**Semester**	**2nd**

Unit 1

Sr No	**Questions**	**COs**	**B.T**
1	Which material has the lowest electrical resistivity? a) Glass b) Silicon c) Rubber d) Gold	1	1
2	What is the unit of electrical resistivity? a) ohm b) ohm-m c) volt d) ampere	1	3
3	Which type of bonding involves delocalized electrons shared among all atoms? a) covalent b) ionic c) hydrogen d) metallic	1	2
4	What principle states that no two electrons can have the same set of quantum numbers? a) Heisenberg's uncertainty principle b) Pauli's exclusion principle c) Bohr's quantization rule d) Fermi-Dirac principle	1	3
5	In semiconductors, the band gap typically lies in the range of: a) 0 – 0.1 eV b) 0.1 – 3 eV c) 3 – 10 eV d) >10 eV	1	2
6	Which model explains the formation of energy bands in solids using periodic potentials? a) Drude Model b) Bohr Model c) Kronig-Penney Model d) Lorentz Model	1	1
7	What is the significance of the Fermi energy at 0K? a) it is the lowest energy level b) it is the average energy level c) it is the highest occupied level d) it is the energy gap	1	2
8	Which type of semiconductor is suitable for light-emitting applications? a) indirect band gap b) direct band gap c) intrinsic semiconductor d) degenerate semiconductor	1	2
9	Which material has the highest electron mobility among the following? a) silicon b) germanium c) GaAs d) Glass	1	2
	Section B: Short Questions		
10	How does the effective mass of charge carriers influence their mobility?	1	3
11	Explain the difference between direct and indirect band gap semiconductors using E-k diagrams.	1	2
12	Direct or indirect band gap semiconductors, which semiconductors are preferred for designing electronic devices and why?	1	3

13	What is the difference between resistance and resistivity? Write the units of resistance and resistivity.	1	1
14	What are the limitations of resistivity-based classification?	1	4
15	Graphically demonstrate the position of Fermi level in intrinsic and extrinsic semiconductors.	1	2
16	Plot the I-V characteristics of Ohmic and Schottky junction.	1	3
17	State the equation of density of states.	1	4
18	State the equation of density of states in valence band.	1	3
19	State the equation of density of states in conduction band.	1	2
20	Graphically demonstrate the position of Fermi level in intrinsic and extrinsic semiconductors.	1	2
21	Plot the I-V characteristics of Ohmic and Schottky junction.	1	3
22	Derive an equation for effective mass of electron in conductors	1	4
23	Explain Fermi energy and comment on fermi energy level in p type and n type semiconductors	1	3
24	Define Band Gap	1	1
	Unit 2		
25	How does the refractive index vary in Graded Index fibre? a) Tangentially b) Radially c) Longitudinally d) Transversely	2	2
26	2. What is the other name for a maximum external incident angle in optical fibre? a) Optical angleb) Total internal reflection angle c) Refraction angle d) Wave guide acceptance angle	2	3
27	How is speed and sensitivity enhanced in PIN photodiode? a) decreasing depletion layer b) expanding depletion layer c) introducing P+ layer d) introducing N+ layer	2	4
28	LASER works on the principle of a) spontaneous emission b) diffraction c)stimulated emission d) interference	2	1
29	Which of the following has more distortion? a) Single mode step-index fibre b) Graded index fibre c) Multimode step-index fibre d) step index fibre	2	3
30	Which of the following is a property of Laser light. a)divergence b)scattering c)polychromaticity d) coherence	2	1
31	Which parameters are used to classify optical fibers?	2	1

32	List the various kinds of optical fibers along with diagram.	2	4
33	Describe difference between step-index and graded-index fibers.	2	2
34	Describe a graded-index fiber and its benefits compared to step-index.	2	3
35	Explain total internal reflection principle.	2	2
36	Explain the significance of acceptance angle in fiber communication.	2	3
37	List three applications of PN junction photodiodes.	2	4
38	How does PIN diode improve sensitivity over PN diode?	2	2
39	List common uses of PIN photodiodes.	2	3
40	What are the limitations of PIN diode?	2	2
41	List three applications of PN junction photodiodes.	2	4
42	How does PIN diode improve sensitivity over PN diode?	2	2
43	List common uses of PIN photodiodes.	2	3
44	What are the limitations of PIN diode? Explain Avalanche photodiode	2	2
45	Explain the construction and working of LASER	2	2
46	Explain stimulated and sponataneous emission with diagrams	2	3
47	Explain the working of LED with neat diagrams	2	3
48	List two applications of APD.	2	2
49	Define optoelectronics devices.	2	3
50	List various types of optoelectronic devices.	2	4
51	List three practical applications of LED.	2	4
52	What are the key characteristics of laser light?	2	3
53	Discuss the applications of lasers.	2	3
54	List the main components of Laser system.	2	3
55	List the conditions of LASER.	2	2
56	Write full form of LASER and explain its principle.	2	2
57	Explain the construction and working of a diode laser.	2	1
58	Discuss the working principle and construction of PIN junction photodiode.	2	1
59	Write the benefits of using optical fibers.	2	3
60	A fiber has a core refractive index of 1.56 and a cladding refractive index of 1.51. What is its numerical aperture?	2	2
61	A fiber has a core refractive index of 1.55 and a cladding refractive index of 1.50. What are its numerical aperture and acceptance angle in air?	2	2
62	**Unit 3**		
63	Explain the three failures of classical physics that led to the development of quantum	3	3
64	mechanics.	3	2
65	Write a short note on quantum tunnelling.	3	4
66	Derive the Time Independent Schrödinger Equation (TISE) for a particle in one	3	3
67	dimension.	3	4

68	Explain the differences between classical and quantum computing.	3	3
69	Write 5 applications of quantum technology in various fields.	3	2
70	Discuss the limitations and challenges of current quantum technology.	3	1
71	Define wave-particle duality with one example.	3	4
72	State Heisenberg's Uncertainty Principle in mathematical form.	3	2
73	Write the de Broglie wavelength equation for a moving particle.	3	3
74	What is meant by a well-behaved wave function?	3	2
75	Define probability density in quantum mechanics.	3	2
76	Define wave-particle duality with one example.	3	4
77	State Heisenberg's Uncertainty Principle in mathematical form.	3	2
78	Write the de Broglie wavelength equation for a moving particle.	3	3
79	Differentiate between eigenfunction and eigenvalue.	3	1
80	Write the Time Dependent Schrödinger Equation (TDSE) in 1D.	3	3
81	State Postulate 1 of quantum mechanics.	3	2
82	Differentiate between eigenfunction and eigenvalue.	3	1
83	**Unit 4**		
84	Define nanomaterials and give one example.	4	4
85	Differentiate between micromaterials and nanomaterials in one point.	4	4
86	Write any two examples of 0-D nanomaterials.	4	3
87	What is the significance of surface area-to-volume ratio in nanomaterials?	4	3
88	Name two carbon allotropes that are considered nanomaterials.	4	2
89	State one difference between top-down and bottom-up approaches of nanomaterial	4	2
90	Define nanomaterials and give one example.	4	4
91	Differentiate between micromaterials and nanomaterials in one point.	4	4
92	Classify nanomaterials based on dimensions with suitable examples.	4	4
93	Describe the top-down approach for synthesis of nanomaterials with two techniques.	4	3
94	Discuss the effect of particle size on the melting point of nanomaterials with an	4	3
95	example.	4	4
96	Explain the mechanical properties (elasticity, hardness, ductility) of nanomaterials	4	2
97	Discuss the effect of particle size on the melting point of nanomaterials with an	4	3
98	Explain Blue shift in nanomaterials	4	3

99	Expalin various health hazards associated with nanomaterials	4	2
100	Describe top down method with one example	4	1
101	Describe bottom up method with one example	4	1
102	Explain, thermal and electrical properties of nano	4	2
103	Expalin quantum confinement	4	1
104	Write a short note on various carbon nanomaterials	4	2
105	Describe novel materials and cite one aaplication	4	3