Unit IV

Solid State Physics

1	At absolute zero, Si acts as? a) non-metal b) metal c) insulator d) none of these
2	Carbon, Silicon and Germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$ respectively. Which one of the following relationship is true in their case? a) $(E_g)_C > (E_g)_{Si}$ b) $(E_g)_C < (E_g)_{Si}$ c) $(E_g)_C = (E_g)_{Si}$ d) $(E_g)_C < (E_g)_{Ge}$
3	The forbidden energy gap in an insulator is a) > 6 eV b)< 6 eV c) 1 eV d) 4 eV
4	In an insulator, the number of electrons in the valence shell in general is a) less than 4 b) more than 4 c) equal to 4 d) none of these
5	Energy band gap size for semiconductors is in the range _________ eV. a) 1-2 b) 2-3 c) 3-4 d) > 4
6	Energy band gap size for insulators is in the range _________ eV. a) 1-2 b) 2-3 c) 3-4 d) 3-6
7	Not an example for intrinsic semiconductor a) Si b) Al c) Ge d) Sn
8	Which is the correct ordering of the band gaps within the group 14 elements? a) Diamond > silicon < germanium b) Diamond > silicon > germanium c) Diamond < silicon > germanium d) Diamond < silicon < germanium
9	Energy band formation is prominent in ……. a) Solids b) Liquids c) Gases d) All the above
10	Elements in gaseous state give rise to ………. spectrum. a) band b) line c) continuous d) all the above
11	Elements in crystalline solid give rise to ……… spectrum. a) band b) line c) continuous d) all the above
12	In solids there is significant interaction between ………. electrons of different atoms. a) innermost b) free c) outermost d) all the above
13	……….. band contains free electrons. a) Valence b) Conduction c) Forbidden d) Both valence and conduction
14	……….. band contains valence electrons. a) Valence b) Conduction c) Forbidden d) Both valence and conduction e)
15	……….. band does not contain electrons. a) Valence b) Conduction

	c) Forbidden d) Both valence and conduction
16	Electrons exist in ………. a) Valence band b) Conduction band c) Forbidden band d) Both valence and conduction band
17	If *N* atoms are brought close together to form a solid, the *s* energy band can accommodate ………… electrons. *a)* *N* *b)* 2 *N* *c)* 6 *N* *d)* 8 *N*
18	If *N* atoms are brought close together to form a solid, the *p* energy band can accommodate ………… electrons. *a)* *N* *b)* 2 *N* *c)* 6 *N* *d)* 8 *N*
19	If the outermost energy band in a solid is partially filled, the solid will be …………. a) insulator b) semiconductor c) good conductor d) any of the above
20	If the outermost energy band in a solid is completely filled, the solid will be ………. a) insulator b) semiconductor c) good conductor d) either insulator or semiconductor
21	If the outermost energy band in a solid is completely filled and the energy difference with the next energy band is small, the solid will be ……………. a) insulator b) semiconductor c) good conductor d) any of the above
22	If the outermost energy band in a solid is completely filled and the energy difference with the next energy band is large, the solid will be ……………. a) insulator b) semiconductor

	c) good conductor d) any of the above
23	An energy band is ………… a) a set of continuous energies b) a set of closely spaced allowed energy levels c) a set of widely spaced allowed energy levels d) none of the above e)
24	What is the origin of energy bands in solids? a) Atomic mass b) Temperature c) Closely packed periodic structure of solid d) Atomic number of atoms in solid
25	Which of the following decides electrical properties of a solid? a) Electronic configuration b) Interatomic distance c) Both Electronic configuration and Interatomic distance d) Neither Electronic configuration nor Interatomic distance e)
26	Valence band in a metal contains ………. a) free electrons b) holes c) valence electrons d) both holes and valence electrons
27	Valence band in a semiconductor contains ……………..Free electrons a) Holes b) Valence electrons c) Both holes and valence electrons
28	Conduction band in a metal contains…….. a) free electrons b) holes c) valence electrons d) both holes and valence electrons
29	Conduction band in a semiconductor contains ……………. a) Free electrons b) Holes c) Valence electrons

	d) Both holes and valence electrons
30	The energy gap in good conductors is …… a) 0 b) ~ 1 eV c) ~ 5 eV d) none of th above
31	The energy gap in insulators is ………….. a) 0 b) ~ 1 eV c) ~ 5 eV d) none of th above
32	The energy gap in semiconductors is …… a) 0 b) ~ 1 eV c) ~ 5 eV d) none of the above
33	Which of the following has maximum band gap energy ? a) Tin b) Silicon c) Germanium d) Carbon in diamond form
34	Which of the following has minimum band gap energy ? a) Tin b) Silicon c) Germanium b) Carbon in diamond form c)
35	Pure semiconductors are known as …………. a) intrinsic b) doped c) extrinsic d) compound
36	Impure semiconductors are known as …………. a) intrinsic b) doped c) extrinsic d) compound
37	The donor impurity levels lie ………. a) just above the valence band b) just below the conduction band c) at the centre of forbidden band d) just above the conduction band
38	The acceptor impurity levels lie ………. a) just above the valence band b) just below the conduction band c) at the centre of forbidden band d) just above the conduction band

39	There is no forbidden band in ……… a) good conductor b) semiconductor c) insulators d) both semiconductors and insulators e)
40	The band gap energy in Silicon is……….. a) 0 b) 0.7 eV c) 1.1 eV d) 5 Ev
41	The band gap energy in Germanium is….. a) 0 b) 0.7 eV c) 1.1 eV d) 5 eV
42	Which of the following is not a semiconductor? a) Silicon b) Germanium c) GaAs d) Carbon
43	Valence band of a semiconductor at 0 K will be …………….. a) completely filled b) partially filled c) completely empty d) either completely filled or completely empty
44	Valence band of a semiconductor at temperatures above 0 K will be ……… a) completely filled b) partially filled c) completely empty d) either completely filled or completely empty
45	Conduction band of a semiconductor at 0 K will be …………….. a) completely filled b) partially filled c) completely empty d) either completely filled or completely empty
46	Conduction band of a semiconductor at

	temperatures above 0 K will be ……….. a) completely filled b) partially filled c) completely empty d) either completely filled or completely empty
47	The classical free electron theory of metals was initiated by ……………….. a) Pauli b) Summerfield c) Lorentz and Drude d) Fermi-Dirac
48	According to classical free electron theory the electrons follow ……… distribution of energy. a) Binomial b) Maxwell-Boltzmann c) Fermi-Dirac d) Bose-Einstein
49	According to quantum free electron theory the electrons follow ……… distribution of energy. a) binomial b) Maxwell-Boltzmann c) Fermi-Dirac d) Bose-Einstein
50	According to classical free electron theory the electrons ………….. in absence of external electric field. a) remain at rest b) move randomly c) have drift velocity d) none of the above
51	Identical particles which are so far apart that they can be distinguished and their wave functions do not overlap obey …………….. distribution for energy. a) Binomial b) Maxwell-Boltzmann c) Fermi-Dirac d) Bose-Einstein
52	Identical particles with zero or integer spins with overlapping wavefunctions which can not be distinguished obey …………….. distribution for energy. a) Binomial b) Maxwell-Boltzmann c) Fermi-Dirac d) Bose-Einstein
53	Identical particles for which the spin is an odd integer multiple of half which can not be distinguished from one another obey …………….. distribution for energy. a) Binomial b) Maxwell-Boltzmann c) Fermi-Dirac d) Bose-Einstein
54	According to classical free electron theory the electrons ………….. in absence of external electric field. a) remain at rest b) move randomly c) have drift velocity d) none of the above
55	Average kinetic energy $\left(\overline{E_0}\right)$ of a free electron gas at 0 K is a) $\frac{2}{5}E_F$ b) $\frac{5}{3}E_F$ c) $\frac{3}{5}E_F$ d) E_F
56	Which of the following, when added as an impurity, into the Silicon, produces n-type semi conductor a) Phosphorous b) Aluminum c) Magnesium d) both ‘b’ and ‘c’
57	When arsenic is added as an impurity to Silicon, the resulting material is a) n-type semiconductor b) p-type semiconductor c) n-type conductor e) Insulator f)
58	To obtain a p-type germanium semiconductor, it must be doped with? a) Arsenic b) Antimony c) Indium d) Phosphorus
59	Which of the following when added acts as an

	impurity into silicon produced n-type semi conductor? a) P b) Al c) B d) Mg
60	A semiconductor is doped with donor impurity is a) p type b) n type c)npn type d)pnp type
61	One serious drawback of semiconductors is a) they are costly b) they pollute the environment c) they do not last for long time d) they can't withstand high voltage
62	in a p type semiconductor, the acceptor valence band is a) above the conduction band of the host crystal b) below the conduction band of the crystal c) above the valence band of the crystal d) below the conduction band of the crystal
63	In intrinsic semiconductors, number of free electrons is ___________ number of holes. a) Equal to b) Greater than c) Less than d) Can not define
64	In *n*-type semiconductors, number of holes is ___________ number of free electrons. a) Equal to b) Greater than c) Less than d) Can not define
65	In *p*-type semiconductors, number of holes is ___________ number of free electrons. a) Equal to b) Greater than c) Less than d) Twice
66	*n*-type semiconductors are: a) Negatively charged b) Produced when Indium is added as an impurity to Germanium c) Produced when phosphorous is added as an impurity to silicon d) None of the above
67	*p*-type semiconductors are: a) Negatively charged b) Produced when Indium is added as an impurity to Germanium c) Produced when phosphorous is added as an impurity to silicon d) None of the above
68	A long specimen of *p*-type semiconductor material: a) Is positively charged b) Is electrically neutral c) Has an electric field directed along its length d) None of the above
69	When N-type semiconductor is heated, a) number of free electrons increases while that of holes decreases b) number of holes increases while that of electrons decreases c) number of electrons and holes remain same d) number of electron and holes increases equally
70	A piece of copper and other of germanium are cooled from the room temperature to 80K, then a) resistance of each will increase b) resistance of copper will decrease c) the resistance of copper will increase while that of germanium will decrease d) the resistance of copper will decrease while that of germanium will increase
71	At low temperature, the resistivity of a metal is proportional to ……………… a) T^2 b) T c) T^5 d) $T^{1/2}$
72	The intrinsic semiconductor becomes an insulator at a) 0°C b) 0K c) 300K d) —100°C
73	In semiconductors at a room temperature a) the conduction band is completely empty b) the valence band is partially empty and the conduction band is partially filled c) the valence band is completely filled and the conduction band is partially filled d) the valence band is completely filled
74	Choose the only false statement from the

following.
a) in conductors the valence and conduction bands may overlap.
b) Substances with energy gap of the order of 5 eV are insulators.
c) The resistivity of a semiconductor increases with increase in temperature.
d) The conductivity of a semiconductor increases with increase in temperature.

75 What is the conductivity of semiconductor if free electron density = $5x10^{12}/cm^3$ and hole density = $8x10^{13}/cm^3$? [μ_e = 2.3 and μ_h = 0.01 in SI units]
a) 5.634 b) 1.968 c) 3.421 d) 8.964

76 Difference in the variation of resistance with temperature in a metal arises essentially due to the difference in
a. type of bonding
b. crystal structure
c. scattering mechanism with temperature
d. number of charge carriers with temperature

77 The difference in the variation of resistance with temperature in semiconductor arises essentially due to the difference in
a) type of bonding
b) crystal structure
c) scattering mechanism with temperature
d)number of charge carriers with temperature

78 Resistance of a semiconductor
a) increases with temperature
b) decreases with temperature
c) remains unaffected with temperature
d) none of these

79 The temperature coefficient of the resistance of semiconductors is always
a) positive b) negative
c) zero d) infinite

80 Electrical conductivity of insulators is of the order of ______________.
a) $10^{-10}(\Omega\text{-mm})^{-1}$
b) $10^{-10}(\Omega\text{-cm})^{-1}$
c) $10^{-10}(\Omega\text{-m})^{-1}$
d) $10^{-8}(\Omega\text{-m})^{-1}$

81 Unit for electric field strength is
a) A/cm^2 b) mho/meter
c) $cm^2/V.s$ d) V/cm

82 Flow of electrons is affected by the following
a) Thermal vibrations b) Impurity atoms
c) Crystal defects d) all

83 Mobility of holes is ___________ mobility of electrons in intrinsic semiconductors.
a) Equal to b) Greater than c) Less than d) Can not define

84 The conductivity of an intrinsic semiconductor is given by (symbols have the usual meanings):
a) $\sigma_i = en_i^2 (\mu_n - \mu_p)$
b) $\sigma_i = en_i (\mu_n - \mu_p)$
c) $\sigma_i = en_i (\mu_n + \mu_p)$
d) None of the above

85 In an intrinsic semiconductor, the mobility of electrons in the conduction band is:
a) Less than the mobility of holes in the valence band
b) Zero
c) Greater than the mobility of holes in the valence band
d) None of the above

86 If the drift velocity of holes under a field gradient of 100 V/m is 5m/s, the mobility (in the same SI units)is ....
a) 0.05
b) 0.55
c) 500
d) None of the above

87 The electron and hole concentrations in a intrinsic semiconductor are n_i and p_i respectively. When doped with a *p*-type material, these change to n and p, respectively. Then:
a) $n + p = n_i + p_i$
b) $n + n_i = p + p_i$

	c) $n_p = n_i p_i$ d) None of the above
88	If the temperature of an extrinsic semiconductor is increased so that the intrinsic carrier concentration is doubled, then: a) The minority carrier density doubles b) The majority carrier density doubles c) Both majority and minority carrier densities double d) None of the above
89	At room temperature, the current in an intrinsic semiconductor is due to a) Holes b) Electrons c) Holes and electrons d) None of the above
90	The mobility is given by (notations have their usual meaning): a) $\mu = v_0/E_0$ b) $\mu = v_0/E_0^2$ c) $\mu = v_0^2/E_0$ d) None of the above
91	In a *p*-type semiconductor, the conductivity due to holes (σ_p) is equal to (*e* is the charge of hole, μ_p is the hole mobility, p_0 is the hole concentration): a) $p_0.e/\mu_p$ b) $\mu_p/p_0.e$ c) $p_0.e.\mu_p$ d) None of the above
92	Near room temperature, resistivity is maximum for………………… a) Good conductors b) Semiconductors c) Insulators d) Both semiconductors and insulators
93	Near room temperature, resistivity is minimum for………………… a) Good conductors b) Semiconductors c) Insulators d) Both semiconductors and insulators
94	Resistivity increases with increase in temperature for ………………… a) Good conductors b) Semiconductors c) Insulators d) Both semiconductors and insulators
95	Resistivity decreases with increase in temperature for ………………… a) Good conductors b) Semiconductors c) Insulators d) Both semiconductors and insulators
96	If a semiconductor is transparent to light of wavelength greater than λ, the band gap energy will be………… a) $\frac{hl}{c}$ b) $\frac{hc}{l}$ c) $\frac{h}{l}$ d) $\frac{lc}{h}$
97	If the band gap energy of a semiconductor is E_g ,the material will be ……… a) transparent to wavelength greater than $\frac{hc}{E_g}$ b) opaque to wavelength greater than $\frac{hc}{E_g}$ c) transparent to wavelength less than $\frac{hc}{E_g}$ d) none of the above
98	Which of the following have a positive temperature coefficient of resistance? a) Good conductor b) Semiconductor c) Insulators d) Both semiconductors and insulators
99	Which of the following have a negative temperature coefficient of resistance? a) Good conductor b) Semiconductor c) Insulators d) Both semiconductors and insulators

100	Conduction in intrinsic semiconductors is due to ……….. a) only free electrons b) only holes c) both free electrons and holes d) positive and negative ions
101	If a free electron moves towards right and combines with a hole, the hole ……… a) moves towards right b) moves towards left c) remains at the same place d) is neutralized
102	If a bound electron moves towards right and combines with a hole, the hole ……… a) moves towards right b) moves towards left c) remains at the same place d) is neutralized
103	In an electric field, an electron initially at rest will move ……… a) in the direction of electric field b) opposite to the direction of electric field c) perpendicular to the direction of electric field d) none of the above
104	In an electric field, a hole initially at rest will move ……… a) in the direction of electric field b) opposite to the direction of electric field c) perpendicular to the direction of electric field d) none of the above
105	Mobility of holes is ………. that of free electrons. a) more than b) less than c) equal to d) can be more or less than
106	The charge carriers in intrinsic semiconductors are ………….. a) free electrons b) holes c) both free electrons and holes d) neither free electrons nor holes
107	The charge carriers in p - type semiconductors are ………….. a) free electrons b) holes c) both free electrons and holes d) neither free electrons nor holes
108	The charge carriers in n - type semiconductors are ………….. a) free electrons b) holes c) both free electrons and holes d) neither free electrons nor holes
109	The majority charge carriers in p - type semiconductors are ………….. a) free electrons b) holes c) both free electrons and holes d) neither free electrons nor holes
110	The majority charge carriers in n - type semiconductors are ………….. a) free electrons b) holes c) both free electrons and holes d) neither free electrons nor holes
111	The resistance of a conductor of unit length and unit cross section area is known as ………… a) resistivity b) conductivity c) resistance d) conductance
112	The reciprocal of resistivity is ………… a) resistivity b) conductivity c) resistance d) conductance
113	The reciprocal of resistance is ………… a) resistivity b) conductivity

	c) resistance d) conductance
114	The amount of charge flowing through unit cross section area per unit time is known as ……….. a) current b) current density c) conductance d) resistance
115	The amount of charge flowing through any cross section area per unit time is known as ……….. a) current b)current density c) conductance d) resistance
116	Current in a semiconductor can be due to a) electric field b) density gradient of charge carriers c) both electric field and density gradient of charge carriers d) either electric field or density gradient of charge carriers
117	The unit for resistivity is ……………. a) ohm b) ohm / m c) ohm-m d) mho / m
118	The unit for conductivity is ……………. a) ohm b) ohm / m c) ohm-m d) mho / m
119	Which of the following equations for mobility is correct? a) $m = \frac{v_d}{E}$ b) $m = \frac{s}{ne}$ c) $m = \frac{1}{ner}$ d) All the above
120	If I_e is the current due to electrons and I_h is the current due to holes in a semiconductor under the influence of an external electric field, the total current is …………. a) $I_e + I_h$ b) $I_e - I_h$ c) $\frac{I_e}{I_h}$ d) $\frac{I_h}{I_e}$
121	The equation for current density is $J = \cdots\cdots\cdots$ a) nev_d b) $neav_d$ c) nea d) none of the above
122	The equation for current is $I = \cdots\cdots\cdots$ a) nev_d b) $neav_d$ c) nea d) none of the above
123	If an electric field of 10 V / m is applied to *n*-type Germanium in which the mobility of free electrons is 3800 cm^2 / V-s, the drift velocity of electrons will be …………. m/s. a) 38000 b) 38 c) 3.8 d) 0.38
124	If an electric field of 10 V / m applied to *p*-type Germanium gives rise to a drift velocity of 1.7 m / s for the holes, the mobility of holes is …………. cm^2 / V-s. a) 1.7 b) 17 c) 170 d) 1700
125	A small concentration of minority carriers is injected into a homogeneous semiconductor crystal at one point. An electric field of 10 V/cm is applied across the crystal and this moves the minority carrier a distance of 1 cm in 20 µsec. The mobility (in cm^2/volt.sec) is: a) 10000 b) 20000 c) 50 d) 100
126	If the electrical resistivity of Ti is 4.3×10^{-7} Ω m, what is the resistance of a 0.85 m long piece of wire of cross section 2.0×10^{-6} m^2? a) 0.18 Ω b) 5.47 Ω c) 0.25 Ω d) 3.95 Ω
127	The effective mass of an electron is negative ……………. a) near the bottom of conduction band b) near the top of valence band c) in the valence band d) in the forbidden band

128	The effective mass is same as its mass for a) near the bottom of conduction band b) near the top of valence band c) in the valence band d) in the forbidden band
129	The effective mass of an electron is positive …………… a) near the bottom of conduction band b) near the top of valence band c) in the valence band d) in the forbidden band
130	The Fermi-Dirac probability distribution function is …………….. a) $P(E)=\frac{1}{1+e^{(E-E_F)/kT}}$ b) $P(E)=\frac{1}{1+e^{(E_F-E)/kT}}$ c) $P(E)=\frac{1}{e^{(E-E_F)/kT}}$ d) $P(E)=\frac{1}{1-e^{(E-E_F)/kT}}$
131	The value of Fermi Function at 0K for E < E_F is ………… a) 0 b) 1 c) 0.5 d) 0.75
132	The value of Fermi Function at 0K for E > E_F is ………… a) 0 b) 1 c) 0.5 d) 0.75
133	The value of Fermi Function at T > 0K for E = E_F is ………… a) 0 b) 1 c) 0.5 d) 0.75
134	The probability that an electron in a metal occupies the Fermi-level, at any temperature (>0 K) is: a) 0 b) 1 c) 0.5 d) none of the above
135	The value of Fermi-distribution function at absolute zero (T = 0K) is 1, i.e. F(E) = 1, under the condition ……………. a) $E>E_F$ b) $E<E_F$ c) $E=E_F$ d) $E>>E_F$
136	Fermi energy level for intrinsic semiconductors lies a) At middle of the band gap b) Close to conduction band c) Close to valence band d) None
137	Fermi energy level for *p*-type extrinsic semiconductors lies a) At middle of the band gap b) Close to conduction band c) Close to valence band d) None
138	Fermi energy level for *n*-type extrinsic semiconductors lies a) At middle of the band gap b) Close to conduction band c) Close to valence band d) None
139	Fermi level for extrinsic semiconductor depends on a) Donor element b) Impurity concentration c) Temperature d) All
140	The density states of electrons between the energy range E and E + dE is proportional to a) $E^{1/2}$ b) E^2 c) E d) $E^{3/2}$
141	When we increase the temperature of extrinsic semiconductor, after a certain temperature it behaves like …… a) an insulator b) an intrinsic semiconductor c) a conductor d) a superconductor
142	In a n-type semiconductor, the Fermi level at 0K is …………… a) between valence band and acceptor levels b) between acceptor levels and intrinsic Fermi

	level c) between intrinsic Fermi level and donor level d) between donor level and conduction band
143	In a p-type semiconductor, the Fermi level at 0K is .... a) between valence band and acceptor levels b) between acceptor levels and intrinsic Fermi level c) between intrinsic Fermi level and donor level d) between donor level and conduction band
144	In a n-type semiconductor, the Fermi level at T > 0K is .... a) between valence band and acceptor levels b) between acceptor levels and intrinsic Fermi level c) between intrinsic Fermi level and donor level d) between donor level and conduction band
145	In a p-type semiconductor, the Fermi level at T > 0K is .... a) between valence band and acceptor levels b) between acceptor levels and intrinsic Fermi level c) between intrinsic Fermi level and donor level d) between donor level and conduction band
146	The Fermi level shifts .... in p-type semiconductor with increase in temperature. a) upwards b) downwards c) neither upward nor downward d) none of the above
147	The Fermi level shifts .... in n-type semiconductor with increase in temperature. a) upwards b) downwards c) neither upward nor downward d) none of the above
148	The Fermi level shifts .... in intrinsic semiconductor with increase in temperature. a) upwards b) downwards c) neither upward nor downward

	d) none of the above
149	The Fermi level shifts .... in n-type semiconductor with increase in impurity concentration. a) upwards b) downwards c) neither upward nor downward d) none of the above
150	The Fermi level shifts .... in p-type semiconductor with increase in impurity concentration. a) Upwards b) downwards c) neither upward nor downward d) none of the above
151	A p-n junction is said to be forward biased, when a) the positive pole of the battery is joined to the p-semiconductor and negative pole to the n-semiconductor b) the positive pole of the battery is joined to the n-semiconductor and negative pole of the battery is joined to the p-semiconductor c) the positive pole of the battery is connected to n- semiconductor and p- semiconductor d) a mechanical force is applied in the forward direction
152	The depletion layer in the P-N junction region is caused by? a) drift of holes b) diffusion of charge carriers c) migration of impurity ions d) drift of electrons
153	A semi-conducting device is connected in a series circuit with a battery and a resistance. A current is found to pass through the circuit. If the polarity of the battery is reversed, the current drops to almost zero. The device may be a) A p-n junction b) An intrinsic semi-conductor c) A p-type semi-conductor d) An n-type semi-conductor

154	The cause of the potential barrier in a p-n diode is ? a) Depletion of positive charges near the junction b) Concentration of positive charges near the junction c) Depletion of negative charges near the junction d) Concentration of positive and negative charges near the junction
155	In forward bias, the width of potential barrier in a p-n junction diode? a) increases b) decreases c) remains constant d) first increases then decreases
156	A depletion layer consists of? a)electrons b) protons c)mobile ions d) immobile ions
157	The part of depletion layer in the p-type contains ……….. a) holes b) positive ions c) free electrons d) negative ions
158	The part of depletion layer in the n-type contains ……….. a) holes b) positive ions c) free electrons d) negative ions
159	In a junction diode, the holes are due to a) protons b) extra electrons c) neutrons d) missing electrons
160	In an unbiased p-n junction a) The potential of the p and n sides becomes higher alternately b) The p side is at higher electrical potential than the n side c) The n side is at higher electrical potential than the p side d) Both the p and n sides are at the same potential
161	Reverse bias applied to a junction diode a) increases the minority carrier current b) lowers the potential barrier c) raises the potential barrier d) increases the majority carrier current
162	Application of a forward bias to a p—n junction a) widens the depletion zone. b) increases the potential difference across the depletion zone. c) increases the number of donors on the n side. d) increases the electric field in the depletion zone.
163	On increasing the reverse bias to a large value in pn junction diode the current: a) Increases slowly b) remains fixed c) Suddenly increases d) decreases slowly
164	The number of ……………. charge carriers increases with increase in temperature in n-type semiconductor. a) minority b) majority c) both minority and majority d) neither minority nor majority
165	The number of ……………. charge carriers increases with increase in temperature in p-type semiconductor. a) minority b) majority c) both minority and majority d) neither minority nor majority
166	The electrical resistance of depletion layer is large because: a) it has no charge carriers b) it has large number of charge carriers c) it contains electrons as charge carriers d) it has holes as charge carriers
167	In forward biased p-n junction the current is of the order of a) ampere b)milliampere c) microampere d)nanoampere

168	When p-n junction diode is reverse biased the flow of current across the junction is mainly due to a) diffusion of charges b) depends on nature of material c) drift of charges d) both drift and diffusion of charges
169	The number of ……………. charge carriers increases with increase in light incident on n-type semiconductor. a) minority b) majority c) both minority and majority d) neither minority nor majority
170	The number of ……………. charge carriers increases with increase in in light incident on p-type semiconductor. a) minority b) majority c) both minority and majority d) neither minority nor majority
171	Application of forward bias to the p-n junction a) increases the number of donors on n side b) increases electric field in depletion region c) increases potential difference across the depletion region d) widens the depletion zone e)
172	Within depletion region of the p-n junction diode a) p side is positive and n side is negative b) p side is negative and n side is positive c) both sides are either positive or negative d) both sides are neutral
173	Barrier potential of p-n junction does not depend on a) temperature b) forward bias c) reverse bias d) diode design
174	For the same electric field and density of doping in two identical semiconductors, one p-type and the other n-type, the current will be …………….
	a) more in n-type b) more in p-type c) same in both d) none of the above
175	The potential difference across an open circuited p-n junction is known as …………….. a) knee voltage b) cut-in-voltage c) potential barrier d) none of the above
176	The dominant mechanism for motion of charge carriers in forward and reverse biased silicon p-n junction are a) drift in both forward and reverse bias b) diffusion in both forward and reverse c) diffusion in forward and drift in reverse d) drift in forward and diffusion in reverse
177	If V_B is the barrier potential, the energy difference between the conduction bands of n-type and p-type in open circuited p-n junction diode is …………….. a) eV_B b) $\frac{V_B}{e}$ c) $e+V_B$ d) $e-V_B$
178	If V_B is the barrier potential and V is the applied voltage, the energy difference between the conduction bands of n-type and p-type in forward biased p-n junction diode is …………….. a) eV_B b) eV_B+eV c) eV_B-eV d) $V-V_B$
179	If V_B is the barrier potential and V is the applied voltage, the energy difference between the conduction bands of n-type and p-type in reverse biased p-n junction diode is …………….. a) eV_B b) eV_B+eV c) eV_B-eV d) $V-V_B$
180	Under equilibrium conditions in a p-n junction, the Fermi level in n-type is at ………. level than/as that in p-type. a) higher

	b) lower c) same d) none of the above
181	When forward bias is applied to a p-n junction diode, the Fermi level in n-type …………. with respect to the Fermi level in p-type. a) rises b) falls c) remains at the same level d) initially rises and then falls
182	When reverse bias is applied to a p-n junction diode, the Fermi level in n-type …………. with respect to the Fermi level in p-type. a) rises b) falls c) remains at the same level d) initially rises and then falls
183	When forward bias voltage is applied to a p-n junction diode, the width of the depletion layer…………. a) increases b) decreases c) remains constant d) initially increases and then decreases
184	When reverse bias voltage is applied to a p-n junction diode, the width of the depletion layer…………. a) increases b) decreases c) remains constant d) initially increases and then decreases
185	In a forward biased diode, the conduction is mainly due to …………….. a) electrons b) holes c) electrons in p-type and holes in n-type d) holes in p-type and electrons in n-type
186	In a reverse biased diode, the conduction is mainly due to …………….. a) electrons b) holes

	c) electrons in p-type and holes in n-type d) holes in p-type and electrons in n-type
187	the recombination of electron hole pairs in a forward biased GaAs diode gives rise to ……………. radiation. a) visible b) infra red c) ultra violet d) microwave
188	The depletion layer opposes the flow of .. a) majority charge carriers b) minority charge carriers c) both minority and majority charge carriers d) neither minority nor majority charge carriers
189	The part of a transistor, which is heavily doped to produce large number of majority carriers, i a) emitter b) base c) collector d) any of the above depending upon the nature of transistor
190	When a n-p-n transistor is used as an amplifier then? a) the electrons flow from emitter to collector b) the holes flow from emitter to collector c) the electrons flow from collector to emitter d) the electrons flow from battery to emitter
191	If a transistor is to work as an amplifier, the emitter-base junction must be …………. a) forward biased b) reversed biased c) not be biased d) any of the above
192	If a transistor is to work as an amplifier, the collector-base junction must be …………. a) forward biased b) reversed biased c) not be biased d) any of the above
193	In an n-p-n transistor, …………..electrons from emitter get neutralized in base. a) a large number of

	b) very few c) all d) none of the
194	The concentration of impurities in a transistor : a) equal for emitter, base and collector b) least for emitter region c) largest for emitter region d) largest for collector region
195	In an n-p-n transistor, ………….electrons from emitter cross over to collector. a) a large number of b) very few c) all d) none of the
196	In a biased n-p-n transistor, the Fermi level of emitter ……….with respect to that in base. a) remains at the same level b) shifts upwards c) shifts downwards d) first shifts up and then down
197	In a biased n-p-n transistor, the Fermi level of collector ……….with respect to that in base. a) remains at the same level b) shifts upwards c) shifts downwards d) first shifts up and then down
198	The base of transistor is made thin and lightly doped because a) about 95% of the charge carriers may cross b) about 100% of the charge carriers may cross c) the transistors can be saved from large currents d) none of these
199	The Hall Effect voltage in intrinsic silicon is: a) Positive b) Zero c) None of the above d) Negative
200	In Hall effect, the magnetic field is applied …………….. a) in the direction of current b) opposite to direction of current c) either in or opposite to direction of current d) perpendicular to direction of current
201	In Hall effect voltage is developed ……………. a) in the direction of current b) opposite to direction of current c) either in or opposite to direction of current d) perpendicular to direction of current
202	If an electron moves along positive x axis and a magnetic field is applied in positive y direction, the electron will experience a force along ……………… a) positive z b) negative z c) positive x d) negative x
203	If a hole moves along positive x axis and a magnetic field is applied in positive y direction, the hole will experience a force along ……………… a) positive z b) negative z c) positive x d) negative x
204	The Hall voltage is given by $V_H = \ldots$ a) $\frac{IBd}{nqa}$ b) $\frac{Bd}{Inqa}$ c) $\frac{IqBd}{na}$ d) $\frac{IBad}{nq}$
205	The Hall coefficient is given by $R_H = \ldots$ a) nq b) $\frac{1}{nq}$ c) $\frac{n}{q}$ d) $\frac{q}{n}$
206	The Hall effect is used to determine ….. a) polarity of majority charge carriers b) density of charge carriers c) mobility of charge carriers d) all the above

207	The Hall coefficient of an intrinsic semiconductor is: a) Positive under all conditions b) Negative under all conditions c) Zero under all conditions d) None of the above
208	If the Hall coefficient of a material is 1.25×10^{-11} m^3 / C and charge of an electron is 1.6×10^{-19} C, the density of electron is .... per m^3. a) $2{\times}10^{29}$ b) $4{\times}10^{29}$ c) $5{\times}10^{29}$ d) $2{\times}10^{24}$
209	Hall effect is observed in a specimen when it (metal or a semiconductor) is carrying current and is placed in a magnetic field. The resultant electric field inside the specimen will be in: a) A direction normal to both current and magnetic field b) The direction of current c) A direction anti parallel to magnetic field d) None of the above
210	When n_e and n_h are electron and hole densities, and μ_e and μ_n are the carrier mobilities, the Hall coefficient is positive when a) $n_h\,\mu_h > n_e\mu_e$ b) $n_h\,\mu_h^2 > n_e\mu_e^2$ c) $n_h\mu_h < n_e\mu_h$ d) None of the above
211	Measurement of Hall coefficient in a semiconductor provides information on the: a) Sign and mass of charge carriers b) Mass and concentration of charge carriers c) Sign of charge carriers alone d) Sign and concentration of charge carriers
212	Hall coefficient is given by the relation . a) $R_H = -neJ$ b) $R_H = \frac{1}{ne}$ c) $R_H = -\frac{1}{Jne}$ d) $R_H = \frac{-1}{ne}$

213	The Hall coefficient of (A) at room temperature s $4{\times}10^{-4}$ m^3 $coulomb^{-1}$. The carrier concentration n sample A at room temperature is: a) ~ 10^{21} m^{-3} b) ~ 10^{20} m^{-3} c) ~ 10^{22} m^{-3} d) None of the above
214	The generation of an e.m.f. across an open circuited p-n junction when light is made incident on it is known as ....effect. a) photoemissive b) photoconductive c) photovoltaic d) none of the above
215	The output from a solar cell is .... a) a.c. b) d.c. c) can be either a.c. or d.c. d) none of the above
216	A solar cell consists of .... a) alkali metal b) pure semiconductor c) an extrinsic semiconductor d) p-n junction
217	When the load resistance connected across the solar cell is infinite, we get .... a) open circuit current b) open circuit voltage c) short circuit current d) short circuit voltage
218	When the load resistance connected across the solar cell is zero, we get .... a) open circuit current b) open circuit voltage c) short circuit current d) short circuit voltage
219	Ideal diode equation is, a) $I_0 = I\,(e^{\frac{eV_F}{KT}}-1)$ b) $I = I_0\,(e^{\frac{eV_F}{KT}}+1)$ c) $I = I_0\,(e^{\frac{eV_F}{KT}}-1)$ d) $1 = I_0\,(e^{\frac{eV_F}{KT}}-1$

Unit IV
Answer Key

Q. No	ANS	Q. No.	ANS	Q.No.	ANS	Q.No.	ANS	Q.No.	Ans	Q.No.	ANS
1.	c	41.	b	81.	d	121.	a	161.	c	201.	d
2.	a	42.	d	82.	d	122.	b	162.	c	202.	b
3.	b	43.	a	83.	c	123.	c	163.	c	203.	a
4.	c	44.	b	84.	c	124.	d	164.	c	204.	a
5.	a	45.	c	85.	c	125.	b	165.	c	205.	b
6.	d	46.	b	86.	a	126.	a	166.	a	206.	d
7.	b	47.	c	87.	d	127.	b	167.	b	207.	d
8.	b	48.	b	88.	a	128.	a	168.	c	208.	c
9.	a	49.	c	89.	c	129.	a	169.	c	209.	a
10.	b	50.	b	90.	a	130.	a	170.	c	210.	a
11.	a	51.	b	91.	c	131.	b	171.	b	211.	d
12.	c	52.	d	92.	c	132.	a	172.	b	212.	d
13.	b	53.	c	93.	a	133.	c	173.	d	213.	c
14.	a	54.	b	94.	a	134.	c	174.	b	214.	c
15.	c	55.	c	95.	d	135.	b	175.	c	215.	b
16.	d	56.	a	96.	b	136.	a	176.	a	216.	d
17.	b	57.	a	97.	a	137.	c	177.	a	217.	b
18.	c	58.	c	98.	a	138.	b	178.	c	218.	c
19.	c	59.	a	99.	d	139.	d	179.	b	219.	c
20.	d	60.	b	100.	b	140.	a	180.	c		
21.	b	61.	d	101.	d	141.	b	181.	a		
22.	a	62.	c	102.	b	142.	d	182.	b		
23.	b	63.	a	103.	b	143.	a	183.	b		
24.	c	64.	c	104.	a	144.	c	184.	a		
25.	c	65.	b	105.	b	145.	b	185.	d		
26.	a	66.	c	106.	c	146.	a	186.	c		
27.	d	67.	b	107.	c	147.	b	187.	a		
28.	a	68.	b	108.	c	148.	c	188.	a		
29.	a	69.	d	109.	b	149.	a	189.	a		
30.	a	70.	d	110.	a	150.	b	190.	a		
31.	c	71.	c	111.	a	151.	a	191.	a		
32.	b	72.	b	112.	b	152.	b	192.	b		
33.	d	73.	b	113.	d	153.	a	193.	b		
34.	a	74.	c	114.	b	154.	d	194.	c		
35.	a	75.	b	115.	a	155.	b	195.	a		
36.	c	76.	c	116.	c	156.	d	196.	b		
37.	b	77.	d	117.	c	157.	d	197.	c		
38.	a	78.	b	118.	d	158.	b	198.	a		
39.	a	79.	b	119.	d	159.	d	199.	b		
40.	c	80.	a	120.	a	160.	c	200.	d		