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Objective Solved
Questions

Volume-2

Basics Electronics
Measurement

MCOQ

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UNIT-I

BASIC ELECTRONICS

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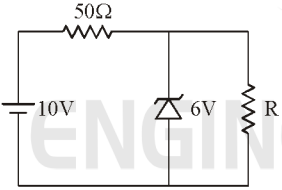
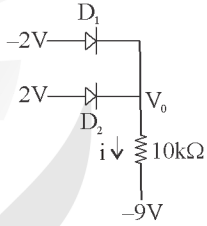
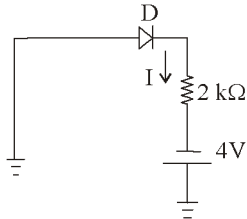
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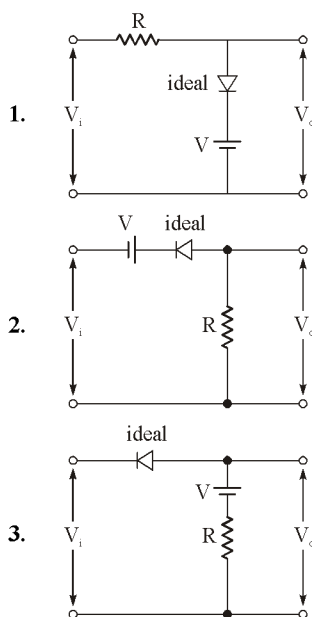
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SEMICONDUCTOR BASICS & DIODES

OBJECTIVE QUESTIONS

- The values of voltage (V_D) across a tunnel-diode corresponding to peak and valley currents are V_p and V_v respectively. The range of tunnel-diode voltage V_D for which the slope of its $I - V_D$ characteristics is negative would be
 - $V_D < 0$
 - $0 \leq V_D < V_p$
 - $V_p \leq V_D \leq V_v$
 - $V_D \geq V_v$
 - In a p^+n junction diode under reverse bias, the magnitude of electric field is maximum at
 - The edge of the depletion region on the p-side
 - The edge of the depletion region on the n-side
 - The p^+n junction.
 - The centre of the depletion region on the n-side
 - In a bridge rectifier the input and output connections are interchanged. What will happen if supply is switched on :
 - DC output will be very low
 - DC output reduced to half the rated values DC
 - All the diodes will get over heated
 - Causes short circuit
 - The 6 V zener diode shown in figure has zero zener resistance and a knee current of 5 mA. The minimum value of R so that the voltage across it does not fall below 6 V is
 
 - 1.2 kΩ
 - 80 Ω
 - 50 Ω
 - 0 Ω
 - Consider a p-n junction diode made of silicon, In this case, which of the following statements is true?
 - The value of current depends exponentially on the voltage applied
 - The value of voltage depends exponentially on the current through the diode
 - The value of current depends linearly on the voltage applied
 - The value of voltage depends linearly on the current through the diode
 - C_d and C_s represent depletion and diffusion capacitance of a diode, respectively, which one of the following statements is not correct?
 - C_d varies inversely with depletion width
 - C_s varies directly with the rate of change of diode current with respect to diode voltage
 - C_d varies directly with the transit time.
 - Effective junction capacitance is the parallel combination of C_d and C_s
- Directions : 7 & 8**
Assume D_1 and D_2 refer to the ideal diodes
- 
- Which one of the following statement is true?
 - Both D_1 and D_2 are ON
 - Both D_1 and D_2 are OFF
 - D_1 is ON and D_2 is OFF
 - D_2 is ON and D_1 is OFF
 - Values of V_0 and I respectively are
 - 2 V and 1.1 mA
 - 0 V and 0 mA
 - 2 V and 0.7 mA
 - 4 V and 1.3 mA
 - The diode 'D' is ideal in the network shown in the given figure. The current 'I' will be
 
 - 1 mA
 - zero
 - 2 mA
 - 4 mA
 - A Zener diode has a Zener resistance of 5Ω. If the current through the Zener diode changes from 10 mA to 20 mA, the change of voltage across the Zener diode will be
 - 0.05 V
 - 0.075 V
 - 0.1 V
 - 0.5 V

11. Consider the following circuits



Which of the above circuits will yield the following input output characteristics for the clipper?

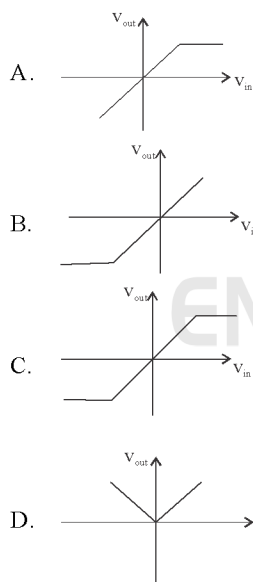
$$V_o = \begin{cases} V_i & \text{for } V_i < V \\ V & \text{for } V_i \geq V \end{cases}$$

Select the correct answer using the code given below:

(a) 1 only (b) 2 only (c) 1 and 3 (d) 1, 2 and 3

12. Match List-I (Transfer Characteristic of Clipper Circuit/ Rectifier) with List-II (type of Clipper/Rectifier) and select the correct answer using the code given below the Lists:

List-I



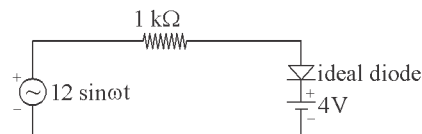
List-II

1. Doubled ended clipper
2. Positive Clipper
3. Negative Clipper
4. Full-wave positive rectifier and not a clipper

Codes: A B C D

- (a) 1 2 3 4
(b) 2 3 4 1
(c) 1 2 4 3
(d) 2 3 1 4

13. The peak current through the resistance in the circuit shown is



(a) 18 mA (b) 12 mA (c) 8 mA (d) 4 mA

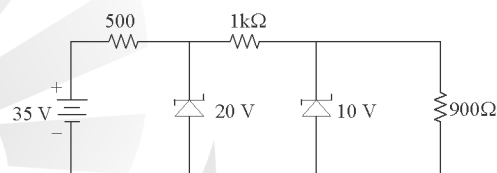
14. In a full wave rectifier circuit with centre tap transformer, if voltage between one end of secondary winding and centre is 300 V peak, then PIV (peak inverse voltage) is

(a) 300 V (b) 150V (c) 600V (d) 900 V

15. A PN junction in series with a 100 ohm resistor is forward biased so that a current of 100 mA flows. If voltage across the combination is instantaneously reversed to 10 V at time $t = 0$, the reverse current that flows through the junction at $t = 0$ is approximately given by

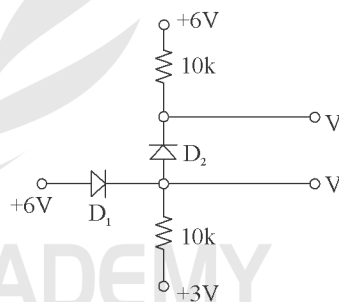
(a) 0 mA (b) 200 mA (c) 50 mA (d) 100 mA

16. What is the output voltage across the 900 ohm load in the circuit given below?



(a) 10 V (b) 14.67 V (c) 20 V (d) 9.47 V

17. The voltages at V_1 and V_2 of the arrangement shown in the figure will be respectively



(a) 6 V and 5.4 V (b) 6 V and 6 V
(c) 3 V and 5.4 V (d) 6 V and 3 V

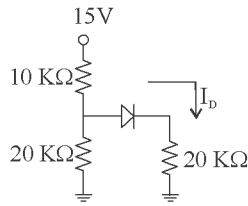
18. How much dynamic resistance does a Ge diode have at room temperature for forward current of 26 mA?

(a) 0.1 ohm (b) 1 ohm (c) 10 ohm (d) 1000 ohm

19. When operating as a voltage regulator the breakdown in a Zener diode occurs due to the

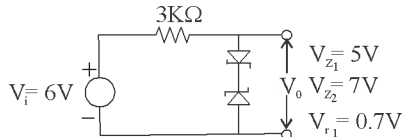
- (a) Tunneling effect
(b) Avalanche breakdown
(c) Impact ionization
(d) Excess heating of the junction

20. If the forward biased voltage $V_D = 0.7V$. Find the diode current I_D



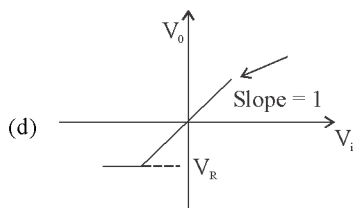
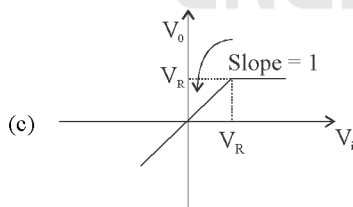
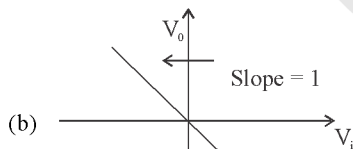
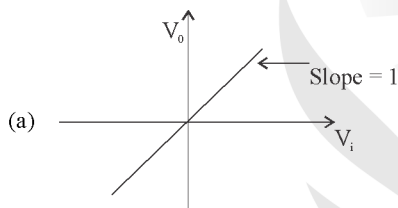
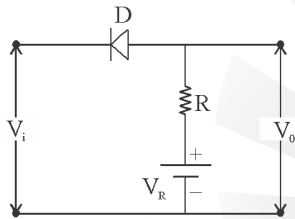
- (a) 0.349 mA (b) 0.465 mA (c) 0.476 mA (d) 0.486 mA

21. The output voltage for the circuit shown in figure is



- (a) 5.7 V (b) 7.7 V (c) 6.3 V (d) 6 V

22. The transfer characteristic of the network shown in the given figure is represented as



23. Negative resistance characteristic is exhibited by a

- (a) Zener diode (b) Schottky diode
(c) Photo diode (d) Tunnel diode

24. The correct match between the following two columns is

List-I

List-II

- A. Tunnel diode
B. Zener diode
C. PIN diode
D. Schottky diode

1. Microwave amplification
2. Voltage regulation
3. Photo detection
4. High speed switching

Codes: A B C D

- (a) 1 4 2 3
(b) 1 3 2 4
(c) 4 2 1 3
(d) 1 2 3 4

25. A special purpose diode which uses metals like gold, silver or platinum on one side of the junction, n-type doped silicon on another side and has almost no charge storage in the junction, is a

- (a) Schotky diode (b) Tunnel diode
(c) Varactor diode (d) Zener diode

26. In LED, light is emitted because

- (a) Recombination of charge carries takes place
(b) Diode gets heated up
(c) Light falling on the diode gets amplified
(d) Light gets reflected due to lens action

27. Consider the following semiconductor diodes;

1. Germanium diode
2. Silicon diode
3. Tunnel diode
4. Photo diode

The correct increasing order of forward voltage drop of these diodes is

- (a) 1, 2, 3, 4 (b) 3, 4, 1, 2
(c) 3, 1, 4, 2 (d) 1, 3, 2, 4

28. Match List-I (Device) with List-II (Biasing mode) and select the correct answer using the codes given below the lists:

List-I

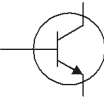
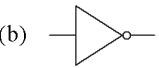
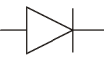
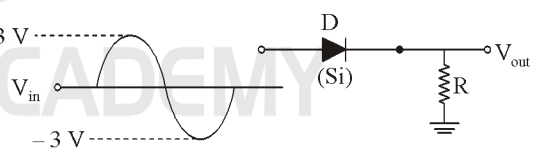
List-II

- A. LED
B. Zener
C. Varactor
D. SCR

1. Forward Bias
2. Reverse Bias

Codes: A B C D

- (a) 1 1 2 2
(b) 1 2 1 2
(c) 1 2 2 1
(d) 2 2 1 1

81. Which of the following reduces the number of electron-hole pairs?
 (a) Recombination (b) Re-energization
 (c) Recastination (d) None of these
82. Which of the following statements is true?
 (a) Resistivity of silicon is more than that of germanium.
 (b) Resistivity of silicon is less than that of germanium.
 (c) Resistivity of silicon is same as that of germanium,
 (d) Resistivity of silicon is half of that of germanium.
83. Which of the following contributes to flow of current in semiconductors?
 (a) Holes (b) Electrons
 (c) Both (a) and (b) (d) None of these
84. What is the resistivity of a material when it becomes a superconducting material?
 (a) Zero
 (b) 50% of its normal value
 (c) Between 50% and 100% of the normal value
 (d) None of these
85. Which of the following rectifiers requires four diodes?
 (a) Half-wave voltage doublers
 (b) Full-wave voltage doublers
 (c) Full-wave bridge circuits
 (d) Voltage quadrupler
- [UPPCL JE - 2014]
86. The diffusion capacitance of a forward biased P^+N^- (highly doped P-region) junction diode with a steady state current I depends on
 (a) Junction area
 (b) Mean life-time of the electrons
 (c) Mean life time of the holes
 (d) Width of the depleted region
- [TNPSC AE - 2018]
87. The minority carriers in n-type semiconductors are:
 (a) Electrons (b) Holes (c) Positrons (d) Protons
- [UPPCL JE - 2014]
88. A diode can be used as a frequency multiplier because of
 (a) Charge carrier concentration
 (b) Junction capacitance
 (c) Non-linearity
 (d) Avalanche voltage
- [UPPCL JE - 2014]
89. What is the value of the ripple factor in a full-wave rectifier without filter?
 (a) 0.482 (b) 1.21 (c) 1.79 (d) 2.05
- [UPPCL JE - 2014]
90. The Fermi-level in an intrinsic semiconductor is:
 (a) Closer to the valence band
 (b) Nearly midway between conduction and valence band
 (c) Closer to the conduction band
 (d) Within the valence band
- [UPPCL JE - 2014]
91. The schematic symbol for a PN Junction diode is:
 (a)  (b) 
 (c)  (d) 
- [NMRC JE-2017]
92. A silicon PN Junction in forward conduction has a voltage drop closer to:
 (a) 1.7 V (b) 2.1 V (c) 0.1 V (d) 0.7 V
- [NMRC JE-2017]
93. All semiconductors in their last orbit have
 (a) 8 electrons (b) 2 electrons
 (c) 4 electrons (d) 8 electrons
- [DSSSB JE - 2014]
94. A light emitting diode (L.E.D.) can be made from:
 (a) Phosphorescent material (b) Germanium
 (c) Silicon (d) Gallium arsenide
95. When biased correctly, a zener diode:
 (a) Acts as a fixed resistance
 (b) Has a constant voltage across it
 (c) Has a constant current passing through it
 (d) Never overheats
96. The peak inverse voltage (PIV) for the diode in the given circuit equals

- (a) 3 V (b) 2.3 V (c) 0 V (d) 6 V
97. An example of solid state device is
 (a) Zener diode (b) Triode
 (c) Pentode (d) Thyatron
98. Pure silicon is
 (a) a p-type semiconductor
 (b) an n-type semiconductor
 (c) an intrinsic semiconductor
 (d) an extrinsic semiconductor
- [UPPCL JE - 2007]

99. Impurity atoms to be added to pure silicon in order to make a p-type semiconductor belongs to

(a) Phosphorous (b) Boron
(c) Antimony (d) None of these

[UPPCL JE - 2007]

100. At absolute zero temperature, an intrinsic semiconductor behaves as

(a) a good conductor (b) a super conductor
(c) an insulator (d) variable resistor

[UPPCL JE - 2007]

101. What happens internally in atomic level when external electric field is applied to an intrinsic semiconductor?

(a) More number of electron holes pair combination will be evolved
(b) More number of electron holes pair combination will be broken
(c) No electron holes pair combination will be broken
(d) It will behave as extrinsic semiconductor

[UPPCL JE - 2018]

102. If temperature of a pure silicon specimen is increased, then

(a) only number of free electrons increase.
(b) only number of free holes increase.
(c) number of free holes and free electrons increases.
(d) only number of free holes decrease.

[UPPCL JE - 2007]

103. When used as a voltage regulator, a zener diode is normally

(a) forward biased (b) reversed biased
(c) not biased (d) None of the above

[UPPCL JE - 2007]

104. When a P-N junction is reverse biased

(a) it offers high resistance
(b) its depletion layer becomes narrow
(c) its barrier potential decreases
(d) it breaks down

[UPPCL JE - 2007]

105. If the maximum current of a half-wave rectified wave is 10 A, its r.m.s value is given by

(a) 3.10 A (b) 5.0 A (c) 6.37 A (d) 7.07 A

[UPPCL JE - 2007]

106. The maximum rectification efficiency of a half-wave rectifier is

(a) 40.6% (b) 81.2% (c) 88.0% (d) 100%

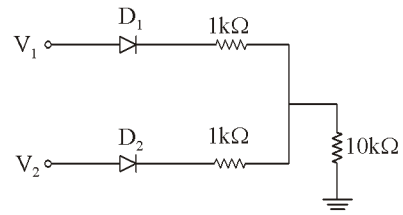
[UPPCL JE - 2007]

107. P-N junction diode is used for the following application :

(a) Amplifier (b) Detector
(c) Radio valve (d) None of these

[UPPCL JE - 2007]

108. In the following figure, $V_1 = 8.0$ V and $V_2 = 0$ V, Which diode will conduct (assume ideal diodes)?



(a) D_1 only (b) D_2 only
(c) Both (a) and (b) (d) neither (a) nor (b)

[UPPCL JE - 2007]

109. With increase in temperature, the resistance of semiconductors:

(a) Increases (b) Decreases
(c) Do not change (d) May increase or decreases

[UPPCL JE - 2016]

110. Peak factor for a half wave rectifier sine wave is:

(a) 1.41 (b) 1.73 (c) 1 (d) 2

[UPPCL JE - 2016]

111. Avalanche breakdown occurs at a reverse bias voltage of :

(a) 2 – 4 V (b) 4 – 6 V (c) 6 – 8 V (d) 8 – 10 V

[UPPCL JE - 2016]

112. At much lower temperature, semiconductors behave as:

(a) Semiconductors only (b) Conductors
(c) Insulators (d) Conductor or insulator

[UPPCL JE - 2016]

113. Number of valence electrons in a Germanium is

(a) 3 (b) 4 (c) 5 (d) 6

[UPPCL JE - 2016]

114. Hall effect is used to determine:

(i) Carrier concentration in semiconductors
(ii) Conductivity
(iii) Mobility

Which of these is/are correct?

(a) only (i) (b) only (ii)
(c) (ii) and (iii) (d) (i), (ii) and (iii)

[UPPCL JE - 2016]

115. Generally, mobility of electrons in semiconductors is _____ times the mobility of holes.

(a) two (b) three (c) four (d) five

[UPPCL JE - 2016]

116. During reverse bias operation of a p-n junction, a feeble current flows known as _____ which is _____ barrier voltage.

(a) reverse current, dependent on
(b) reverse current, independent of
(c) carrier current, dependent on
(d) carrier current, independent on

[UPPCL JE - 2016]

167. Current flow in a semiconductor depends on the phenomenon of

- (a) Drift
- (b) Diffusion
- (c) Recombination
- (d) All of these

[BSNL TTA - 2016]

168. The conductivity of the semiconductor

- (a) Does not depend on temperature
- (b) Decreases with rise in temperature
- (c) Increases with rise in temperature
- (d) First increases and then decreases with rise in temperature

[BSNL TTA - 2016]

169. For a P - type semiconductor, which of the following statement is true—

- (a) Electrons are majority carriers and pentavalent atoms are the dopants
- (b) Electrons are minority carriers and trivalent atoms are the dopants
- (c) Holes are minority carriers and trivalent atoms are the dopants
- (d) Holes are majority carriers and pentavalent atoms are the dopants

[BSNL TTA (JE) - 2015]

170. When a reverse bias is applied to a p-n junction, it

- (a) Rises the potential barrier
- (b) Reduces the majority carrier current to zero
- (c) Lowers the potential barrier
- (d) None of the above

[BSNL TTA (JE) - 2015]

171. The minority carriers in n-type semiconductors are :

- (a) Electrons
- (b) Holes
- (c) Positrons
- (d) Protons

[UPRVUNL - 2014]

172. In pure silicon :

- (a) The holes are the majority carriers
- (b) The electrons are the majority carriers
- (c) The holes and electrons exist in equal numbers
- (d) Conduction is due to there being more electrons than holes

[RPHEd - 2015]

173. Pentavalent impurities .

- (a) Have three valency electrons
- (b) Introduce holes when added to a semiconductor
- (c) Are introduced by adding aluminium atoms to a semiconductor material
- (d) Increase the conduction of a semiconductor material

[RPHEd - 2015]

174. Free electrons in a p-type material :

- (a) Are majority carriers
- (b) Take no part in conduction
- (c) Are minority carriers
- (d) Exist in the same numbers as holes

[RPHEd - 2015]

175. The forbidden gap of a Germanium semiconductor material is

- (a) 0.12 eV
- (b) 0.72 eV
- (c) 7.20 eV
- (d) None of these

[Uttarakhand JE-I - 2013, BSNL TTA-JE - 2015]

176. A piece of doped semiconductor material is introduced into a circuit. If the temperature of the material is raised, the circuit current will :

- (a) Increase
- (b) Remain the same
- (c) Decreases
- (d) Cease to flow

177. Major part of current in an intrinsic semiconductor is due to :

- (a) Conduction band electrons
- (b) thermally generated charge carriers
- (c) Holes in valence band
- (d) Valence band electrons

[LMRC SC/TO - 2015]

178. When the temperature of a doped semiconductor is increased, its conductivity

- (a) Decreases
- (b) Increases
- (c) Does not change
- (d) Increases or decreases depending on whether it is p - type or n - type

[DMRC Electronic - 2014]

179. The following property of semiconductors cannot be determined from Hall effect.

- (a) Semiconductor is n- type or p-type
- (b) The carrier concentration
- (c) The mobility of semiconductor
- (d) The atomic concentration of semiconductor

[DMRC Electronic - 2016]

180. In an n-type semiconductor, as the donor concentration N_D increases, the fermi level E_F .

- (a) Remains unaltered
- (b) Moves towards the conduction band
- (c) Move towards the center of forbidden energy
- (d) May or may not move depending on temperature

181. In a semiconductor holes are present only in

- (a) Conduction band
- (b) Valence band
- (c) Forbidden gap
- (d) All of these

[IOF Electronic - 2014]

224. Precision Rectifier can be used as _____ with small modifications

- (a) Pulse width detector (b) Peak detector
(c) Frequency detector (d) Phase detector

[BSNL TTA 2016]

225. An ideal diode :

- (a) Should have zero resistance in the forward bias as well as reverse bias
(b) Should have zero resistance in forward bias and infinitely large resistance in reverse bias
(c) Should have infinitely large resistance in the forward bias and zero resistance in reverse bias
(d) Should have infinitely large resistance in the forward bias as well as reverse bias

[BSNL TTA 2016]

226. A combination of two diodes connected in parallel when compared to a single diode can withstand

- (a) Twice the value of peak inverse voltage
(b) Twice the value of maximum forward current
(c) A larger leakage current
(d) Twice the value of cut-in voltage

[BSNL TTA-JE-2013]

227. LED gives off visible light form :

- (a) Region of depletion layer
(b) p region alone
(c) n region alone
(d) Both p and n regions

[BSNL TTA JE-2013]

228. In a photo diode, light is focused to fall on

- (a) P region only (b) N-region only
(c) Full P and N regions (d) Junction region only

[BSNL TTA-JE-2013]

229. Silicon is preferred for manufacturing zener diode because it:

- (a) Is relative cheap
(b) Needs lower doping level
(c) Has higher temperature and current capacity
(d) Has lower break-down voltage

[BSNL TTA-JE-2016]

230. The RMS output of full wave rectifier is :

- (a) $V(\text{peak})/\sqrt{2}$ (b) $V(\text{peak})/\sqrt{n}$
(c) $V(\text{peak})/n$ (d) None of these

[BSNL TTA -JE-2016]

231. Zener diode is used as-

- (a) An amplifier (b) A voltage regulator
(c) A rectifier (d) A multivibrator

[LMRC SC/TO-2015UPPCL (AE) electrical-2016-RRB SSE(III) 2015 BSNL TTA]

232. When a crystal diode is used as rectifier, the most important consideration is

- (a) Forward characteristic
(b) Doping level
(c) Reverse characteristic
(d) PIV rating

[BSNL TTA - 2016]

233. Tunnel diode can also be used as..... power microwave oscillators

- (a) High (b) Low
(c) Medium (d) Irrespective of

[BSNL TTA - 2016]

234. Reverse biased zener diode is used for

- (a) DC voltage regulation
(b) AC voltage regulation
(c) AC voltage stabilizer
(d) Voltage rectification

[BSNL-TTA-JE - 2015]

235. Centre tapped transformer is used in

- (a) Half wave rectifier
(b) Full wave rectifier using two diodes
(c) Bridge Rectifier
(d) Silicon controlled rectifier

[BSNL TTA-JE - 2015]

236. A zener diode regulator is a

- (a) shunt regulator (b) Series regulator
(c) Switching regulator (d) Zener follower

[BSNL TTA - 2016]

237. The diode that can be used for harmonic generation is

- (a) backward diode (b) PN junction diode
(c) Tunnel diode (d) Varactor diode

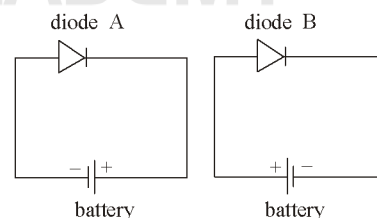
[RRB JE 2015 BSNL TTA - 2016]

238. For full- Wave rectified sine wave, form factor is :

- (a) 1.41 (b) 1.11 (c) 1.5 (d) 1.28

[RRB JE - 2015]

239. In the figure A and B are two semiconductor diodes.

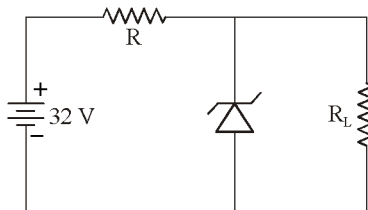


Which of the following statement is true :

- (a) A and B are forward biased
(b) A is forward biased and B is reverse biased
(c) A and B are reverse biased
(d) A is reverse biased and B is forward biased

[DMRC 2015]

323. A 24 V, 600 mW Zener is to be used for providing a 24 V stabilized supply to a variable load. Assume that for proper Zener action, a minimum of 10 mA must flow through the Zener. If the input voltage is 32 V, what would be the value of R and the maximum load current?



- (a) 320 ohm, 10 mA (b) 400 ohm, 15 mA
(c) 400 ohm, 10 mA (d) 320 ohm, 15 mA

[ISRO - 2011]

324. An element is said to have negative resistance when
(a) The element has negative temperature coefficient
(b) The current/voltage curve has negative slope
(c) The element has negative specific resistance
(d) The current /voltage curve has a positive slope

[ISRO S/E - 2017]

325. An ideal rectifier should have transformer utilization factor (TUF) of 1. If the actual TUF is 3.5 it shows that
(a) Diode is under-loaded
(b) The transformer must be 3.5 times larger
(c) The transformer should be only 1/3.5 times the ideal size
(d) The ripple factor is low

[ISRO S/E - 2017]

326. Without a DC source the clipper circuit acts like a
(a) Clamper (b) Chopper (c) Rectifier (d) Demodulator
327. A circuit that adds positive or negative dc voltage to an input sine wave is called
(a) Clipper (b) Limiter
(c) Clamper (d) Either (a) or (b)

[HPSSSB JE - 2018]

328. The forbidden energy band gap in conductor, semiconductor and insulators are E_{G1} , E_{G2} and E_{G3} respectively then
(a) $E_{G1} > E_{G2} > E_{G3}$ (b) $E_{G1} < E_{G2} < E_{G3}$
(c) $E_{G1} > E_{G2} < E_{G3}$ (d) $E_{G1} < E_{G2} > E_{G3}$

[HPSSSB JE - 2018]

329. Silicon is invariably used in the manufacturer of junction photo diodes because
(a) More electron-hole pairs are generated in it.
(b) Its thermally generated minority current is extremely small
(c) It is more rugged than Ge
(d) It needs less reverse bias

[HPSSSB JE - 2017]

330. An AC voltage can be converted into a unidirectional voltage by using
(a) A power amplifier circuit
(b) A multivibrator circuit
(c) An oscillator circuit
(d) A rectifier circuit

[HPSSSB JE - 2017]

331. Avalanche breakdown in a semiconductor diode occurs when
(a) Forward current exceeds a certain value
(b) Reverse bias exceeds a certain value
(c) Forward bias exceeds a certain value
(d) The potential barrier is reduced to zero

[HPSSSB JE - 2017]

332. The output frequencies of bridge rectifier & half wave rectifier respectively are (f_m is input frequency)
(a) $2f_m$ and f_m (b) $2f_m$ and $2f_m$
(c) f_m and $2f_m$ (d) $2f_m$ and $\frac{f_m}{2}$

333. When used in a circuit, a Zener diode is always
(a) Forward biased (b) Connected in series
(c) Troubled by heating (d) Reverse biased

334. The output of full wave rectifier contains
(a) Only even harmonics
(b) Only odd harmonics
(c) Both odd & even harmonics
(d) No harmonics

335. Which of the following will serve as a donor impurity in silicon?
(a) Boron (b) Indium
(c) Germanium (d) Antimony

336. The current flows in semiconductor depends on the phenomenon of
(a) Drift (b) Diffusion
(c) Recombination (d) All of the above

337. Find the magnitude of the electric field intensity in a sample of silver having conductivity $\sigma = 6.17 \times 10^7$ mho/m, permittivity $\mu_e = 0.006$ m²/Vs and drift velocity 1 mm/s.

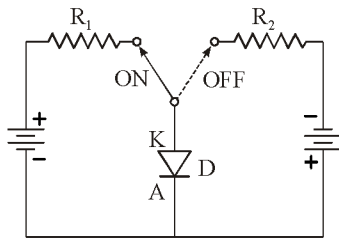
- (a) $\frac{1}{10}$ V/m (b) $\frac{1}{3}$ V/m (c) $\frac{1}{2}$ V/m (d) $\frac{1}{6}$ V/m

[ISRO S/E - 2020]

338. Consider electron and hole mobilities of germanium at 300 K is 0.36 m²/Vs and 0.17 m²/Vs respectively and hole and electron concentration of 2.7×10^{19} per m³. Find the conductivity of germanium at 300 K.
(a) 1.4 mho/m (b) 2.3 mho/m
(c) 1.3 mho/m (d) 2.0 mho/m

[ISRO S/E - 2020]

356. Consider the circuit shown below.



If the switch is in the ON position the diode:

- (a) is forward biased (b) is reverse biased
(c) is saturated (d) remains ideal

[DMRC JE - 2020]

357. The name Bipolar in BJT signifies :

- (a) Current flow is due to transport of both electrons and holes
(b) Current flow is due to transport of only holes but not electrons
(c) Current flow is due to transport of only electrons but not holes
(d) Current flow is due to transport of neither holes nor electrons

[DMRC JE - 2020]

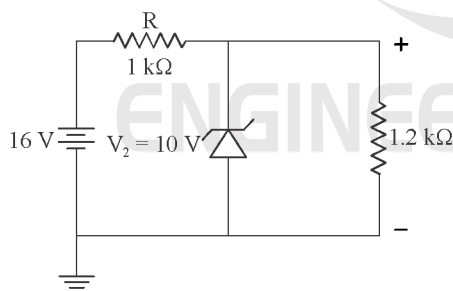
358. The maximum efficiency of solar cells is achieved with the band gap energy of

- (a) 1.12 eV – 2.3 eV (b) 2.3 eV – 3.12 eV
(c) 0.4 eV – 1.1 eV (d) 3.12 eV – 4.23 eV

359. If V_m is the peak voltage across the secondary of the transformer in a half wave rectifier (without any filter circuit), then the maximum voltage on the reverse biased diode is

- (a) V_m (b) $2V_m$ (c) $\frac{1}{2} V_m$ (d) None

360. In the zener diode network shown below, the power P_Z dissipated by the zener diode is :



- (a) 0 W (b) 7.27 W (c) 8.73 W (d) 10 W

361. The PIV of a half wave rectifier circuit with a shunt capacitor filter is :

- (a) $2V_m$ (b) V_m (c) $\frac{V_m}{2}$ (d) $3V_m$

362. The ripple factor of a power supply is a measure of :

- (a) Its-filter efficiency (b) Its voltage regulation
(c) Diode rating (d) Purity of Power output

363. If in a rectifier the ripple voltage is 150 mV and the DC value is 15 V, then ripple factor is given by :

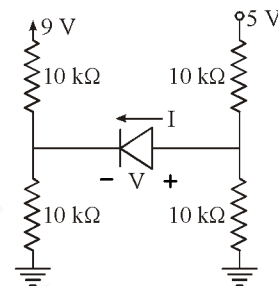
- (a) 0.01 (b) 0.02 (c) 0.001 (d) 0.002

364. The mobility of an electron in a conductor is expressed in terms of :

- (a) $\text{cm}^2/\text{Volt-second}$ (b) $\text{cm}/\text{Volt-second}$
(c) cm^2/Volt (d) $\text{cm}^2/\text{second}$

[RPSC VPITI - 2016]

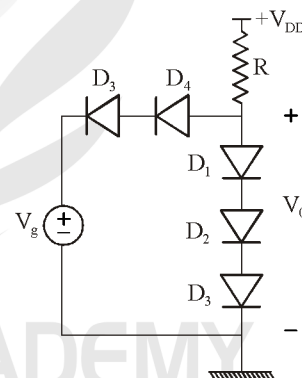
365. Assuming the diodes in the circuit to be ideal i and v in the circuit are respectively



- (a) 0 A, 2 V (b) 0.2 mA, 0 V
(c) 0 A, -2 V (d) 0.2 mA, 2 V

[TSSPDCL - 2018]

366. The diode circuit shown in the figure has $R = 300 \text{ k}\Omega$ and $V_{DD} = 10 \text{ V}$, $V_s = 5 \text{ V}$ and diode drop $V_D = 0.7 \text{ V}$. Then V_o will be



- (a) 2.1 V (b) 2.9 V (c) 3.6 V (d) 6.4 V

[TSSPDCL - 2018]

367. The minority carriers in P-type of semiconductors are

- (a) Holes and electrons (b) Holes
(c) Protons (d) Electrons

[UPPCL JE - 2019]

368. A crystal diode having an internal resistance of 20Ω is used for half wave rectification. If the supply voltage is $50 \sin \omega t$ and find the rms value of the load current.

- (a) 61 mA (b) 30.5 mA (c) 19.4 mA (d) 38.8 mA

[UPPCL JE - 2019]

401. The unit of mobility is
 (a) cm/Vs (b) m²/Vs (c) m/Vs² (d) mho/m

402. Ideal diode is characterized by
 (a) Infinite resistance (b) Zero resistance
 (c) 10 MΩ (d) 1 kΩ

[EPDCL-2010]

403. The diode used in a clipping circuit has $R_F = 25 \Omega$ and $R_L = 1 \text{ M}\Omega$. The external resistor R is
 (a) 50 kΩ (b) 5 kΩ
 (c) 1/25 MΩ (d) 25 MΩ

[APGENCO-2012]

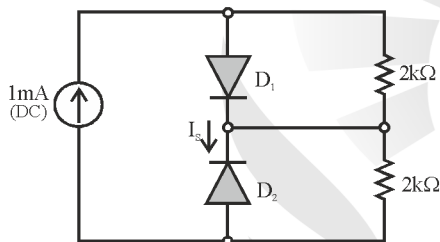
404. The dynamic resistance of a p-n junction germanium diode at room temperature with current of 1mA under forward biasing is
 (a) 100 Ω (b) 13 mΩ (c) 13 Ω (d) 26 Ω

[APGENCO-2012]

405. A diode whose terminal characteristics are related as $i_D = I_s e^{(V/V_T)}$, is biased at $I_D = 2 \text{ mA}$. Its dynamic resistance is
 (a) 25 Ω (b) 12.5 Ω (c) 50 Ω (d) 100 Ω

[HMWS-2012]

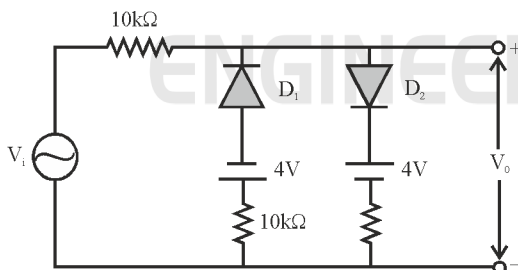
406. Assume that D_1 and D_2 in figure are ideal diode the value of current I_s is



- (a) 0 mA (b) 0.5 mA (c) 1 mA (d) 2 mA

[TRANSCO-AE-2012]

407. A voltage signal $10 \sin \omega t$ is applied to the circuit with ideal diodes as shown in figure. The maximum and minimum values of the output waveform of the circuit are respectively



- (a) 10 V and -10 V (b) 4 V and -4 V
 (c) 7 V and -4 V (d) 4 V and -7 V

[TRANSCO-AR-2012]

408. The cut in voltage for silicon and germanium diodes respectively is
 (a) 0.6 V, 0.2 V (b) 0.7 V, 0.3 V
 (c) 0.3 V, 0.7 V (d) 0.2 V, 0.6 V

[EPDCL-2014]

409. The concentration of minority carries in an extrinsic semiconductor under equilibrium is

- (a) Directly proportional to the doping concentration
 (b) Inversely proportional to the doping concentration
 (c) Directly proportional to the intrinsic concentration
 (d) Inversely proportional to the intrinsic concentration

[ISRO-2014]

410. Device employing the Hall effect is used to measure _____.

- (a) Magnetic flux (b) Magnetic flux density
 (c) Electric charge (d) Electric flux density

[HMWS -2015]

411. As compared to full-wave rectifier using two diodes, the four diode bridge rectifier has the dominant advantage of:

- (a) Higher current carrying capacity
 (b) Lower peak inverse voltage requirement
 (c) Lower ripple factor
 (d) Higher efficiency

[SSC-JE-2014]

412. The current in reverse bias in P-N junction diode may be :

- (a) Few micro or nano amperes
 (b) Few milli amperes
 (c) Between 0.2 A and 2 A
 (d) Between 2 A and 5 A

[SSC-JE-[EPDCL-2014]

413. What are the majority charge carriers in n-type semiconductors?

- (a) Holes
 (b) Electrons
 (c) Both holes and electrons
 (d) Silicon atoms

[GESCOM-AE-2015]

414. Which of the following is used as a pentavalent impurity?

- (a) Arsenic (b) Bismuth
 (c) Phosphorus (d) All the above

[GESCOM-AE-2015]

415. Which of the following is true with respect to schottky diode?

- (a) It has a low forward voltage drop
 (b) It has a very slow switching action
 (c) Both (a) and (b)
 (d) None of these

416. What happens to the conductivity of semiconductor when temperature increases?

- (a) It decreases (b) It increases
 (c) It does not change (d) It becomes zero

[GESCOM-AE-2015]

435. Electronic regulators of fans may be made of

- (a) Gates (b) Diodes
- (c) Transistor (d) TRIAC

[UPPCL-JE-2015]

436. Silicon and germanium are used as

- (a) Conductors (b) Semiconductor
- (c) Insulators (d) Semi insulators

[UPPCL-JE-2015]

437. Which of the following circuits cannot be operated directly from the mains?

- (a) Voltage doubler
- (b) Bridge rectifier
- (c) Half wave rectifier
- (d) Centre tap full wave rectifier

[UPRVUNL-JE-2014]

438. Which of the following is a semi-conductor materials?

- (a) Aluminium (b) Rubber
- (c) Silicon (d) Phosphoras

[UPRVUNL-JE-2014]

439. For a half wave rectified sine wave the ripple factor is

- (a) 1.45 (b) 1.21 (c) 1.00 (d) 11.35

[UPRVUNL-JE-2014]

440. Energy gap in insulator is

- (a) Quite high
- (b) Quite low
- (c) Not available
- (d) Same as that of semiconductors

[UPRVUNL-JE-2015]

441. We will be going to make a _____ if we mix phosphorus with silicon.

- (a) Diode (b) N-type semiconductor
- (c) P-type semiconductor (d) Insulator

[UPRVUNL-JE-2015]

442. LED is power rated in

- (a) Watts (b) Milli watt
- (c) Kilo watt (d) Mega watt

[UPRVUNL-JE-2015]

443. Increase in conductivity on heating in the case of

- (a) Conductor (b) Super conductors
- (c) Metals (d) Semi-conductors

[UPRVUNL-JE-2015]

444. Germanium can be made an n-type semiconductor on doping it with

- (a) Phosphoras (b) Silicon
- (c) Carbon (d) Indium

[UPRVUNL-JE-2015]

445. The electrons from n-side of the junction combine with the holes from p-side due to

- (a) Drifting (b) Merging
- (c) Recombination (d) Diffusion

[UPRVUNL-JE-S1-2015]

446. A LED emits light _____ condition.

- (a) Forward biased (b) Reversed biased
- (c) Unbiased (d) Unknown

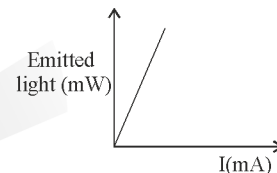
[UPRVUNL-JE-2015]

447. The value of PIV rating of a diode is

- (a) Maximum value of the secondary voltage
- (b) Maximum value of the primary voltage
- (c) Minimum value of the secondary voltage
- (d) Minimum value of the primary voltage

[UPRVUNL-JE-2015]

448. Following is a characteristic curve of



- (a) Varactor diode (b) Solar cell
- (c) LED (d) Photodiode

[UPRVUNL-JE-2015]

449. A solar cell is

- (a) Photovoltaic device (b) Photoconductive device
- (c) Photo emissive device (d) Photoradiative device

[UPRVUNL-JE-2015]

450. The effect of reverse biasing on diodes is

- (a) Increase barrier potential
- (b) Reduces barrier potential
- (c) Nullifies barrier potential
- (d) Has no effect on barrier potential

[UPRVUNL-JE-2015]

451. The electrical circuit used in a rectifier circuit in order to achieve a constant DC supply is called as

- (a) Oscillator (b) Filter
- (c) Amplifier (d) Logic gate

[UPRVUNL-JE-2015]

452. Number of diodes used in a half wave rectifier is

- (a) 0 (b) 1 (c) 2 (d) 4

[UPRVUNL-JE-2015]

453. Energy band gap size for insulator is in the range of _____ eV.

- (a) 1 - 2 (b) 2 - 3 (c) 3 - 6 (d) <1 eV

[UPRVUNL-JE-2015]

454. The mobility of holes is _____ mobility electrons in intrinsic semiconductors

- (a) Equal (b) Greater than
(c) Less than (d) Twice

[UPRVUNL-JE-2015]

455. In p-type semiconductors number of holes is _____ the number of electrons.

- (a) Equal to (b) Greater than
(c) Less than (d) Twice

[UPRVUNL-JE-2015]

456. Fermi level for extrinsic semiconductor depends on-

- (a) Donor element (b) Impurity concentration
(c) Temperature (d) All of these

[UPRVUNL-JE-2015]

457. Metals have _____ energy gap, semiconductors have _____ energy gap and insulators have a _____ energy gap.

- A. Non-existent B. Zero
C. Large D. Small

- (a) A, D, C (b) C, B, A (c) B, C, A (d) A, B, C

[UPRVUNL-JE-2015]

458. In the tunnel diodes the tunneling phenomenon is based on the behaviour of

- (a) Lenz mechanical behaviour
(b) Quantum mechanical behaviour
(c) Potential energy behaviour
(d) Peak energy behaviour

[UPRVUNL-JE-2015]

459. At large forward biases, tunnel diodes due to

- (a) Avalanche multiplication in the space charge layer
(b) The diffusion of carriers across the space charge layer
(c) Displacement currents of the diffusion capacitance
(d) Tunneling of carriers across the forbidden energy gap

[UPRVUNL-JE-2015]

460. The electrical power output of the photodiode is maximum when a

- (a) Small reverse bias exists across it
(b) Large reverse bias across it
(c) Small forward bias exists across it
(d) Small forward current flows through it irrespective of the bias

[UPRVUNL-JE-2015]

461. A simple half wave rectifier made with a single diode and a single load resistor converts an AC voltage to

- (a) An essentially constant DC voltage
(b) A sinusoidal voltage which has a DC shift
(c) A wave form that has only the positive or the negative half of the input sinusoidal
(d) None of these

[UPRVUNL-JE-S2-2015]

462. The equivalent DC output voltage of a full wave rectifier is _____ the equivalent DC output voltage of a half wave rectifier.

- (a) Equal to (b) Not related
(c) Half (d) Double

[UPRVUNL-JE-2015]

463. The peak inverse voltage across the diodes in a full wave rectifier made with two diodes and a centre topped transformer is _____ that in a bridge rectifier.

- (a) Equal to (b) Not related to
(c) Half (d) Double

[UPRVUNL-JE-2015]

464. With a capacitor connected across the output the ripple in half wave rectifier is _____ the ripple in a full wave rectifier.

- (a) Greater than (b) Less than
(c) Equal to (d) Exactly half of

[UPRVUNL-JE-S2-2015]

465. Zener diode is used as the main component in DC power supply for

- (a) Rectification (b) Voltage regulation
(c) Filter action (d) Both (a) and (b)

[RPSC(Vice Principal/Suptdt.)-2018]

466. The electron-hole mobility ratio in Germanium is :

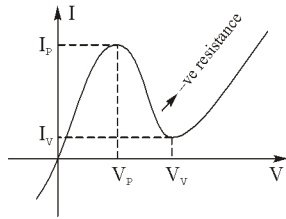
- (a) (1.2) : 1 (b) (2.8) : 1
(c) 1 : 1 (d) 2 : 1

[DFCCIL - 2016]

467. The process by which electrons and electron holes are created and eliminated is called _____.

- (a) Recreation (b) Creative destruction
(c) Recurrent elimination (d) Recombination

[GESCOM-AE-2015]

ANSWERS AND EXPLANATIONS1. *Ans. (c)*2. *Ans. (c)*

Electrical field is always maximum at the junction.

3. *Ans. (d)*4. *Ans. (b)*

$$I = \frac{10 - 6}{50} = 80 \text{ mA}$$

 $\therefore$

$$I_{ZK} = 5 \text{ mA}$$

Then,

$$I_{L(\text{max})} = 80 - 5 = 75 \text{ mA}$$

So,

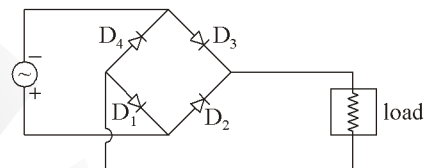
$$R = \frac{6}{75 \times 10^{-3}} = 80 \text{ ohms.}$$

5. *Ans. (a)*6. *Ans. (c)*7. *Ans. (d)*8. *Ans. (a)*9. *Ans. (c)*10. *Ans. (a)*11. *Ans. (c)*12. *Ans. (d)*13. *Ans. (c)*14. *Ans. (c)*15. *Ans. (d)*16. *Ans. (d)*17. *Ans. (b)*18. *Ans. (b)*19. *Ans. (a)*20. *Ans. (a)*21. *Ans. (d)*22. *Ans. (c)*23. *Ans. (d)*24. *Ans. (d)*25. *Ans. (a)*26. *Ans. (a)*27. *Ans. (c)*28. *Ans. (c)*29. *Ans. (a)*30. *Ans. (b)*31. *Ans. (d)*32. *Ans. (d)*33. *Ans. (d)*34. *Ans. (c)*35. *Ans. (b)*36. *Ans. (b)*37. *Ans. (b)*38. *Ans. (d)*39. *Ans. (b)*40. *Ans. (c)*41. *Ans. (b)*42. *Ans. (c)*43. *Ans. (c)*44. *Ans. (b)*45. *Ans. (b)*46. *Ans. (c)*47. *Ans. (c)*48. *Ans. (b)*49. *Ans. (c)*50. *Ans. (d)*51. *Ans. (b)*52. *Ans. (d)*53. *Ans. (d)*54. *Ans. (a)*55. *Ans. (c)*56. *Ans. (d)*57. *Ans. (d)*58. *Ans. (a)*59. *Ans. (c)*60. *Ans. (d)*61. *Ans. (b)*62. *Ans. (d)*63. *Ans. (b)*64. *Ans. (c)*65. *Ans. (d)*66. *Ans. (d)*67. *Ans. (d)*68. *Ans. (a)*69. *Ans. (a)*70. *Ans. (d)*71. *Ans. (d)*72. *Ans. (d)*73. *Ans. (a)*74. *Ans. (a)*75. *Ans. (d)*76. *Ans. (c)*77. *Ans. (a)*78. *Ans. (d)*79. *Ans. (d)*80. *Ans. (c)*

Varactor diode is a diode with a variable capacitance which is a function of the voltage that is impressed on its terminals.

81. *Ans. (a)*82. *Ans. (a)*83. *Ans. (c)*84. *Ans. (a)*85. *Ans. (c)*

The simplest full wave bridge rectifier is given as

86. *Ans. (b)*

Diffusion capacitance is defined as the rate of change of injected minority carrier charge with respect to forward bias voltage and for P^+N diode, electrons are minority charge carriers.

87. *Ans. (b)*

The n-type semiconductor has electrons as majority carriers and holes as minority carriers.

88. *Ans. (c)*

Frequency multiplier consists of a non-linear circuit that distorts the input signal and consequently generates harmonics of the input signal.

89. *Ans. (a)*

Ripple factor of full wave rectifier is 0.482.

90. *Ans. (b)*

In intrinsic semiconductor number of holes is equal to number of electrons therefore fermi level exists nearly mid way between conduction and valence band.

91. *Ans. (c)*92. *Ans. (d)*93. *Ans. (c)*94. *Ans. (d)*95. *Ans. (b)*96. *Ans. (a)*

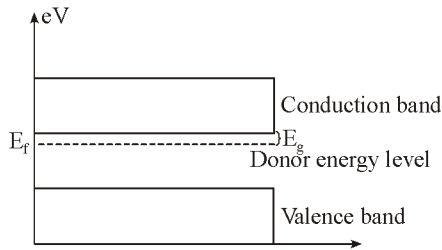
$$\text{PIV of diode} = V_m = 3V$$

97. *Ans. (a)*98. *Ans. (c)*99. *Ans. (b)*

Boron is a trivalent element.

100. *Ans. (c)*101. *Ans. (b)*

314. Ans. (b)

Si $E_g = 0.05 \text{ eV}$ Ge $E_g = 0.01 \text{ eV}$

When donor impurities are added to an intrinsic semiconductor allowable energy levels are introduced at a very small distance below the conduction band.

315. Ans. (a)

Diffusion capacitance

$$C_D = \frac{\tau I_D}{V_T}$$

Where,

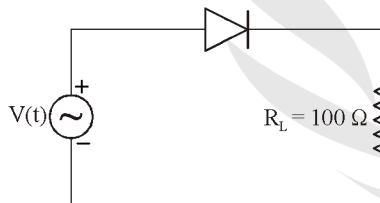
 τ = Mean life time of injected minority charge carrier I_D = DC current V_T = Thermal voltage

316. Ans. (a)

The low frequency response of an amplifier is affected by coupling capacitors and bypass capacitors.

317. Ans. (a)

318. Ans. (b)



The RMS value of a HWR is

$$I_{\text{rms}} = \frac{I_m}{2}$$

The RMS current of a HWR is calculated as-

$$I_{\text{rms}} = \frac{V_m}{2R_L}$$

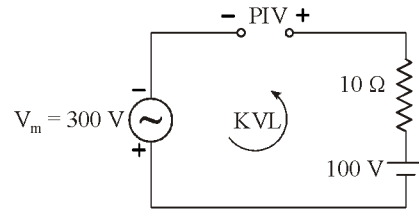
$$= \frac{10}{2 \times 100} = \frac{1}{20}$$

The average power consumed in watts by the load resistance R_L

$$P_L = I_{\text{rms}}^2 \times R_L$$

$$P_L = \frac{100}{400} = 0.25 \text{ W}$$

319. Ans. (d)



KVL

$$-300 - 100 + \text{PIV} = 0$$

$$\text{PIV} = 400 \text{ V}$$

320. Ans. (d)

$$\text{Ripple factor} = \sqrt{(\text{form factor})^2 - 1}$$

$$\text{Form factor} = 1.57$$

$$\text{RF} = \sqrt{(1.57)^2 - 1} = 1.21$$

321. Ans. (b)

The dark current is the current that exist when no light is incident.

322. Ans. (b)

Bridge F.W.R.

$$\text{PIV} = V_m$$

Center tapped F.W.R

$$\text{PIV} = 2V_m$$

323. Ans. (d)

$$\text{Given } V_z = 24 \text{ V}$$

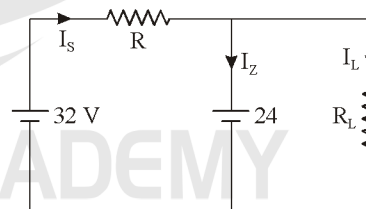
Power rating of zener diode = 600 mW

$$P_z = V_z I_{z \text{ max}}$$

$$I_{z \text{ max}} = \frac{600}{24} = 25 \text{ mA}$$

$$I_{z \text{ min}} = 10 \text{ mA}$$

Zener action takes place



For maximum load current

$$I_{L \text{ max}} = I_s - I_{z \text{ max}}$$

$$\frac{24}{R_L} = \frac{32 - 24}{R} - 10$$

$$I_{L \text{ max}} = \frac{8}{R} - 10 \quad \dots(1)$$

If

then

$$R_L = \infty$$

$$I_{L \text{ max}} = 0 \text{ mA}$$

$$I_{L \text{ max}} = I_s - I_{z \text{ max}}$$

$$\frac{8}{R} = 25 \times 10^{-3}$$

$$R = 320 \text{ ohms}$$

371. *Ans. (c)*

Condition of intrinsic semiconductors

$$n = p$$

$$n = \text{Concentration of free } e^-/\text{cm}^3$$

$$p = \text{Concentration of holes}/\text{cm}^3$$

372. *Ans. (b)*373. *Ans. (b)*Graphite $\rightarrow$ Conductor $\rightarrow E_g \approx 0 \text{ eV}$ Silicon $\rightarrow$ Semiconductor $\rightarrow E_g \approx 1 \text{ eV}$ Diamond $\rightarrow$ Insulator $\rightarrow E_g > 5 \text{ eV}$ 374. *Ans. (a)*375. *Ans. (d)*

The intrinsic semiconductor has little current conduction at room temperature.

376. *Ans. (d)*

Half wave rectifier (HWR)

$$I_{\text{rms}} = \frac{I_m}{2}$$

$$10 = \frac{I_m}{2}$$

$$I_m = 20 \text{ A}$$

Full wave rectification (FWR)

$$I_{\text{rms}} = \frac{I_m}{\sqrt{2}} = \frac{20}{\sqrt{2}} = 14.14 \text{ A}$$

377. *Ans. (d)*378. *Ans. (c)*

Semiconductor have negative temperature coefficient.

379. *Ans. (a)*380. *Ans. (d)*

$$\begin{aligned} f_0 &= 2 f_{\text{in}} \\ &= 2 \times 100 \\ &= 200 \text{ Hz} \end{aligned}$$

381. *Ans. (c)*

$$I_{\text{Rms}} = \frac{I_m}{2} = \frac{10}{2} = 5 \text{ A}$$

382. *Ans. (c)*383. *Ans. (c)*384. *Ans. (c)*

During the positive half of the input signal

$$D_1 \rightarrow \text{F.B}$$

$$D_2 \rightarrow \text{R.B}$$

So,

$$V_0 = 4 \text{ V}$$

385. *Ans. (d)*

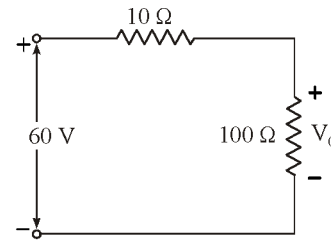
Given,

60 V is peak voltage

$$R_L = 100 \Omega$$

$$R_F = 10 \Omega$$

During the positive half cycle

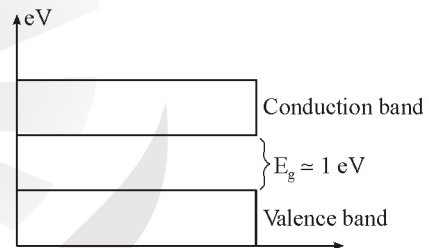


By using voltage division rule

$$(V_o)_m = \frac{100}{100+10} \times 60$$

Average output voltage

$$\begin{aligned} V_{\text{avg}} &= \frac{2V_m}{\pi} \\ &= \frac{2 \times 54.545}{\pi} \\ V_{\text{avg}} &= 34.7 \text{ V} \end{aligned}$$

386. *Ans. (a)*387. *Ans. (a)*388. *Ans. (b)*389. *Ans. (d)*

$$R = \frac{10}{1 \times 10^{-6}} = 10 \text{ M}\Omega$$

390. *Ans. (a)*391. *Ans. (a)*392. *Ans. (b)*393. *Ans. (b)*

$$\sigma = \frac{1}{\rho} \text{ for n-type}$$

$$\rho = \frac{1}{\sigma}$$

and

$$\sigma = qN_D\mu_n$$

$$\rho = \frac{1}{qN_D\mu_n}$$

 $\Rightarrow$

$$N_D = \frac{1}{q\rho\mu_n}$$

$$= \frac{1}{1.6 \times 10^{-19} \times 0.5 \times 1250}$$

$$N_D = 1 \times 10^{16} / \text{cm}^3$$

394. Ans. (b)

$$I_{S_2} = I_{S_1} 2^{\frac{(T_2 - T_1)}{10}}$$

$$= 10 \times 2^{\frac{20}{10}}$$

$$I_{S_2} = 40 \text{ pA}$$

395. Ans. (d)

396. Ans. (a)

Metal have positive temperature coefficient.

397. Ans. (a)

398. Ans. (d)

399. Ans. (d)

400. Ans. (a)

401. Ans. (b)

402. Ans. (b)

403. Ans. (b)

$$R = \sqrt{R_f R_r} = 5 \text{ k}\Omega$$

404. Ans. (d)

Given data

$$\eta = 1 \text{ (Ge)}$$

$$I_T = 1 \text{ mA}$$

$$V_T = 26 \text{ mV}$$

$$R_d = \frac{\eta V_T}{I_T}$$

$$R_d = 26 \Omega$$

405. Ans. (a)

$$R_d = \frac{\eta V_T}{I_D}$$

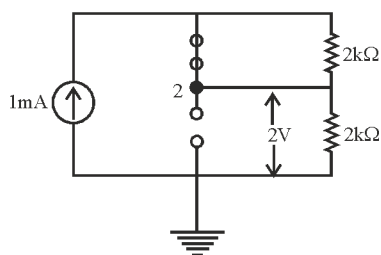
$$= \frac{2(25 \text{ mV})}{2 \text{ mA}}$$

$$R_d = 25 \Omega$$

406. Ans. (a)

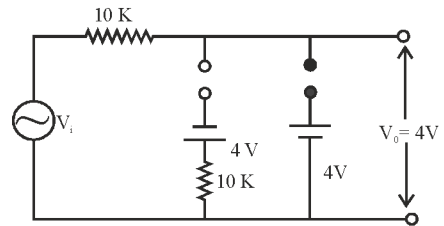
The current always selects the low resistance path. D_1 - ON and D_2 - OFF.

The I directed from N type to P-type

(D_2 - R.B) As D_2 - R.B. replaced by O.C. $\therefore I = 0$ 

407. Ans. (d)

For positive half cycle

(i) (When $V_i > 4\text{V}$) D_2 ON, D_1 = OFF then(ii) When $V_i < 4\text{V}$, D_1 & D_2 = OFF

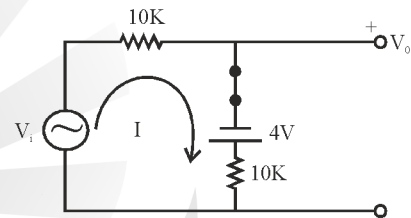
$$\Rightarrow V_o = V_i$$

(iii) For negative half cycle,

 D_1 - ON, and D_2 - OFF

$$V_i - 10I + 4 - 10I = 0$$

$$I = \left(\frac{V_i + 4}{20} \right) \text{ mA}$$



When

 $V_i = -10 \text{ V}$ (maximum value)

$$i = \frac{-6}{20} \text{ mA}$$

$$V_o + 4 - 10I = 0$$

$$V_o = 10I - 4 = 10 \left(\frac{-6}{20} \right) - 4$$

$$= -3 - 4$$

$$V_o = -7 \text{ V}$$

408. Ans. (a),(b)

409. Ans. (b)

Concentration of minority carriers in N-type semiconductor,

$$n_p = \frac{n_i^2}{N_D} \quad \dots(1)$$

Where, N_D is donor impurity concentration And P-type semiconductor.

$$P_n = \frac{n_i^2}{N_A} \quad \dots(2)$$

Where, N_A is acceptor impurity concentration.

410. Ans. (b)

411. Ans. (b)

PIV of full wave bridge rectifier = V_m PIV full wave centre tapped rectifier = $2V_m$