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Date : 28.03.2025

Time : 03:00:00

Marks : 200

TEST ID: 61

PHYSICS

10.SEMICONDUCTOR,16.SEMICONDUCTOR DEVICES

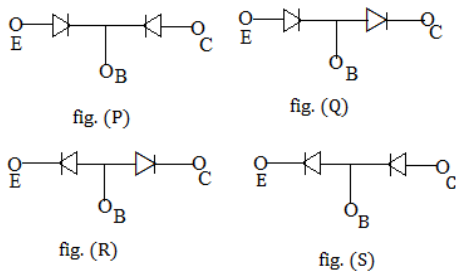
Single Correct Answer Type

- To obtain full wave rectification, we require
 - Only one diode
 - Triode
 - Two diodes
 - Transistor
- Which of the following gives output 1 in the AND gate?
 - $A = 0, B = 0$
 - $A = 0, B = 1$
 - $A = 1, B = 1$
 - $A = 1, B = 0$
- Leakage current in a junction diode
 - Decreases with temperature
 - Increases with temperature
 - Is due to majority carrier
 - Depends on the biasing voltage
- Depletion layer in the p-n junction is caused by
 - drift of holes.
 - diffusion of charge carriers.
 - migration of impurity ions.
 - drift of electrons.
- LED constructed by Silicon carbide, Zinc Selenide emits radiation of.
 - Blue colour
 - Red colour
 - Orange colour
 - All of these
- In an n-p-n transistor, the emitter current is
 - equal to the base current
 - slightly more than the collector current
 - equal to the collector current
 - slightly less than the collector current
- Solar cell produces photo voltage when incident light has energy which is:
 - of any value
 - equal to band gap energy
 - greater than band gap energy
 - smaller than band gap energy
- The current gain α in common base mode of transistor is
 - $\alpha = \frac{\Delta I_C}{\Delta I_B} V_{CB} - \text{const}$
 - $\alpha = \frac{\Delta I_B}{\Delta I_C} V_{CB} - \text{const}$
 - $\alpha = \frac{\Delta I_C}{\Delta I_E} V_{CB} - \text{const}$
 - $\alpha = \frac{\Delta I_E}{\Delta I_C} V_{CB} - \text{const}$
- For a transistor, the current ratio $\alpha_{dc} = \frac{69}{70}$. The current gain β_{dc} is
 - 66
 - 67
 - 69
 - 71
- Fermi energy/is the
 - minimum energy of electrons in a metal at 0 K
 - maximum energy of electrons in a metal at 0 K
 - minimum energy of electrons in a metal at 0°C
 - maximum energy of electrons in a metal at 0°C
- In a semiconductor diode, P side is earthed & n-side is applied a potential of -2 V, the diode will
 - conduct
 - not conduct
 - conduct partially
 - breakdown.
- The order of thickness of depletion region in p-n junction is
 - 10^{-12} m
 - 10^{-6} m
 - 1 mm
 - 1 cm
- In an n-p-n transistor 10^{10} electrons enter the emitter in 10^{-6} s, 3% of the electrons are lost in the base. The current transfer ratio is
 - 0.94
 - 0.95
 - 0.96
 - 0.97
- If the two ends p and n of p-n junction diode are joined by a wire,
 - There will not be a steady current in the circuit
 - There will be a steady current from n-side to p-side
 - There will be a steady current from p-side to n-side
 - There will not be a current depending upon the resistance of the connecting wire
- In a full wave rectifier circuit, current flows continuously through load resistance due to the conduction of:
 - both the diode in alternate half cycle
 - both the diodes in every half cycle
 - only one diode in each complete cycle
 - none of these
- Solar cells are large area semiconductor p-n junction in which:
 - electrons have low concentration in n-region
 - electrons have high concentration in n-region
 - electrons have high concentration in p-

region

d) electrons have equal concentration in both the region

17. A n-p-n transistor can be considered to be equivalent to two diodes as shown in :



a) P b) Q c) R d) S

18. Applying different potential at the ends of p-n junction, current is measured for energy potential. Which curve shows the relationship between current and potential

a) Figure b) Figure c) Figure d) Figure

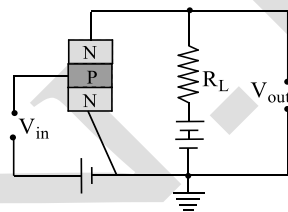
19. The ratio of number of holes and number of conduction electrons in an intrinsic semiconductor is

a) Less than one b) One
c) Greater than one d) Infinity

20. In insulators,

a) the valence band is partially filled with electrons.
b) the conduction band is partially filled with electrons.
c) the conduction band is filled with electrons and valence band is empty.
d) the conduction band is empty and the valence band is filled with electrons.

21. An NPN-transistor circuit is arranged as shown in figure. It is



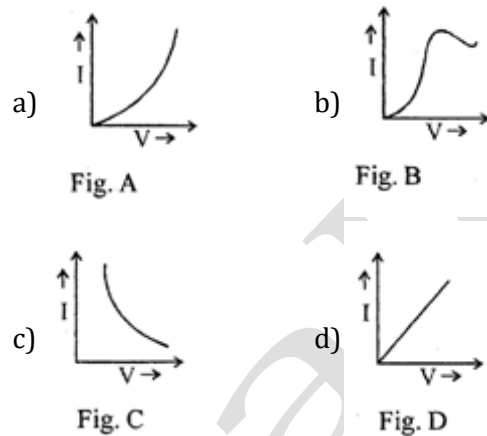
a) A common base amplifier circuit
b) A common emitter amplifier circuit
c) A common collector amplifier circuit
d) Neither of the above

22. In an intrinsic semiconductor,

a) Only electrons are responsible for flow of current
b) Both holes and electrons carry current
c) Both holes and electrons carry current with electrons being majority carriers

d) Only holes are responsible for flow of current

23. Which of the following graph represent variation of forward voltage and forward bias current in p-n junction:



24. When two semiconductors of p and n-type are brought into contact, they form a p-n junction which act like a

a) conductor b) oscillator
c) amplifier d) rectifier

25. The brightness of LED can be controlled by

a) Applied potential differences
b) By changing the value of series resistance
c) By changing the value of parallel resistance
d) None of these

26. When p-n junction is reverse biased, then the width of barrier potential will

a) increase and it will offer more resistance
b) decrease and it will offer more resistance
c) remain constant and it will not offer resistance

d) decrease and it will offer less resistance

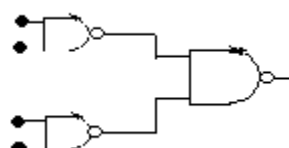
27. once a zener diode is taken in its breakdown region, there is not much change in its

a) current b) resistance
c) voltage d) capacitance

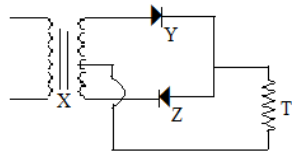
28. Suitable impurities are added to a semiconductor depending on its use. This is done to

a) Increases its life
b) Enable it to withstand higher voltages
c) Increase its electrical conductivity
d) Increase its electrical resistivity

29. combination of NAND gates is equivalent to:



- a) OR gate b) AND gate c) NOT gate d) XOR gate
30. When flow of charge carriers across p-n junction acquire a equilibrium state:
 a) the p-end at positive potential w.r.t. n-end
 b) the n-end at positive potential w.r.t. p-end
 c) the P.o. between P-end and n-end is zero
 d) the free electron move from n-type of portion
31. Transistors are essentially
 a) power driven devices.
 b) current driven devices.
 c) voltage driven devices.
 d) resistance driven devices.
32. The given truth table is for
- | Input | | Output |
|-------|---|--------|
| A | B | Y |
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |
- a) NAND gate b) AND gate
 c) NOR gate d) OR gate
33. Which logic gate produces 'LOW' output when any of the inputs is 'HIGH'?
 a) AND b) OR c) NAND d) NOR
34. Which of the following relations between α and β is true?
 a) $\beta = \frac{\alpha}{1 - \alpha}$ b) $\alpha = \frac{\beta}{1 - \alpha}$
 c) $\beta = \frac{\alpha}{1 + \alpha}$ d) $\alpha = \frac{\beta}{\beta - 1}$
35. A p-n junction diode is said to be forward biased when a potential difference applied across p and n region makes
 a) p-region positive and n-region negative
 b) p-region negative and n-region positive
 c) Both p and n-regions positive
 d) Both p and n-regions negative
36. In a half wave rectifier the AC input source of frequency 50 Hz is used. The fundamental frequency of the output is
 a) 50 Hz b) 150 Hz c) 200 Hz d) 75 Hz
37. In transistor, the base is :
 a) an insulator
 b) conductor of high resistance
 c) conductor of low resistance
 d) an extrinsic semiconductor
38. In transistor, forward bias is always smaller than the reverse bias. The correct reason is
 a) To avoid excessive heating of transistor
 b) To maintain a constant base current
 c) To produce large voltage gain
 d) To provide high current
39. The emitter of a transistor is doped the heaviest, because it
 a) receives the input
 b) is supplier of charge carriers
 c) dissipates minimum power
 d) should have low resistance
40. In an n-type semiconductor, which of the following statement is true?
 a) Electrons are majority carriers and trivalent atoms are dopants
 b) Electron are minority carriers and pentavalent atoms are dopants
 c) Holes are minority carriers and pentavalent atoms are dopants
 d) Holes are majority carriers and trivalent atoms are dopants
41. p-n junction works as an insulator if:
 a) connected to A.C. source
 b) it is in forward bias
 c) it is in reverse biased
 d) connected to either to A.C. Source OR in reverse bias
42. In the transistor, the emitter current is
 a) Slightly more than collector current
 b) Slightly less than collector current
 c) Equal to the collector current
 d) Equal to the base current
43. Potential barrier developed in a junction diode opposes
 a) minority carriers in both regions only
 b) majority carriers
 c) electrons in n-region
 d) holes in P-region
44. npn-transistors are preferred to pnp-transistors because they have
 a) low cost
 b) low dissipation of energy
 c) capable of handling large power
 d) electrons have high mobility than holes and hence high mobility of energy
45. The adjacent circuit cannot work as full wave rectifier as there is wrong connection at four point X, Y, Z and T marked in figure. The point at which wrong connection is



- a) X b) Y c) Z d) T
46. When used in a circuit, Zener diode is always
 a) Forward biased
 b) Reverse biased
 c) Both forward and reverse
 d) Connected in series
47. The correct symbol for zener diode is
 a) b) c) d)
48. A zener diode has a breakdown voltage of 5 V with a maximum power dissipation of 240 mW. The maximum current the diode can handle will be
 a) 50 mA b) 45 mA c) 46 mA d) 44 mA
49. In normal mode of working of transistor which of the following statement is correct. :
 a) electrons are injected from emitter into base in PNP transistor
 b) holes are injected from emitter into base in PNP transistor
 c) holes emerge out of the collector of NPN transistor
 d) charge carriers never recombine in the base layer
50. A photodiode is operated in
 a) Forward bias
 b) Reverse bias
 c) p-type semiconductor
 d) n-type semiconductor
51. In a transistor with normal bias, the emitter base junction
 a) has a high resistance.
 b) has a low resistance.
 c) is reverse biased.
 d) emits such carriers into base which are majority in base.
52. A solar cell is a p-n junction operating in
 a) reverse bias condition
 b) unbiased condition
 c) forward bias condition
 d) in both forward and reverse bias condition
53. A hole in a semiconductor is rather different from an electron because it has
 a) Zero mass
 b) Positively charged vacancy
 c) Negatively charged particle

d) Zero charge

54. In a transistor if collector current is 25 mA and base current is 1 mA, then current amplification factor α is
 a) $\frac{25}{24}$ b) $\frac{24}{25}$ c) $\frac{25}{26}$ d) $\frac{26}{25}$
55. In the following figures, the diodes are either forward biased or reversed biased. Choose the CORRECT statement.
- 1) 2) 3) 4)
- a) (1) and (2) are forward biased and (3) and (4) reverse biased.
 b) (1) and (4) are forward biased and (2) and (3) reverse biased
 c) (1) and (3) are forward biased and (2) and (4) reverse biased.
 d) (2) and (3) are forward biased and (1) and (4) reverse biased.
56. GaAs is used to prepare
 a) a zener diode b) a light emitting diode
 c) a transistor d) a half wave rectifier
57. For obtaining maximum power from a solar cell, it should be operated on
 a) knee portion of V-I characteristics
 b) any portion of V-I characteristics
 c) level part of V-I characteristics
 d) falling part of V-I characteristics
58. The Boolean equation of NOR gate is
 a) $C = A+B$ b) $C = \overline{A+B}$
 c) $C = A.B$ d) $C = \overline{A.B}$
59. The circuit below represents a
-
- a) OR gate b) AND gate
 c) NOR gate d) NAND gate
60. The collector supply voltage in CE transistor amplifier is 10V. The base current is 10 μ A in the absence of the signal voltage and the voltage between the collector and the emitter is 4 V. The current gain (β) of a transistor is 200, then the value of the load resistance R_L

- a) 1 k Ω b) 2 k Ω c) 3 k Ω d) 4 k Ω

61. Generally an oscillator is nothing but an amplifier with a

- a) negative feedback
b) positive feedback
c) large gain
d) positive or negative feedback

62. The diagram represents:



- a) NAND b) OR c) AND d) NOR

63. In extrinsic semiconductor, the number of holes and electrons are n_H and n_e respectively then

- a) $n_H < n_e$ b) $n_H > n_e$ c) $n_H = n_e$ d) $n_H \neq n_e$

64. When a p-n junction diode is forward biased, the flow of current across the junction is mainly

- a) Due to drift of charges
b) Drift to diffusion of charges
c) Due to both drift and diffusion of charges
d) Due to chargeless particles

65. Electronic oscillator is better than mechanical one because

- a) It has better frequency stability
b) It has higher efficiency
c) It has low frequency stability
d) It can produce frequency of 1 GHz

66. A pure semiconductor

- a) Has low resistance
b) Is an intrinsic semiconductor
c) Allows inadequate current to pass through it
d) Is an extrinsic semiconductor

67. When p-n junction diode is reverse biased, the flow of current across the junction is mainly due to :

- a) diffusion of charges
b) drift of charges
c) both drift and diffusion of charges
d) depends upon the nature of the material

68. The resistivity of a semiconductor at room temperature is in between

- a) 10^{10} to 10^{12} Ω cm b) 10^6 to 10^8 Ω cm
c) 10^{-3} to 10^6 Ω cm d) 10^{-2} to 10^{-5} Ω cm

69. At room temperature, pure semiconductor carries current due to the motion of:

- a) only holes
b) only electrons

- c) positive and negative ions
d) holes and electrons

70. Majority carriers in semiconductors are

- a) holes in n-type and p-type both
b) electron in n-type and p-type both
c) holes in n-type and electrons in p-type
d) holes in p-type and electrons in n-type

71. Regarding p-type and n-type semiconductor which of the following statements is true?

- a) n-type semiconductors have free electrons in majority
b) n-type semiconductors have holes in majority
c) the concentrations of electrons and holes are equal in both n-type and p-type semiconductors
d) n-type semiconductor has excess negative charge

72. For a common base configuration of P-N-P transistor, $\frac{I_C}{I_E} = 0.98$. Then maximum current gain in common emitter configuration will be

- a) 12 b) 24 c) 6 d) 5

73. What is the order of forbidden energy gap in eV in the energy bands of silicon?

- a) 0.5 eV b) 1.1 eV c) 2.1 eV d) 3.5 eV

74. A p-type semiconductor is

- i) a silicon crystal doped with arsenic impurity
ii) a silicon crystal doped with aluminium impurity
iii) a germanium crystal doped with boron impurity
iv) a germanium crystal doped with phosphorus impurity
a) (i) and (ii) are correct
b) (ii) and (iii) are correct
c) (i) and (iv) are correct
d) only (i) is correct

75. Leakage current in a semiconductor is due to

- a) heat energy b) electrical energy
c) light energy d) chemical energy

76. A combination of AND function and NOT function results in

- a) OR gate b) Inversion
c) NAND gate d) NOR gate

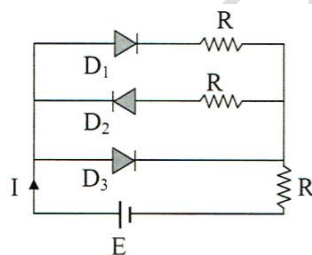
77. In negative feedback,

- a) Phase difference is π b) Phase difference is $\frac{\pi}{2}$
c) Phase difference is 0 d) Phase difference is $\frac{\pi}{2}$

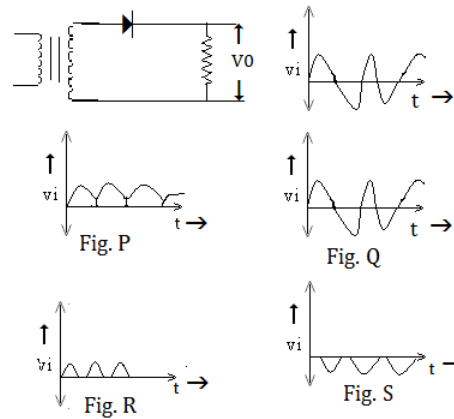
78. If the energy gap between the conduction band and valence band of a substance is of the order

of 0.7 eV, then the substance is

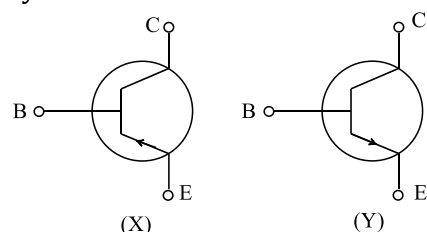
- a) a conductor b) semiconductor
c) an insulator d) a super conductor
79. To a germanium sample, traces of gallium are added as an impurity. The resultant sample would behave like
a) A conductor
b) A P-type semiconductor
c) An N-type semiconductor
d) An insulator
80. In a common base amplifier circuit, calculate the change in base current if that in the emitter current is 2 mA and $\alpha = 0.98$
a) 0.04 mA b) 1.96 mA c) 0.98 mA d) 2 mA
81. For a transistor, the current amplification factor is 4. When the transistor is connected in common emitter configuration, the change in collector current, when the base current changes by 6 mA, is
a) 6 mA b) 4.8 mA c) 24 mA d) 8 mA
82. In p-n junction diode, holes diffuse from p-region to n-region, because
a) the free electrons in the n-region attract them.
b) they are swept across the junction by potential difference
c) there is a greater concentration of holes in p-region as compared to n-region.
d) there is great concentration of electrons in p-region as compared to n-region.
83. In the following circuit of PN junction, diodes D_1 , D_2 and D_3 are ideal then I is



- a) $\frac{E}{R}$ b) $\frac{E}{2R}$ c) $\frac{2E}{3R}$ d) Zero
84. The most commonly used semiconducting material used to prepare a solar cell is
a) Gallium arsenide b) Indium arsenide
c) Cadmium arsenide d) Silicon
85. In a circuit if the given input has the form as shown in figure B, what will be the form of output



- a) P b) Q c) R d) S
86. Identify the true statement of OR gate
a) Output Y will be 1 when the input A or B or both are 1
b) Output Y will be 0 when either of the inputs A and B is 1
c) Output Y will be 1 only when both the inputs A and B are 1
d) Outputs Y will be 1 only when either of the inputs A and B is 1
87. In a pure silicon ($n_i = 10^{16}/\text{m}^3$) crystal at 300 K, 10^{21} atoms of phosphorus are added per cubic meter. The new hole concentration will be
a) 10^{21} per m^3 b) 10^{19} per m^3
c) 10^{11} per m^3 d) 10^5 per m^3
88. When a semiconductor is doped with donor impurity:
a) the hole concentration increases
b) the hole concentration decreases
c) the electron concentration increases
d) the electron concentration decreases
89. Which of the following logic gates is a universal gate?
a) OR b) NOT c) AND d) NOR
90. Which of the following represents standard symbols for transistors?



- a) Both represent p-n-p transistor
b) Both represent n-p-n transistor
c) X represents p-n-p transistor and Y represents n-p-n transistor
d) X represents n-p-n transistor and Y represents p-n-p transistor

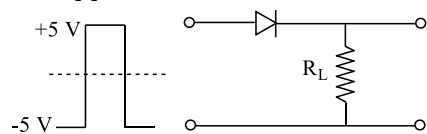
and n_i is electron concentration in an intrinsic semiconductor then,

- a) $\left(\frac{n_e}{n_h}\right) = n_i$ b) $(n_e + n_h) = n_i$
 c) $(n_e - n_h) = n_i^2$ d) $n_e n_h = n_i^2$

106. The current obtained from a simple filter less rectifier is

- a) varying direct current
 b) constant direct current
 c) direct current mixed with alternating current
 d) eddy current

107. If in a p-n junction, a square input signal of 10 V is applied, as shown



Then the output across R_L will be:

- a) b)
 c) d)

108. In an n-type semiconductor donor level is .

- a) above the conduction band of the host crystal
 b) below the valence band of the host crystal
 c) close to the conduction band of the host crystal
 d) close to the valence band of host crystal

109. When output current is in one direction only, but is continuously varying in value, then it is called

- a) anode current
 b) direct current
 c) alternating current
 d) pulsating direct current

110. For rectifying an action, we use

- a) choke b) diode
 c) transformer d) condenser

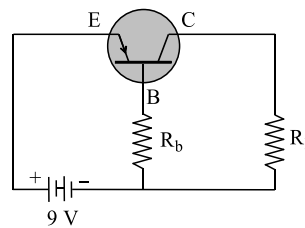
111. In n-p-n transistor the emitter current will be equal to

- a) collector current
 b) base current
 c) sum of the collector and base current
 d) difference of collector and base current

112. In a Zener regulator, if source voltage is 30 V, series resistance is of 1.5 k Ω , load resistance is of 2 k Ω and $V_z = 10$ V, then zener current will be

- a) 13.33 mA b) 5 mA
 c) 10 mA d) 8.33 mA

113. In a transistor circuit shown here, the base current is 35 μ A. The value of the resistor R_b is

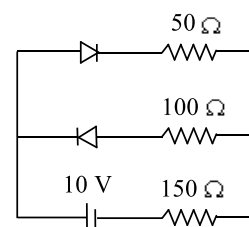


- a) 123.5 k Ω b) 257 k Ω
 c) 380.05 k Ω d) 280.0 k Ω

114. An ideal diode,

- a) should have zero resistance in the forward bias as well as in reverse bias.
 b) should have zero resistance in the forward bias and an 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 forward as well as in reverse bias.

115. Assume that each diode shown in the figure has a forward bias resistance of 50 Ω and an infinite reverse bias resistance. The current through the resistance 150 Ω is



- a) 0.66 A b) 0.05 A c) Zero d) 0.04 A

116. For sustained oscillation, the product of gain of amplifier (A) and feedback factor (B) is :

- a) equal to 1 b) less than 1
 c) greater than 1 d) can not be predicted

117. In a pure conductor, the value of the forbidden energy gap is

- a) 0.5 eV b) 1.1 eV c) zero d) 2.3 eV

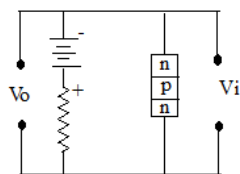
118. A light emitting diode is

- a) always used in forward biased condition
 b) always used in reverse biased condition
 c) never used in forward biased condition
 d) used in both forward and reverse biased positions depending upon its application

119. Conductivity of semiconductor is :

- a) always decreases with increase in temperature
 b) increases with increase in temperature

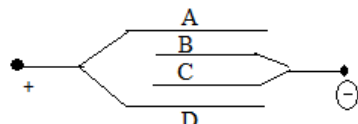
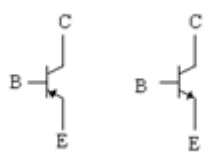
- c) always increases with addition of impurity
d) decreases with addition of impurity
120. Find the 'wrong' component from the following. An electronic oscillator consists of
a) an amplifier
b) a tank circuit or oscillating circuit
c) externally applied input signal
d) feedback network
121. In a half wave rectifier, the r.m.s. value of the A.C. component of the wave is
a) Equal to D.C. value b) More than D.C. value
c) Less than D.C. value d) Zero
122. As n-p-n transistor circuit is arranged as shown in fig. is



- a) a common amplifier circuit
b) a common emitter amplifier circuit
c) a common collector amplifier circuit
d) neither of these
123. In an NPN transistor the collector current is 24 mA. If 80% of electrons reach collector its base current in mA is
a) 36 b) 26 c) 16 d) 6
124. The transistors provide good power amplification when they are used in
a) Common collector configuration
b) Common emitter configuration
c) Common base configuration
d) Any configuration
125. In a transistor,
a) Length of emitter is greater than collector
b) Length of collector is greater than emitter
c) Length of base is greater than emitter
d) Length of base is greater than collector
126. A solar cell can be made from
a) A thin wafer of Si doped with As
b) A thin wafer of germanium
c) A thin wafer of pure gallium arsenide
d) A thin wafer of copper
127. The value of current gain (β)
a) is always less than 1
b) is always infinity
c) is always greater than 150
d) lies between 50 and 150
128. Avalanche breakdown is due to :
a) collisions of majority charge carriers in

- respective regions
b) collisions of minority charges carriers in respective regions
c) increase in thickness of depletion region
d) none of these
129. In which of the configuration of a transistor. The power gain is highest
a) common base b) common emitter
c) common collector d) same in all of three
130. At 0°K fermi level for metals:
a) separate, empty and filled levels
b) lies between filled levels
c) depends upon metal
d) lies between empty levels
131. The energy band gap is maximum in
a) Metals b) Super conductors
c) Insulators d) Semiconductors
132. In which of the following circuits a transformer with C.T. (centre tap terminal) in secondary coil is required:
a) Half wave rectifier
b) Bridge rectifier
c) Full wave rectifier
d) Common emitter amplifier
133. Regarding p-type and n-type semiconductors, which of the following statements is true?
a) n-type semiconductors have free electrons in majority
b) n-type semiconductors have holes in majority
c) The concentration of electrons and holes are equal in both n-type and p-type semiconductors
d) n-type semiconductor is obtained by doping with trivalent impurity
134. Barrier potential in Ga-As-P LED is about
a) 5 volt b) 0.5 volt c) 1.5 volt d) 2.5 volt
135. The band gap in germanium and silicon in eV respectively are
a) 0.7, 1.1 b) 1.1, 0.7 c) 1.0, 0 d) 0, 1.1
136. At absolute zero temperature the forbidden energy gap of conductor is :
a) 0.7 eV b) 6 eV c) 1.1 eV d) zero
137. Which of the following is NOT a 'donor' impurity?
a) Bismuth b) Antimony
c) Indium d) Arsenic
138. When a p-n junction diode is forward biased, the flow of current across the junction is mainly
a) due to drift of charges.

- b) due to diffusion of charges.
 c) due to both drift and diffusion of charges.
 d) depending due to charge less particle
139. For a transistor, the current amplification factor is 0.8. The transistor is connected in common emitter configuration. The change in the collector current when the base current changes by 6 mA is
 a) 6 mA b) 4.8 mA c) 24 mA d) 8 mA
140. Which is the correct relation for forbidden energy gap in conductor, semiconductor and insulator?
 a) $(\Delta E_g)_{\text{conductor}} > (\Delta E_g)_{\text{sc}} > (\Delta E_g)_{\text{insulator}}$
 b) $(\Delta E_g)_{\text{insulator}} > (\Delta E_g)_{\text{sc}} > (\Delta E_g)_{\text{conductor}}$
 c) $(\Delta E_g)_{\text{conductor}} > (\Delta E_g)_{\text{insulator}} > (\Delta E_g)_{\text{sc}}$
 d) $(\Delta E_g)_{\text{sc}} > (\Delta E_g)_{\text{conductor}} > (\Delta E_g)_{\text{insulator}}$
141. A zener-regulated power supply consists of a 9 V battery connected in series with a resistance of 100Ω and a zener diode. The zener diode maintains a constant voltage drop of 4 V across a load resistance of 400Ω . The current drawn by the load resistance will be
 a) 0.025 A b) 0.050 A c) 0.01 A d) 0.015 A
142. How many NAND gates are needed to form an AND gate?
 a) 2 b) 3 c) 4 d) 5
143. Logic gates are the building blocks of a
 a) Digital system b) Analog system
 c) Abacus system d) house
144. A transistor has $\alpha = 0.96$. If the emitter current is 8 mA, what are the values of collector and base currents?
 a) 7.8 mA, 0.5 mA b) 7.7 mA, 0.3 mA
 c) 7.6 mA, 0.2 mA d) 7.5 mA, 0.1 mA
145. In LED, intensity of emitted light
 a) Increases with forward current
 b) Decreases with forward current
 c) Increases with reverse current
 d) Decreases with reverse current
146. Barrier potential in LED depends on type of
 a) Impurity b) Junction
 c) Biasing d) Semiconductors
147. The base of a transistor serves a similar function as:
 a) plate in triode b) filament in triode
 c) grid in triode d) coating on cathode
148. The majority and minority charge carriers in n-type semiconductors are respectively
 a) electrons and electrons.

- b) electrons and holes
 c) holes and electrons.
 d) holes and holes.
149. Among the substance maintained below, the semiconductor are (list: 1) copper, 2) carbon, 3) silicon, 4) Germanium 5) Gallium:
 a) 1,3,5 b) 2, 4, 5 c) 2,3,4 d) 2, 5
150. Solar cell is a p-n junction of semiconducting material which is operating in :
 a) forward bias condition
 b) unbiased condition
 c) reverse bias condition
 d) reverse bias and forward bias condition
151. To obtain full wave rectification, we require
 a) only one diode b) triode
 c) two diodes d) transistor
152. At absolute zero temperature, a crystal of pure germanium
 a) Behaves as perfect conductor
 b) Behaves as perfect insulator
 c) Behaves as a semiconductor
 d) Contains no electron
153. In case of a p-n junction diode at high value of reverse bias, the current rises sharply. The value of reverse bias is known as :

 a) cutt off voltage b) zener voltage
 c) inverse voltage d) critical voltage
154. The following represent standard symbol for transistors state if

 a) both represent p-n-p transistors
 b) both represent n-p-n transistors
 c) first is p-n-p while second is n-p-n transistor'
 d) first is n-p-n while second is p-n-p transistor
155. Consider an NPN transistor amplifier in common-emitter configuration. The current gain of the transistor is 100. If the collector current changes by 1 mA, what will be the change in emitter current
 a) 1.1 mA b) 1.01 mA c) 0.01 mA d) 10 mA
156. In the working of n-p-n transistor, the number of free electrons which recombine with holes

in the base layer is about

- a) 97% of the number injected into the base
- b) 50% of the number injected into the base
- c) 30% of the number injected into the base
- d) 25% of the number injected into the base

157. A diode rectifier

- a) Converts A.C. into D.C.
- b) Converts D.C. into A.C.
- c) Amplifies A.C. signals
- d) Amplifies D.C. signals

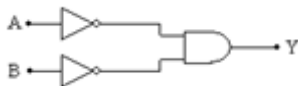
158. The Boolean expression for OR function is

- a) $Y = A + B$
- b) $Y = A \cdot B$
- c) $Y = A - B$
- d) $Y = A$

159. Zener breakdown in a semiconductor diode occurs when

- a) Forward current exceeds certain value
- b) Reverse bias exceeds certain value
- c) Forward bias exceeds certain value
- d) Potential barrier is reduced to zero

160. What is the output Y of the gate circuit shown in figure ?

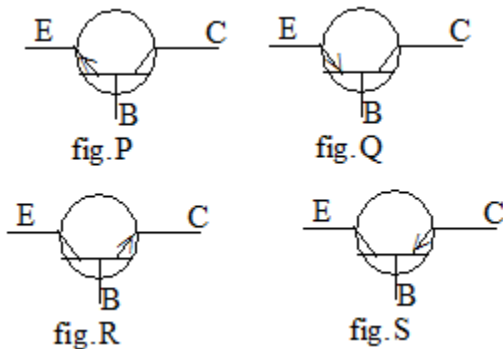


- a) $\overline{A} \cdot \overline{B}$
- b) $\overline{A} \cdot B$
- c) $\overline{A} \cdot \overline{B}$
- d) $\overline{A} \cdot B$

161. In a N-P-N transistor about 10^{10} electrons enter the emitter in $2 \mu s$, when it is connected to a battery. Then $I_E = \underline{\hspace{1cm}} \mu A$.

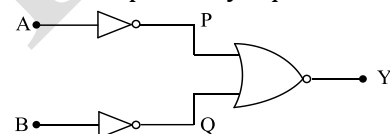
- a) 200
- b) 400
- c) 800
- d) 1600

162. The p-n-p transistor is shown by the symbol



- a) P
- b) R
- c) Q
- d) S

163. In the following circuit, $Y = 1$ for this inputs A and B respectively equal to



- a) 0, 0
- b) 0, 1
- c) 1, 0
- d) 1, 1

164. In a common-base amplifier, the phase difference between the input signal voltage and the output voltage is

- a) 0
- b) $\pi/4$
- c) $\pi/2$
- d) π

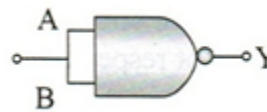
165. In p-type semiconductor the acceptor impurity level are little;

- a) below conduction band
- b) above conduction band
- c) below valence band
- d) above the valence band

166. Electronic oscillator is better than mechanical one because:

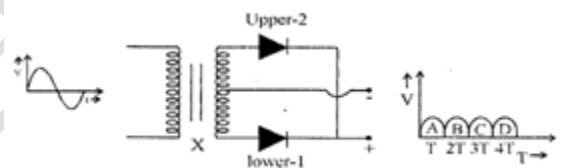
- a) it has low frequency stability
- b) it has better frequency stability
- c) it has higher efficiency
- d) it has variable efficiency

167. This symbol represents



- a) NOT gate
- b) OR gate
- c) AND gate
- d) NOR gate

168. A full wave rectifier along with output is shown in figure. The contribution from the diode-I is



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

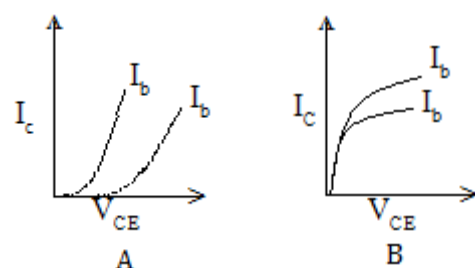
169. For obtaining maximum power from a solar cell, it should be operated in

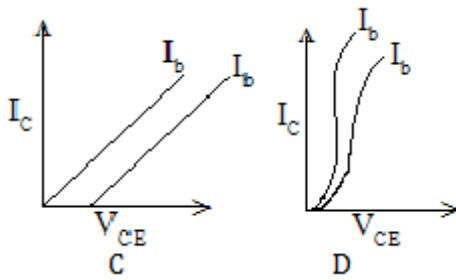
- a) Knee portion of V-I characteristics
- b) Any portion of V-I characteristic
- c) Level part of V-I characteristic
- d) Falling part of V-I characteristic

170. What is the name of the level formed due to the impurity atom in the forbidden energy gap near the valence band in a p-type semiconductor?

- a) Conduction level
- b) Forbidden level
- c) Donor level
- d) Acceptor level

171. Which of the following represent output characteristics of transistor in common emitter mode:



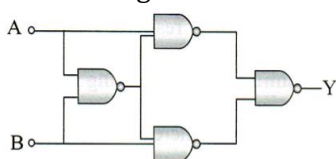


- a) A b) B c) C d) D
172. Energy bands in solids are a consequence of
 a) Ohm's Law
 b) Pauli's exclusion principle
 c) Bohr's theory
 d) Heisenberg's uncertainty principle
173. The width of depletion region:
 a) is independent on biasing
 b) becomes large in forward bias.
 c) becomes small in reversed bias
 d) becomes small in forward bias
174. The most commonly used semiconductors are
 a) wool and glass
 b) copper and brass
 c) glass and ebonite
 d) germanium and silicon
175. Consider the following statements A and B and identify the correct choice of the given answers
 (i) A zener diode is always connected in reverse bias
 (ii) The potential barrier of p-n junction lies between 0.1 to 0.3 V approximately
 a) (i) and (ii) are correct
 b) (i) and (ii) are wrong
 c) (i) is correct but (ii) is wrong
 d) (i) is wrong but (ii) is correct
176. In a half-wave rectifier the r.m.s. value of A component of the wave is
 a) less than zero
 b) less than D.C. Value
 c) equal to D.C. value
 d) greater than D.C. value
177. In common base amplifier the phase difference. between signal voltage and output voltage (across collector and base) is:
 a) 0 b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) π
178. Which one of the following gains is not defined for transistor amplifier
 a) voltage gain b) current gain
 c) Energy gain d) Resistance gain
179. In normal operation of n-p-n transistor, the mean current crossing the collector is :

- a) hole current b) base current
 c) drift current d) diffusion current
180. In Boolean expression which gate is expressed as $y = \overline{A + B}$?
 a) OR gate b) NAND gate
 c) AND gate d) NOR gate
181. A pure semiconductor has
 a) an infinite resistance at 0° C
 b) a finite resistance which does not depend upon temperature
 c) a finite resistance which decrease with temperature
 d) a finite resistance which increases with temperature
182. In case of forward biasing p-n junction which of the following diagrams is correct
- a) Fig.A
- b) Fig.C
- c) Fig.B
- d) Fig.D
183. The band of maximum energy in which electrons are present is called the
 a) conduction band b) valence band
 c) forbidden band d) none of these
184. The LED's used for giving I.R. radiation are prepared from:
 a) Silicon dioxide
 b) Gallium arsenide
 c) Gallium phosphide
 d) Gallium arsenide phosphide
185. Transistor consists of two junction diodes which are connected
 a) one after another b) back to back
 c) one across another d) one upon other
186. Which of the following is the part of oscillator?

- a) Tank circuit b) Amplifier
c) Feedback circuit d) All of these
187. In insulators (C.B. is conduction band and V.B. is valence band)
a) V.B. is partially filled with electrons
b) C.B. is partially filled with electrons
c) C.B. is empty and V.B. is filled with electrons
d) C.B. is filled with electrons and V.B. is empty
188. Pure semiconductor well below 0°C has:
a) low resistance like metals
b) high resistance like insulator
c) high resistance smaller than that of insulator
d) low resistance smaller than that of metal

189. Truth table for system of four NAND gates as shown in figure is



a)	$\begin{vmatrix} A & B & Y \\ 0 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix}$	b)	$\begin{vmatrix} A & B & Y \\ 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{vmatrix}$	c)	$\begin{vmatrix} A & B & Y \\ 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{vmatrix}$	d)	$\begin{vmatrix} A & B & Y \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{vmatrix}$
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190. In transistor which of the following is larger in size:
a) emitter b) collector
c) base d) emitter base junction

191. The intrinsic semiconductor has forbidden energy gap is:
a) very large
b) zero
c) very small
d) half of the forbidden gap in condition

192. Let n_p and n_e be the number of holes and conduction electrons respectively in a semiconductor. Then,
a) $n_p > n_e$ in an intrinsic semiconductor.
b) $n_p = n_e$ in an extrinsic semiconductor.
c) $n_p = n_e$ in an intrinsic semiconductor.
d) $n_e > n_p$ in an intrinsic semiconductor.

193. The frequency of oscillation in oscillator is (where L- inductance C- capacitance in a circuit) :

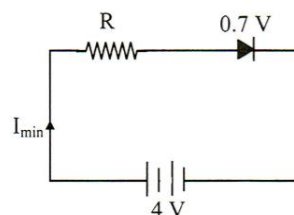
a) $f = \frac{1}{\sqrt{2\pi LC}}$	b) $f = \frac{1}{2\pi\sqrt{LC}}$
c) $f = \frac{1}{2\pi}\sqrt{LC}$	d) $f = \frac{1}{2\pi}\sqrt{\frac{L}{C}}$

194. The ratio of number of holes and number of conduction electrons in an intrinsic

semiconductor is

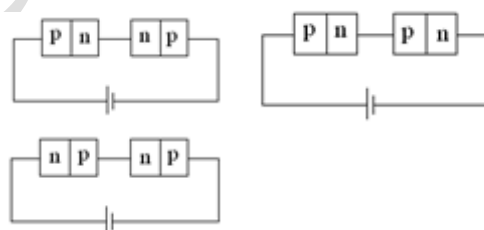
- a) less than one b) one
c) greater than one d) infinity

195. The silicon diode in the circuit as shown in figure requires a minimum current of 2 mA to be above the knee point 0.7 V of its I-V characteristics. Assume that the voltage across the diode is independent of current above the knee point. The power dissipated in the resistance R when a current of 2 mA flows in the circuit is



- a) $3.3 \times 10^{-3} \text{ W}$ b) $6.6 \times 10^{-3} \text{ W}$
c) $9.63 \times 10^{-5} \text{ W}$ d) $1.5 \times 10^{-6} \text{ W}$

196. Two identical p-n junctions may be connected in series with a battery in three ways as shown in figure. The potential drops across the two p-n junction are equal in



Circuit 1 Circuit 2 Circuit 3

- a) circuit 1 only b) circuit 1 and circuit 2
c) circuit 2 and circuit 3 d) all of these circuits
197. If a p-n junction diode is not connected to any circuit
a) the potential is the same everywhere
b) the p-type side is at a higher potential than
c) there is an electric field at the junction directed from the n-type side to the p-type side
d) there is an electric field at the junction directed from the p-type side to the n-type

198. Transistors are essentially

- a) Power driven devices
b) Current driven devices
c) Voltage driven devices
d) Resistance driven devices

199. The emitter-base junction of a transistor is _____ biased while the collector-base junction

is _____ biased

- a) Reverse, forward b) Reverse, reverse
- c) Forward, forward d) Forward, reverse

200. The diode is called an electronic valve since

- a) It permits the flow of electric current only in one direction from cathode to anode
- b) It permits the flow of electric current only in one direction from anode to cathode in

external circuit

- c) It permits current in both directions
- d) It permits the flow of electric current in any direction

N.B.Navalale

N.B.Navale

Date : 28.03.2025
Time : 03:00:00
Marks : 200

TEST ID: 61
PHYSICS

10.SEMICONDUCTOR,16.SEMICONDUCTOR DEVICES

: ANSWER KEY :

1)	c	2)	c	3)	b	4)	b	105)	d	106)	c	107)	d	108)	c
5)	a	6)	b	7)	c	8)	c	109)	d	110)	b	111)	c	112)	d
9)	c	10)	b	11)	a	12)	b	113)	b	114)	b	115)	d	116)	a
13)	d	14)	c	15)	a	16)	b	117)	c	118)	a	119)	b	120)	c
17)	c	18)	c	19)	b	20)	d	121)	d	122)	d	123)	d	124)	b
21)	b	22)	b	23)	a	24)	d	125)	b	126)	b	127)	c	128)	b
25)	a	26)	a	27)	c	28)	c	129)	b	130)	a	131)	c	132)	c
29)	a	30)	b	31)	b	32)	a	133)	a	134)	c	135)	a	136)	d
33)	d	34)	a	35)	a	36)	a	137)	c	138)	a	139)	c	140)	b
37)	d	38)	a	39)	b	40)	c	141)	c	142)	a	143)	a	144)	b
41)	c	42)	a	43)	b	44)	d	145)	a	146)	d	147)	c	148)	b
45)	c	46)	b	47)	a	48)	b	149)	c	150)	b	151)	c	152)	b
49)	b	50)	b	51)	b	52)	b	153)	b	154)	c	155)	b	156)	c
53)	b	54)	c	55)	c	56)	b	157)	a	158)	a	159)	b	160)	b
57)	a	58)	b	59)	b	60)	c	161)	c	162)	c	163)	d	164)	a
61)	b	62)	c	63)	d	64)	a	165)	d	166)	b	167)	a	168)	c
65)	a	66)	b	67)	a	68)	c	169)	a	170)	d	171)	b	172)	b
69)	d	70)	d	71)	a	72)	b	173)	d	174)	d	175)	c	176)	d
73)	b	74)	b	75)	a	76)	c	177)	a	178)	c	179)	c	180)	d
77)	a	78)	b	79)	b	80)	a	181)	c	182)	d	183)	b	184)	b
81)	c	82)	c	83)	a	84)	d	185)	b	186)	d	187)	c	188)	b
85)	c	86)	a	87)	c	88)	c	189)	a	190)	b	191)	c	192)	c
89)	d	90)	c	91)	a	92)	a	193)	b	194)	b	195)	b	196)	c
93)	a	94)	a	95)	b	96)	d	197)	c	198)	b	199)	d	200)	a
97)	c	98)	c	99)	d	100)	b								
101)	c	102)	c	103)	d	104)	b								

Date : 28.03.2025

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PHYSICS

10.SEMICONDUCTOR,16.SEMICONDUCTOR DEVICES

: HINTS AND SOLUTIONS :

Single Correct Answer Type

9 (c)

$$\beta_{dc} = \frac{\alpha_{dc}}{1 - \alpha_{dc}} = \frac{69/70}{1 - (69/70)} = 69$$

21 (b)

As emitter (N) is common to both, the base (P) and collector (N), it is a CE amplifier circuit

38 (a)

If forward bias is made large, the majority charge carriers would move from the emitter to the collector through the base with high velocity. This would give rise to excessive heat causing damage to transistor

40 (c)

In n-type semiconductors, minority carriers are holes, majority carriers are electrons and pentavalent atoms are dopants

48 (b)

$$I = \frac{P}{V} = \frac{240 \times 10^{-3}}{5} = 48 \text{ mA}$$

54 (c)

Here,

Collector current, $I_C = 25 \text{ mA}$

Base current, $I_B = 1 \text{ mA}$

As $I_E = I_B + I_C = (1 + 25) \text{ mA} = 26 \text{ mA}$

$$\text{As } \alpha = \frac{I_C}{I_E} = \frac{25}{26}$$

60 (c)

$$\beta = \frac{I_C}{I_B} \Rightarrow I_C = \beta I_B = 2 \times 10^{-3} \text{ A}$$

$$V_{CC} - I_C R_L = V_{CE} \Rightarrow 10 - (2 \times 10^{-3}) R_L = 4 \Rightarrow R_L = 3 \text{ k}\Omega$$

72 (b)

$$\beta = \frac{\alpha}{1 - \alpha} = \frac{0.96}{1 - 0.96} = 24$$

79 (b)

Gallium is trivalent impurity

80 (a)

$$\Delta I_C = \alpha \Delta I_E = 0.98 \times 2 = 1.96 \text{ mA}$$

$$\therefore \Delta I_B = \Delta I_E - \Delta I_C = 2 - 1.96 = 0.04 \text{ mA}$$

81 (c)

The current gain,

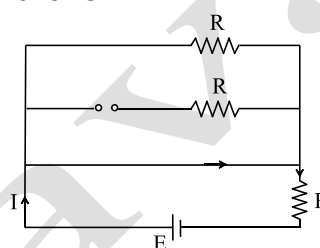
$$\beta = \frac{\Delta I_C}{\Delta I_B}$$

$$\therefore \Delta I_C = \beta \times \Delta I_B = 4 \times 6 = 24 \text{ mA}$$

$$\therefore \text{Change in collector current} = 24 \text{ mA}$$

83 (a)

Diodes D_1 and D_3 are forward biased and D_2 is reverse biased. So the circuit can be redrawn as follows



$$\therefore I = \frac{E}{R}$$

86 (a)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

Y will be 1 when either of the inputs or both the inputs are 1

87 (c)

By using mass action law,

$$n_i^2 = n_e n_h$$

$$\therefore n_h = \frac{n_i^2}{n_e} = \frac{(10^{16})^2}{10^{21}} = 10^{11} \text{ per m}^3$$

89 (d)

'NOR' gates are considered as universal gates, because all the gates like AND, OR, NOT can be obtained by using only NOR gates

94 (a)

$$A_v = \beta \frac{R_o}{R_{in}} = \frac{I_C}{I_B} \frac{R_o}{R_{in}} = \frac{I_C R_o}{V_{in}} = g_m R_o$$

$$\therefore A_v \propto g_m$$

$$\therefore \frac{A_{v_1}}{A_{v_2}} = \frac{g_{m_1}}{g_{m_2}} = \frac{0.03}{0.02} = \frac{3}{2}$$

$$\therefore A_{v_2} = \frac{2}{3} A_{v_1} = \frac{2}{3} G$$

100 (b)

$$I_E = I_B + I_C \Rightarrow I_C = I_E - I_B$$

101 (c)

If inputs are A and B, then output for NAND gate is

$$Y = \overline{AB}$$

$$\therefore \text{If } A = B = 1, Y = \overline{1 \cdot 1} = \overline{1} = 0$$

107 (d)

Diode will be in forward bias only in 0-5 volt

hence, it will conduct

112 (d)

$$I_S = \frac{V_S - V_Z}{R_S}$$

$$= \frac{30 - 10}{1.5 \times 10^3} = 13.33 \text{ mA}$$

$$I_L = \frac{V_O}{R_L} = \frac{10}{2 \times 10^3} = 5 \text{ mA}$$

$$I_Z = I_S - I_L = 13.33 - 5 = 8.33 \text{ mA}$$

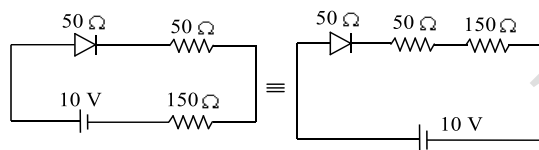
113 (b)

$$V_b = I_b R_b$$

$$\therefore R_b = \frac{9}{35 \times 10^{-6}} = 257 \text{ k}\Omega$$

115 (d)

Since the diode in reverse bias offers infinite resistance, the equivalent circuit becomes



$$I = \frac{10}{50 + 50 + 150} = 0.04 \text{ A}$$

123 (d)

$$I_C = \frac{80}{100} \times I_E$$

$$\therefore 24 = \frac{80}{100} \times I_E \Rightarrow I_E = 30 \text{ mA}$$

$$\text{Using, } I_E = I_B + I_C,$$

$$I_B = 30 - 24 = 6 \text{ mA}$$

139 (c)

$$\alpha = 0.8 \Rightarrow \beta = \frac{0.8}{(1 - 0.8)} = 4$$

$$\therefore \beta = \frac{\Delta i_C}{\Delta i_B} \Rightarrow \Delta i_C = \beta \times \Delta i_B = 4 \times 6 = 24 \text{ mA}$$

155 (b)

Current gain,

$$\beta = \frac{\Delta i_C}{\Delta i_B} \Rightarrow \Delta i_B = \frac{1 \times 10^{-3}}{100} = 10^{-5} \text{ A} = 0.01 \text{ mA}$$

$$\text{By using } \Delta i_E = \Delta i_B + \Delta i_C \Rightarrow \Delta i_E = 1.01 + 1 = 1.01 \text{ mA}$$

159 (b)

When reverse bias is increased, the electric field at the junction also increases. At some stage, the electric field breaks the covalent bonds thus generating a large number of charge carriers. This is called Zener breakdown

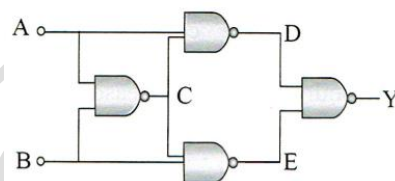
161 (c)

$$I_E = \frac{nq}{t} = \frac{10^{10} \times 1.6 \times 10^{-19}}{2 \times 10^{-6}} = 800 \times 10^{-6} \text{ A} = 800 \mu\text{A}$$

187 (c)

In insulator, conduction band is empty and valence band is filled with electron

189 (a)



A	B	C	D = $\overline{A} \cdot C$	E = $\overline{C} \cdot B$	Y
0	0	1	1	1	0
0	1	1	1	0	1
1	0	1	0	1	1
1	1	0	1	1	0

199 (d)

The emitter-base junction is forward biased while collector-base junction is reverse biased