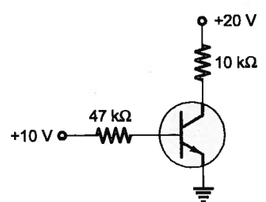
3 Bipolar Junction Transistor

Multiple Choice Questions

Q.1 The DC current gain (β) of a BJT is 50. Assuming that the emitter injection efficiency is 0.995. The base transport factor is
(a) 0.980 (b) 0.985
(c) 0.990 (d) 0.995

Q.2 In a uniformly doped BJT, assume that N_E, N_B and N_C are emitter, base and collector doping in atoms/cm^3 respectively. If the emitter injection efficiency of the BJT is close to unity which one of the following is true?
(a) $N_E = N_B = N_C$
(b) $N_E >> N_B$, $N_B > N_C$
(c) $N_E = N_B$ and $N_B < N_C$
(d) $N_E < N_B < N_C$

Q.3 In the transistor shown in figure below, collector to ground voltage is +20 V, which of the following is the probable cause of error



(a) collector-emitter terminals shorted
(b) emitter to ground connection open
(c) 10 kΩ resistor open
(d) collector base terminals shorted

Q.4 In a bipolar transistor at room temperature. If the emitter current is doubled, the voltage across its base emitter junction
(a) doubles
(b) halves
(c) increases by about 20 mV
(d) decreases by about 20 mV

Q.5 Find the output resistance of BJT for which $V_A = 100$ V at $I_C = 0.1$ mA
(a) 1 kΩ (b) 1 MΩ
(c) 2 MΩ (d) 30 kΩ

Q.6 Assume the transistor current gain β = 100 and that the breakdown voltage at base collector junction is βV_{CBO} is 120 V. Assume constant $n = 3$. Then βV_{CEO} is
(a) 20 V (b) 25.9 V
(c) 35 V (d) 40 V

Q.7 The reverse saturation current of collector base junction (I_{CBO}) of a BJT is found to be 10 nA at lower collector voltages. The low voltage current amplification factor (α) is 0.98. Find reverse saturation current with base open (I_{CEO})
(a) 1 μA (b) 0.5 μA
(c) 2 μA (d) 3 μA

Q.8 The phenomenon known as "Early effect in a bipolar transistor refers to a reduction of the effective width caused by"
(a) electron-hole recombination at the base
(b) the reverse biasing of base collector junction
(c) the forward biasing of emitter-base junction
(d) the early removal of stored base charge during saturation to cut-off switching

Numerical Data Type Questions

Q.9 A transistor has a current gain of 0.99 in the CB mode. Its current gain in the CC mode is ____.

Q.10 The neutral base width of a bipolar transistor, biased in the active region, is 0.5 μm. The maximum electron concentration and the diffusion constant in the base are 10^{14}/cm^3 and $D_n = 25$ cm^2/sec respectively. Assuming negligible recombination in the base, the collector current density is _____ A/cm^2.
(the electron charge is 1.6×10^{-19} Coulomb)

Q.11 A transistor having β = 49 has emitter cut-off current of 5 μA. The base cut-off current is ___.

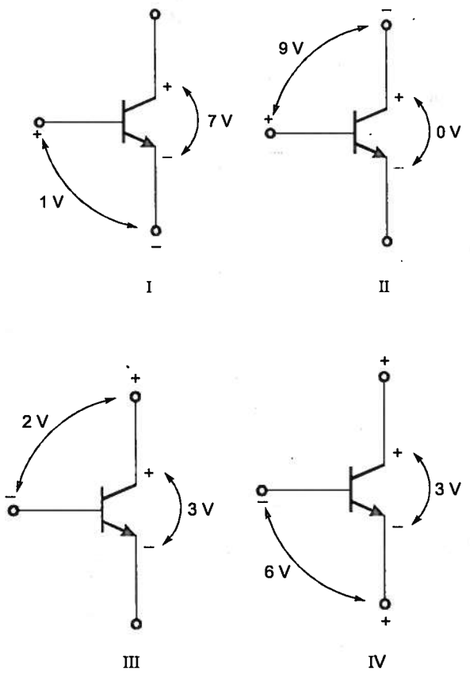
Q.12 For a BJT, the common-base current gain α = 0.98 and the collector base junction reverse bias saturation current $I_{CO} = 0.6$ μA. This BJT is connected in the common emitter mode and operated in the active region with a base drive current $I_B = 20$ μA. The collector current I_C for this mode of operation is _____ mA.

Q.13 If the α of a transistor changes 0.75% from its nominal value of 0.95, The percentage change in β will be_____%.

Try Yourself

T1. The leakage currents of a transistor are $I_{CBO} = 3$ μA and $I_{CEO} = 0.6$ mA and $I_B = 10$ μA, then the value of β is
(a) 79 (b) 80
(c) 199 (d) 200

T2. Consider the circuits shown below,



then, which of the following options is correct?
(a) I → Active
II → Reverse Active
III → Active
IV → Reverse Active
(b) I → Active
II → Saturation
III → Active
IV → Active
(c) I → Active
II → Saturation
III → Active
IV → Cut off
(d) I → Saturation
II → Saturation
III → Reverse Active
IV → Reverse Active

T3. For a Si transistor $\beta = 100$ has a base to collector leakage current I_{CBO} of 15 μA. If the transistor is connected for common-emitter operation, the collector current considering $I_B = 0$ will be.

(a) 148.5 μA (b) 148.5 mA

(c) 1.515 μA (d) 1.515 mA

T4. Out of the following statements which one of the following is not true for getting a high value of β.

(a) The concentration on the emitter side should be greater than that of base

(b) The length of emitter should be greater than the length of base

(c) The length of base should be greater than the diffusion length of the carrier in the base.

(d) The recombinations at the base should be kept minimum.

T5. In a transistor, collector to base reverse bias current when emitter is open $I_{CBO} = 3$ μA and the collector to emitter is reverse bias current when base is open $I_{CEO} = 0.6$ mA and base current $I_B = 10$ μA, then the value of collector current I_C will be _____ mA.

■■■■