UNIT-1-TRANSISTOR BIASING CIRCUITS

Bipolar Junction Transistors (BJTs) Questions and Answers

Q1. Explain why an ordinary junction transistor is called bipolar?

Because the transistor operation is carried out by two types of charge carriers (majority and minority carriers), an ordinary transistor is called bipolar.

Q2. Why transistor is called current controlled device?

The output voltage, current or power is controlled by the input current in a transistor. So it is called the current controlled device.

Q3. What is the significance of the arrow-head in the transistor symbol?

Arrow head is always marked on the emitter. The direction indicated the conventional direction of current flow(from emitter-to-base in case of p-n-p transistor and from base-to-emitter in case of n-p-n transistor). Generally no arrow head is marked for collector since its reverse leakage current is always opposite to the direction of emitter current.

Q4. Discuss the need for biasing the transistor.

For normal operation, base-emitter junction should be forward biased and the collector-base junction reverse biased. The amount of bias required is significant for the establishment of the operating or the Q-point which is dictated by the mode of operation desired.

In case the transistor is not biased properly, it would : work inefficiently produce distortion in the output signal with the change in transistor parameters or temperature rise, the operating point may shift and the amplifier output will be unstable.

Q5. What are ‘emitter injection efficiently’ and ‘base transport factor’ and how do they influence the transistor operation?

The ratio of current of injected carriers at emitter junction to the total emitter current is called the emitter junction efficiency. The ratio of collector current to base current is known as transport factor

i.e. $\beta^* = IC/IB$

The larger the value of emitter injection efficiency, the larger the injected carriers at emitter junction and this increases the collector current. The larger the β^* value the larger the injected carriers across collector junction and hence collector current increases.

Q6. Which of the transistor currents is always the largest? Which is always the smallest? Which two currents are relatively close in magnitude?

The emitter current IE is always the largest one. The base current IB is always the smallest. The collector current IC and emitter current IE are relatively close in magnitude.

Q7. Why silicon type transistors are more often used than germanium type?

Because silicon transistor has smaller cut-off current ICBO, small variations in ICBO due to variations in temperature and high operating temperature as compared to those in case of germanium type.

Q8. Why collector is made larger than emitter and base?

Collector is made physically larger than emitter and base because collector is to dissipate much power.

Q9. Why the width of the base region of a transistor is kept very small compared to other regions?

Base region of a transistor is kept very small and very lightly doped so as to pass most of the injected charge carriers to the collector.

Q10. Why emitter is always forward biased?

Emitter is always forward biased w.r.t base so as to supply majority charge carriers to the base.

Q11. Why collector is always reverse-biased w.r.t base?

Collector is always reverse-biased w.r.t baseso as to remove the charge carriers from the base-collector junction.

Q12. Can a transistor be obtained by connecting tow semiconductor diodes back-to-back?

No. Because in case of two discrete back-to-back connected diodes there are four doped regions instead of three and there is nothing that resembles a thin base region between an emitter and a collector.

Q13. How α and β are related to each other?

α and β are related as below:

$\alpha = \beta/(1+\beta)$ or $\beta = \alpha/(1-\alpha)$

Q14. Define beta of a transistor.

The β factor transistor is the common emitter current gain of that transistor and is defined as the ratio of collector current to the base current :

B = IC/IB

Q15. Why is there a maximum limit of collector supply voltage for a transistor?

Although collector current is practically independent of collector supply voltage over the transistor operating range, but if VCB is increase beyond a certain vale collector current IC is eventually increases rapidly and possibly destroys the device.

Q16. Explain why ICEO >> ICBO?

The collector cut-off current denoted by ICBO is much larger than ICBO. ICEO is given as :

ICEO = ICBO/(1-α)

Because α is nearly equal to unity (slightly less than unity), ICEO >> ICBO

Q17. Why CE configuration is most popular in amplifier circuits?

CE configuration is mainly used because its current, voltage and power gains are quite high and the ratio of output impedance and input impedance are quite moderate.

Q18. Why CC configuration is called a voltage buffer? What is other name?

Because of its high input impedance and low output impedance, the common collector circuit finds wide application as a buffer amplifier between a high impedance source and low impedance load. it is called a voltage buffer. Its other name is emitter follower.

Q19. What are the main purposes for which a CC amplifier may be used.

Because of its high input impedance and low output impedance, the common collector circuit finds wide application as a buffer amplifier between a high impedance source and low impedance load.

Q20.Which configuration among CE, CB, CC gives highest input impedance and no voltage gain?

Common collector configuration has the highest input impedance and has voltage gain less than unity.

Q21. What do you understand by collector reverse saturation? In which configuration does it have a greater value?

When input current (IE in case of CB configuration and IB in case of CE configuration) is zero, collector current IC is not zero although it is very small. In fact this is the reverse leakage current or collector reverse saturation current (ICBO or simply ICO in CB configuration and ICEO in CE configuration). In case of CE configuration it is much more than that in case of CB configuration.

Q22. What is meant by operating point?

Quiescent point is a point on the dc load line which represents VCE and IC in the absence of ac signal and variations in VCE and IC take place around this point when ac signal is applied.

Q23. Explain how BJT can be used as an amplifier.

A transistor operates as an amplifier by transfer of the current from low impedance loop to high impedance loop.