Chapter 7

Bipolar Junction Transistor

One mark questions (Knowledge):

1. What is an unbiased transistor?
2. What is a biased transistor?
3. Write the symbol of an npn transistor.
4. Write the symbol of a pnp transistor.
5. Name the majority charge carriers in npn transistor.
6. Name the minority charge carriers in npn transistor.
7. What is the function of base region in a transistor?
8. What is the function of collector region in a transistor?
9. Mention the function of the emitter region in a transistor.
10. Write the physical structure of pnp transistor.
11. Write the expression showing relation between I_B, I_C and I_E of transistor.
12. Define α_{dc} of a transistor.
13. Define β_{dc} of a transistor.
14. What is an opto-coupler?
15. Write the symbol of phototransistor.
16. Write one application of phototransistor.
17. Write the symbol of IR transistor.
18. Write one important application of a transistor.
19. Write an expression showing the relation between α and β.
20. Mention any one operating region of a transistor.

One mark questions (Understanding):

1. Why is transistor called transfer resistor device?
2. Which region of the transistor is heavily doped?
3. Which region of the transistor is moderately doped?
4. Which region of the transistor is physically larger?
5. Which region of the transistor is physically narrow?
6. What does the arrow in the circuit symbol of a transistor indicate?
7. Why collector region is made larger?
8. How many pn junctions a transistor has?
9. Which operating region of a transistor is suitable for amplification?
10. Which operating region of a transistor is suitable for switching action?
11. In which mode of operation the transistor can be used as a switch?

One mark questions (Application):

1. For a transistor I_C = 6 mA and I_E = 6.35 mA, find I_B.   Ans:I_B = 0.35 mA
2. Find the value of β, if α = 0.99.   Ans: β = 99
3. A transistor has β = 100. What is the value of α?   Ans: α = 0.99

4. An npn transistor has a DC current gain β of 200. Calculate the base current I_B when the collector current is 4 mA. Ans: I_B= 0.02 mA

Two marks questions (Knowledge):

1. What are the biasing conditions of a transistor to operate in active region and cut off region?
2. Define α_{dc} of a transistor and write the expression.
3. Define β_{dc} of a transistor and write the expression.
4. State different configurations of a transistor.
5. What is an opto-coupler? Mention one application.
6. What is an IR transistor? Write its circuit symbol.
7. Write any two application of IR transistor.
8. Write the circuit symbol of IR receiver. Mention its one application.
9. What is a phototransistor? Write its circuit symbol.
10. Write any two application of phototransistor.

Two marks questions (Understanding):

1. Distinguish doping levels of emitter and base in a transistor.
2. Why is the collector of transistor made larger and moderately doped?
3. Distinguish between α_{dc} and β_{dc}.
4. Obtain the relation between α and β of a transistor.
5. Distinguish between cut-off region and saturation region.

Two marks questions (Application):

1. In a transistor circuit, I_E = 5 mA and I_B is 1 μA. Find a value of I_C and α.

    Ans.: I_C = 4.995 mA, α = 0.999

2. For a transistor I_C = 6 mA and I_E = 6.35 mA, Find β.

    Ans.: I_B = 0.35 mA, β = 17.14

3. A transistor has α = 0.98. If I_C = 6 mA, Find I_B.

    Ans.: I_B = 0.122 mA

4. A transistor has α = 0.9, if I_E = 10 mA, calculate the values of I_C and β.

    Ans.: I_C = 9mA, β = 9

5. In a transistor the base current and collector current is 60μA and 1.75mA respectively. What will be the emitter current? Calculate the values of α of a transistor.

    Ans.: I_E = 1.75 mA, α = 0.967

6. A transistor has β = 150. Calculate the approximate collector and base currents if the emitter current is 12 mA. Ans.: α = 0.993, I_C = 11.916 mA, I_B = 0.084 mA

7. A transistor amplifier connected in CE mode has β = 100 and I_B= 50 μA, calculate the values of I_C and α. Ans.: I_C = 5 mA, α = 0.99

8. A transistor has α = 0.9, if I_E = 10 mA, calculate the values of I_C and β.

    Ans.: I_C = 9 mA, β = 9

9. In a transistor the base current and collector current are 60 μA and 1.75mA respectively. What will be the emitter current? Calculate the values of β of a transistor.

    Ans.: I_E = 1.75 mA, β = 29.17

10. A transistor connected in CE mode has $\beta = 100$ and $I_B = 50\ \mu A$, calculate the values of I_C, I_E.

Ans.: $I_C = 5$ mA, $I_E = 5.05$ mA

11. A transistor has $I_B = 105\ \mu A$ and $I_C = 2.05$ mA. Find β and α of the transistor.

Ans.: $\beta = 19.5$, $\alpha = 0.95$

12. If α for a transistor is 0.99, the base current is 100 μA, estimate the collector current.

Ans.: $\beta = 99$, $I_C = 9.9$ mA

13. A Transistor connected in CE mode has $\beta = 80$ and $I_C = 5$ mA. Calculate I_E.

Ans: $I_B = 0.0625$ mA, $I_E = 5.0625$ mA

Three marks questions (Knowledge):

1. Explain is the doping levels and physical sizes of emitter, base and collector layers.
2. List the different types of transistor configuration with necessary circuit diagram.
3. Define DC current gain in CB mode (α_{dc}), DC current gain in CE mode (β_{dc}) and Output resistance (R_o) in CE mode.
4. Describe with the diagram, the input characteristics of an npn transistor for CE configuration.
5. Briefly describe the different regions of output characteristics of transistor in CE mode.
6. What is a phototransistor? Write the circuit symbol and one application of a phototransistor.

Five marks questions (Understanding):

1. Explain with the diagram the construction and working of an npn transistor.
2. Distinguish between the different types of transistor configurations with necessary circuit diagram.
3. Distinguish between the active, saturation and cut-off regions of a transistor.
4. Explain how the input and output characteristics of an npn transistor in CE mode are drawn.
5. Briefly explain the working of the phototransistor. Write the circuit symbol and output characteristics of phototransistor.

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