|  |  |  |  |
| --- | --- | --- | --- |
| **Name:** | **Basic Electronic Circuits** | **Semester:** | **III** |
| **Date of Performance:** | **14/9** | **Batch No:** | **B2** |
| **Faculty Name:** | **BPK** | **Roll No:** | **1912052** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 5**

**Title: Study of BJT Characteristics**

|  |
| --- |
| **Aim and Objective of the Experiment:** Study of BJT Characteristics |
| 1. Study CB, CE, and CC Characteristics of NPN  2. Study CB,CE and CC Characteristics of PNP |

|  |
| --- |
| **COs to be achieved:** |
| CO2 |

|  |
| --- |
| **Theory:** |
| Transistors are three terminal active devices made from different semiconductor materials that can act as either an insulator or a conductor by the application of a small signal voltage. The transistor’s ability to change between these two states enables it to have two basic functions: “switching” (digital electronics) or “amplification” (analogue electronics). Then bipolar transistors have the ability to operate within three different regions:   * Active Region   –   the transistor operates as an amplifier and Ic = β\*Ib * Saturation   –   the transistor is “Fully-ON” operating as a switch and Ic = I(saturation) * Cut-off   –   the transistor is “Fully-OFF” operating as a switch and Ic = 0 |

|  |
| --- |
| **Circuit Diagram/ Block Diagram:** |
| **NPN**  **CB**    **CE**    **CC**    **PNP**  **CB**    **CE**    **CC** |

|  |
| --- |
| **Stepwise-Procedure:** |
| 1. Open a new Schematic. 2. Draw the Circuit As Shown. 3. Note down the parameters as per the observation table. |

|  |
| --- |
|  |
| Configuration:  CB input characteristics   |  |  |  |  | | --- | --- | --- | --- | | Parameters | VCC = 0V | VCC = 5V | VCCC = 10 | | NPN  Input current (IB)  @ VEE = 0 v | 0A | 0A | 0A | | PNP  Input current (IB)  @ VEE = 0 v | 0A | 0A | 0A | | NPN  Input current (IB)  @ VEE = 2 v | 91mA | 92mA | 294.65396mA | | PNP  Input current (IB)  @ VEE = 2 v | 54mA | 67.2mA | 100.95246mA |   CB output characteristics   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Parameters | VEE = 0V | VEE = 1V | VEE = 2 | Region of operation | | NPN  Output current (IC)  @ VCC = 0 v | 0A | 0.355A | 1.352A |  | | PNP  Output current (IC)  @ VCC = 0 v | 0A | 0.284A | 1.492A |  | | NPN  Output current (IC)  @ VCC = 5 v | 0A | 0.363A | 2.007A |  | | PNP  Output current (IC)  @ VCC = 5 v | 0A | 0.305A | 1.603A |  | | NPN  Output current (IC)  @ VCC = 10 v | 0A | 0.371A | 2.046A |  | | PNP  Output current (IC)  @ VCC = 10 v | 0A | 0.316V | 1.660A |  |   CE Input characteristics   |  |  |  |  | | --- | --- | --- | --- | | Parameters | VCC = 0V | VCC = 5V | VCCC = 10 | | NPN  Input current (IE)  @ VEE = 0 v | 0A | 0A | 0A | | PNP  Input current (IE)  @ VEE = 0 v | 0A | 0A | 0A | | NPN  Input current (IE)  @ VEE = 2 v | 0.5A | 2.01A | 2.1A | | PNP  Input current (IE)  @ VEE = 2 v | 0.4A | 1.65A | 1.7A |   CE output characteristics   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Parameters | VBB = 0V | VBB = 1V | VBB = 2 | Region of operation | | NPN  Output current (IC)  @ VCC = 0 v | 0A | 0.055A | 0.316A |  | | PNP  Output current (IC)  @ VCC = 0 v | 0A | 0A | 0A |  | | NPN  Output current (IC)  @ VCC = 5 v | 0A | 0.364A | 1.986A |  | | PNP  Output t current (IC)  @ VCC = 5 v | 3.367A | 2.636A | 1.863A |  | | NPN  Output current (IC)  @ VCC = 10 v | 0V | 0.369A | 2.032A |  | | PNP  Output current (IC)  @ VBB = 10 v | 7A | 6.306A | 5.603A |  |   CC Input characteristics   |  |  |  |  | | --- | --- | --- | --- | | Parameters | VEE = 0V | VEE = 5V | VEE = 10 | | NPN  Input current (IB)  @ VBB = 0 v | 0A | 0A | 0A | | PNP  Input current (IB)  @ VBB = 0 v | 0A | 0A | 0A | | NPN  Input current (IB)  @ VBB = 2 v | 91mA | 100mA | 862.87928mA | | PNP  Input current (IB)  @ VBB = 2 v | 80mA | 88mA | 830.12615mA |   CC output characteristics   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Parameters | VBB = 0V | VBB = 1V | VBB = 2 | Region of operation | | NPN  Output current (IE)  @ VEE = 0 v | 0A | 0.079A | 0.536A |  | | PNP  Output current (IE)  @ VEE= 0 v | 0A | 0A | 0A |  | | NPN  Output current (IE)  @ VEE = 5 v | 0A | 0.367A | 2.101A |  | | PNP  Output current (IE)  @ VEE = 5 v | 0.830A | 1.022A | 1.176A |  | | NPN  Output current (IE)  @ VEE = 10 v | 0A | 0.378A | 2.133A |  | | PNP  Output current (IE)  @ VEE = 10 v | 1.745A | 1.855A | 1.964A |  | |

|  |
| --- |
| **Calculation:** |
| 1. Rin  2. Ro |

|  |
| --- |
| **Waveform** |
| All input and output characteristics(12)  NPN  CB      CE |
| CC      PNP  CB      CE      CC |

|  |
| --- |
| **Post Lab Subjective/Objective type Questions: (hand written)** |
| **Characteristic** |
| Input Dynamic  Resistance |
| Output Dynamic  Resistance |
| Current Gain |
| Voltage gain |
| Power gain |
| Leakage current |
| **Common base (CB)** |
| Very Low(less than  100 ohm) |
| Very High |
| Less than 1 |
| Greater than CC but less than CE |
| Medium |
| Very small |
| **Common emitter**  **(CE)** |
| Low(less than 1K) |
| High |
| High |
| Highest |
| Highest |
| Very large |
| **Common collector**  **(CC)** |
| Very High(750K) |
| Low |
| Very High |
| Lowest(less than 1) |
| Medium |
| Very large |
| In phase  2. Comparison of NPN and PNP mm  The NPN and PNP both are the bipolar junction transistor. It is the current controlling device and mainly used for switching and amplifying the signal. Mostly, the NPN transistor is used in the circuit because in NPN transistors the conduction current is mainly by electrons while in the PNP transistor the conduction current is because of the holes. As the electrons are more mobile the NPN has high conduction.  The letter PNP and NPN show the voltage required by the emitter, collector and base of the junction transistor. The NPN and PNP transistor, both are made up of different material due to which the current developed in them also differs. Sometimes when the voltage applied across the emitter the electrons cross the base junction and reach the collector region. This happens because the base of the NPN and PNP transistor is very thin and lightly doped. |

|  |
| --- |
| **Conclusion: (to be written in own words)** |
| In this experiment we studied the CB, CE and CC characteristics of NPN and PNP transistors and plotted waveforms for the same. |

|  |
| --- |
| **Signature of faculty in-charge with Date:** |