Lab Report - 08

Characteristics of Transistor

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Submitted by: **Hassan Zaib Jadoon**

Registration No: **22PWCSE2144**

Class Section: **A**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: ______________

Submitted to:

Engr. Usman Malik

Month Day, Year (15 05, 2024)

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

Objectives:

- To determine transistor type (npn, pnp), terminals and material using Digital multimeter.
- To determine the values of the alpha and beta ratios of transistors.

Equipment:

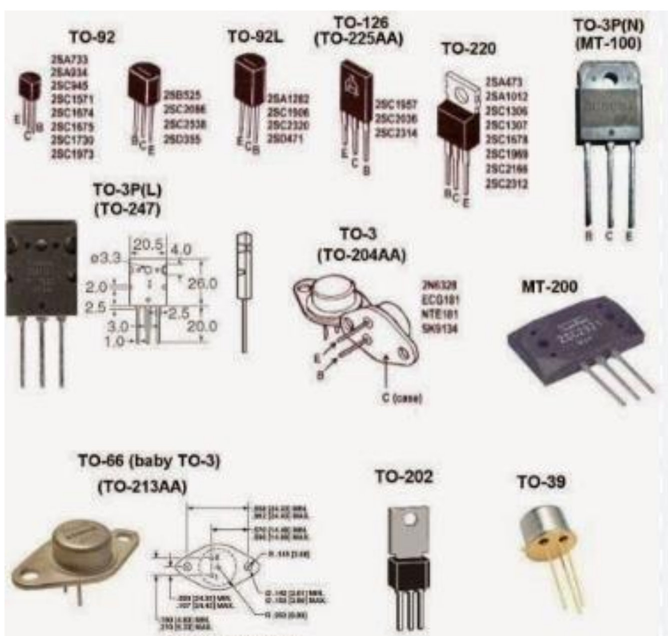
1. Digital Multimeter (DMM)
2. DC Power Supply

Components

1. Resistors: 1 kΩ, 330 kΩ,
2. 10 kΩ potentiometer, 1MΩ potentiometer
3. Transistors: 2N390

Theory:

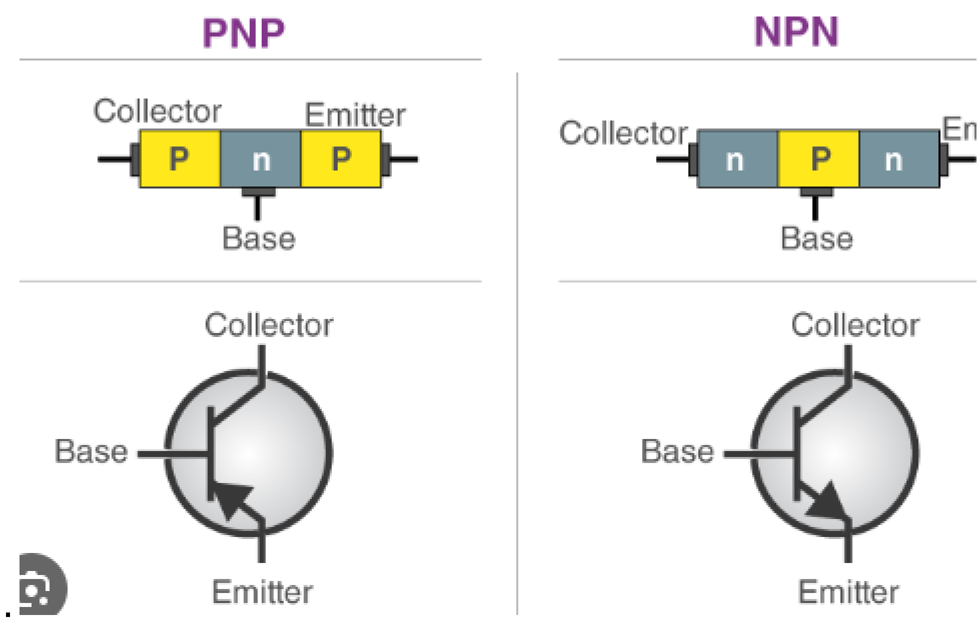
1. **Transistor:**
   A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit.



Bipolar Junction Transistor (BJT)

Bipolar Junction Transistor (BJT) is a Semiconductor device constructed with three doped Semiconductor Regions (Base, Collector and Emitter) separated by two p-n Junctions, Figure 1.

p-n Junction between the Base and the Emitter has a Barrier Voltage (V0) of about 0.6 V, which is an important parameter of a BJT. The relationships between the voltages and the currents associated with a BJT under various operating conditions determine its performance. These relationships are collectively kown as characteristics of the transistor.

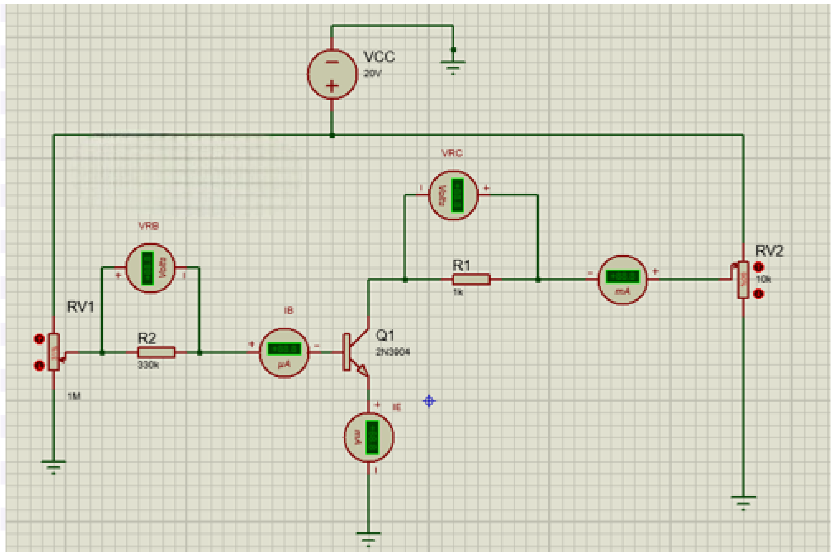


Biasing Circuits of BJT

To make the Q point stable different biasing circuits are tried. The Q point is also called as operating bias point, is the point on the DC load line (a load line is the graph of output current vs. output voltage in any of the transistor configurations) which represents the DC current through the transistor and voltage across it when no ac signal is applied. The Q point represents the DC biasing condition. When the BJT is biased such that the Q point is halfway between cutoff and saturation than the BJT operates as a CLASS-A amplifier. The three circuits or biasing arrangements which are practically used are explained below.

Circuit:

$E_{RB} = 3.3$ V, $I_B =$ 10 micro A



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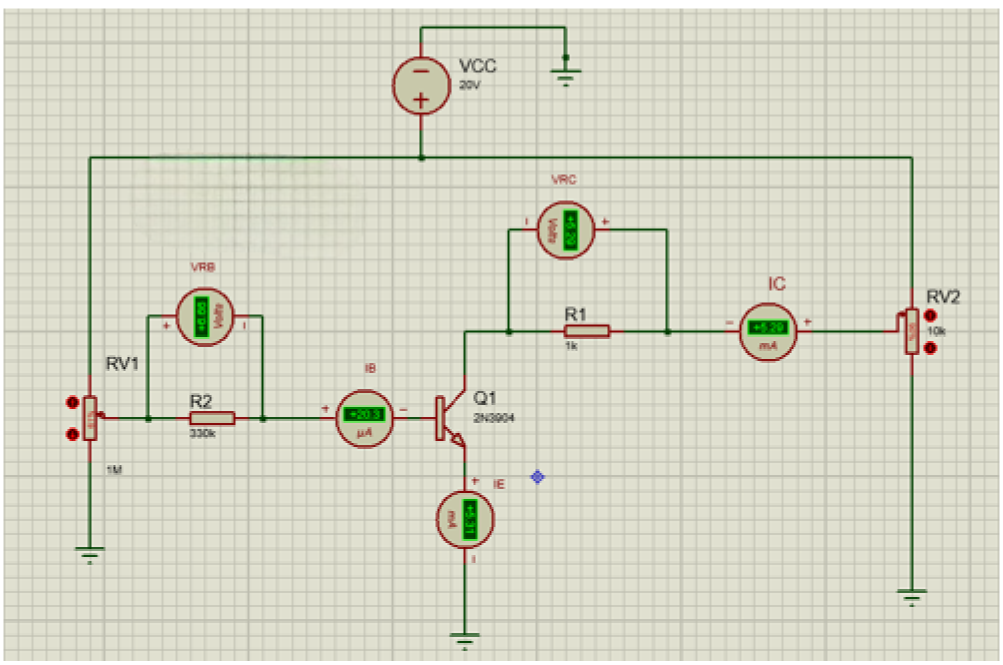

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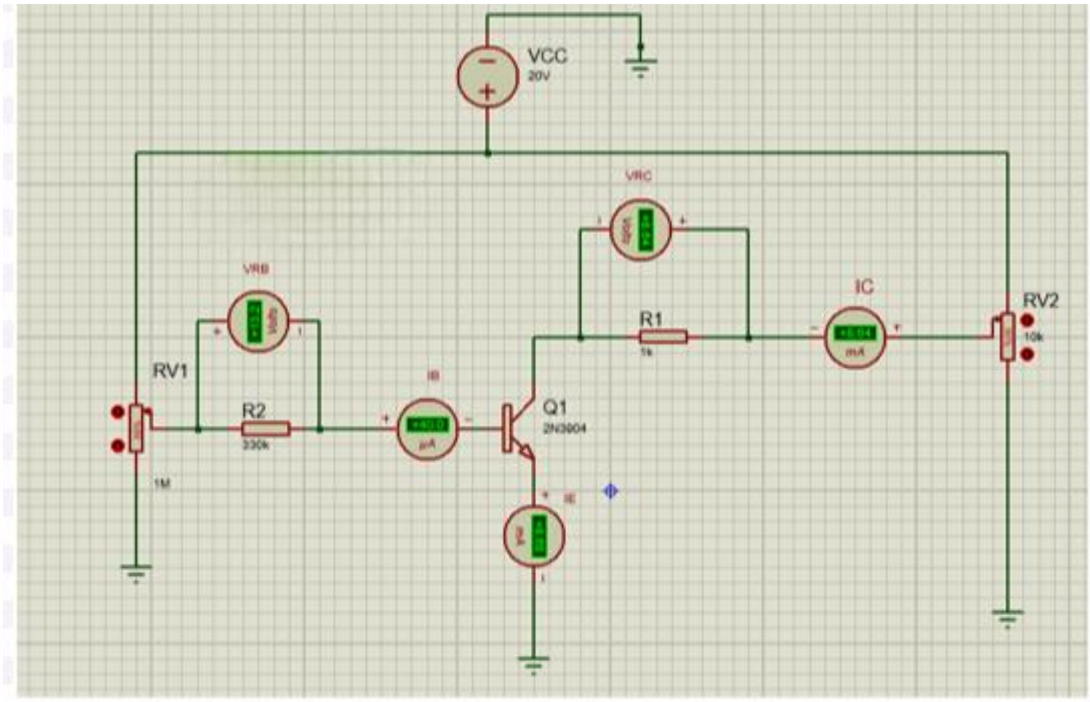

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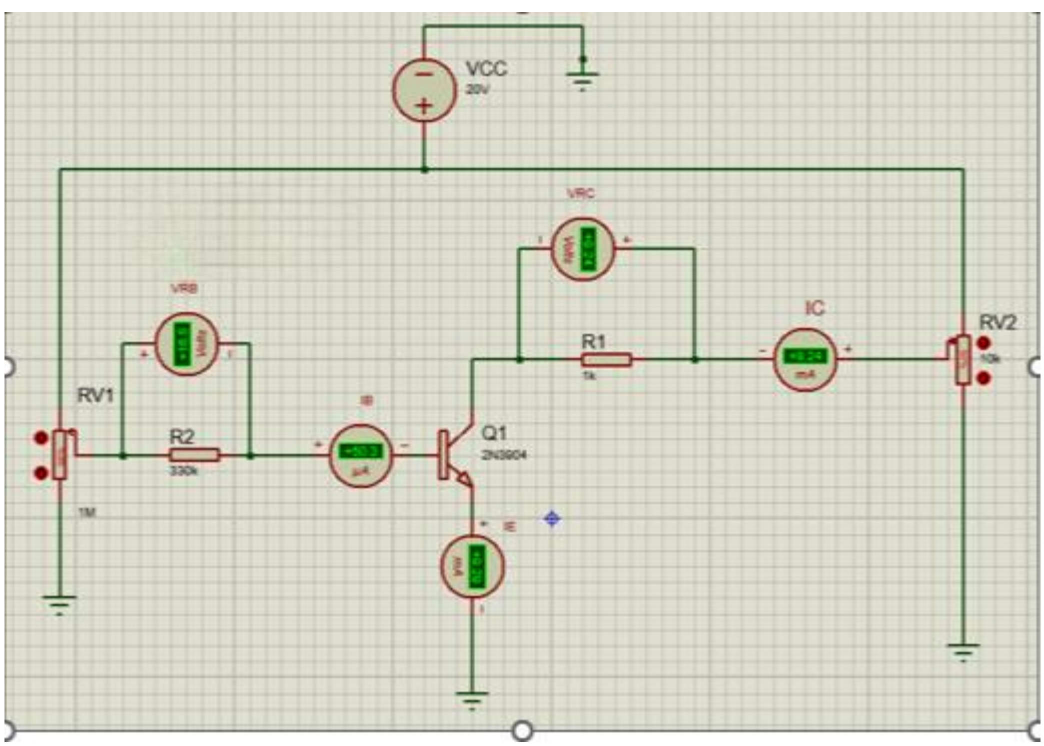

Procedure:

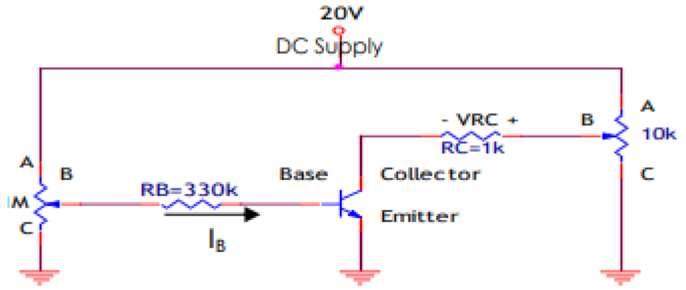

Fig. 1

1. Set the VCE to 2V by varying the 10kΩ potentiometer as required by the first line of Table .
2. Record the VRC and VBE values in Table .
3. Vary the 10 kΩ potentiometer to increase VCE from 2V to the values appearing in Table . (Note: IB should be maintained at 10 µA for the range of VCE levels.
4. Record VRC and VBE values for each of the measured VCE values. Use the mV range for VBE
5. 5. Repeat step 2 through 5 for all values of IB indicated in Table
6. Compute the values of IC (from IC = VRC/RC) and IE (from IE = IB+IC). Use measured resistor value for RC.
7. Compute the values of α (from α = IC/IE) and β (from β = IC/IB). Results: VRB(V) IB(µA) VCE(V) VRC(V) IC(mA) VBE(V) IE(mA)

Readings:

V_{RB}	I_B	V_{RC}	I_C	V_{BE}	I_E	$\alpha = I_C/I_E$	$B = I_C/I_B$
3.3V	10uA	18V	2.98mA	0.7V	2.99mA	0.99	298
6.5V	20uA	5.29V	5.29mA	0.7V	5.31mA	0.99	264.5
9.9V	30uA	7.17V	7.17mA	0.7V	7.20mA	0.995	239
13.2V	40uA	8.64V	8.64mA	0.7V	8.68mA	0.995	216
16.5	50uA	9.24V	9.24mA	0.7V	9.29mA	0.994	184