IC161P: APPLIED ELECTRONICS

Lab Exercise -2 Basics of BJT

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1.Abstract

To understand the basic characteristics of BJT.

2.Apparatus Required

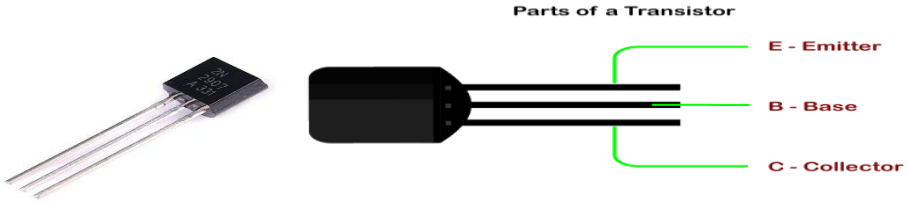
S.N.	Name
1	npn BJT
2	pnp BJT
3	Resistance
4	Power Supply
5	Connecting Wires

3.Theory

Transistor is an electronic semi-conductor device which is divided in two categories namely, BJT(Bipolar Junction Transistor) and FET(Field Effective Transistor).

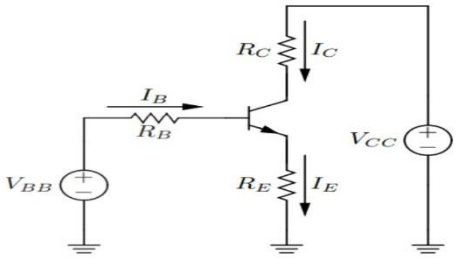
BJT has three terminals namely, emitter ,collector and emitter and is also divided in two categories namely, npn BJT(containg one p region between two n region) and pnp BJT(containg one n region between two p region).

Transistor Symbol

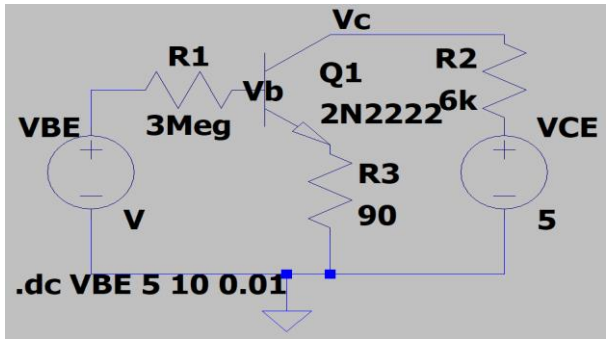


4.Circuit diagram and analysis

Experiment-1



• Set up the circuit shown, with RB = 3 MΩ, RC = 6 kΩ, and RE = 90 Ω. Set VCC to 5 V.



a). Increase VBB until IC = 0.5 mA. Measure VBE and VBC. What is the region of operation of the transistor?

Soln: VBE and VBC comes -637.41mV and 1362.59mV respectively.

The region of operation is Active Mode.

b). Considering above case measure IB. What is the value of β? And using this β find α and calculate IE.

Soln: IB comes 2.47μA .

β=500/2.471 =202.44

α=202.435/203.435 =0.995

IE=500/0.9951 =502.47 μA

c). For VBB = 4 V and VCC = 2 V. Measure IB, IC, VBE, and VBC. What is the region of operation of the BJT? Given reason for your answer.

Soln: IB, IC, VBE and VBC comes 1.22μA, 224.09μA, 636.50mV and -18.69mV.

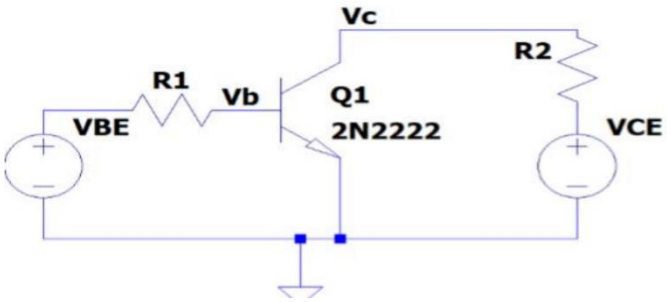
The region of operation is Active Mode as β is high and high voltage gain characteristics.

d). For VBB = −2 V and VCC = 5 V. Measure IB, IC, VBE, and VBC. What is the region of operation of the BJT? Give reason for your answer.

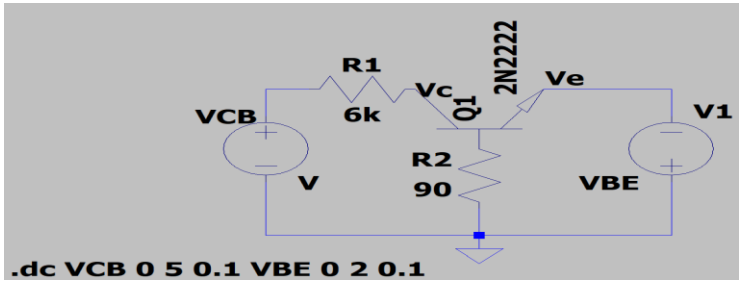
Soln: IB, IC, VBE and VBC comes -9pA, 7pA, -2V and -7V.

The region of operation is Cutoff Mode as both EB and CB junctions are reverse biased.

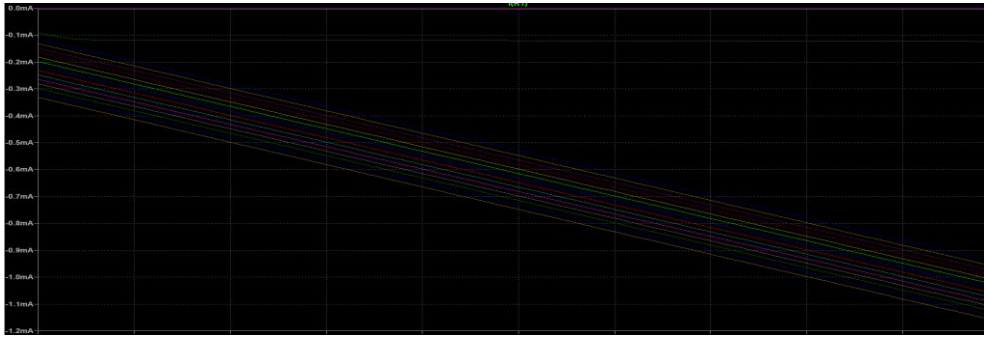
Experiment-2



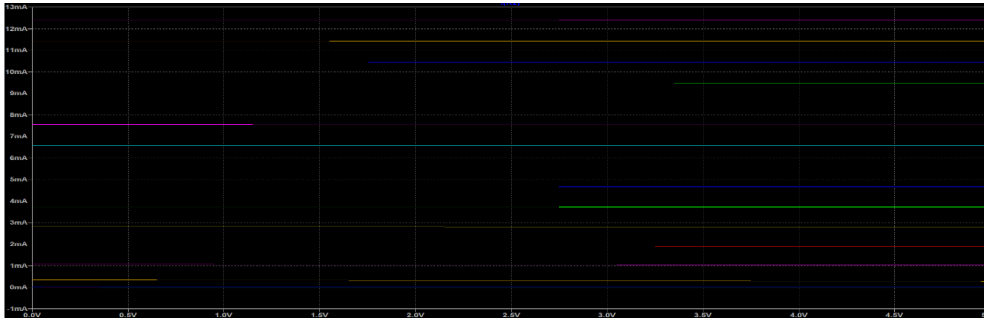
• In the above figure instead of VCE now consider VCB i.e., consider a CB mode configuration and obtain its input and output characteristics.



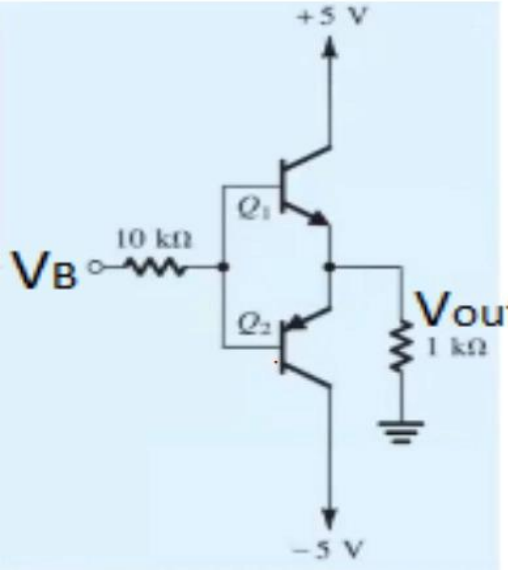
INPUT



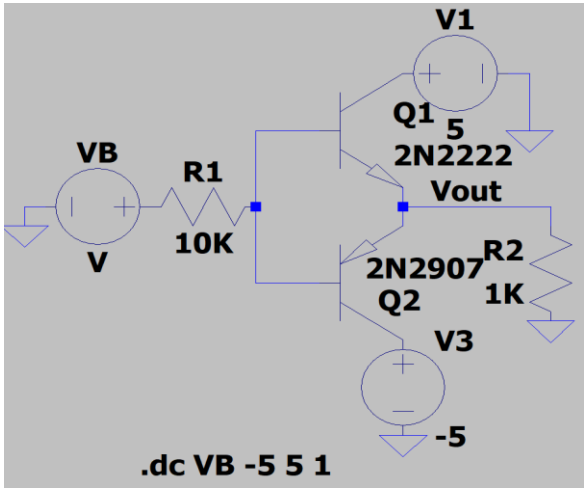
OUTPUT

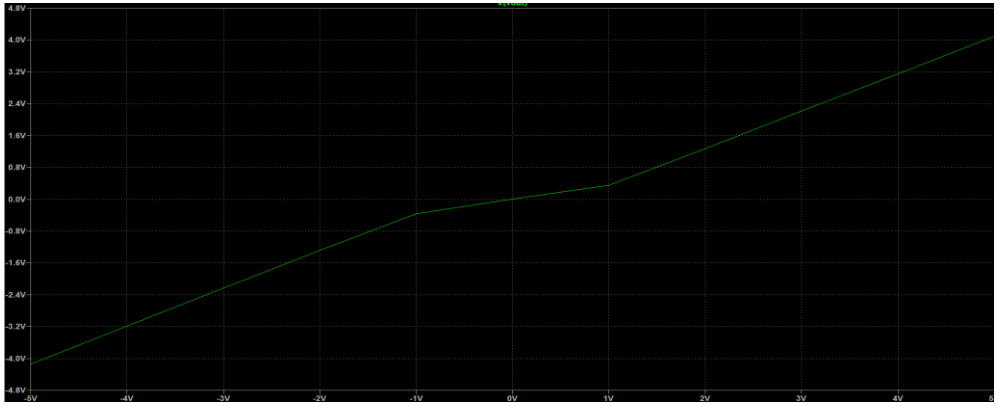


Experiment-3



• In this setup vary VB from -5V to +5V and plot Vout vs VB . Using the plot identify the mode of operation for Q1 and Q2.





When VB is positive, both Q1 and Q2 is in Reveise Active Mode of operation whereas when VB is negative, both are in Saturation Mode of operation.

4.Result Analysis and Conclusion

From the above experiments, we get various results and informations.

In Active mode of operation, EB junction is FB and CB junction is RB, β is quite large compared to one and there is high gain in voltage whereas in Cutoff mode of operation, both EB and CB junctions are RB and there is no voltage gain.

In saturation Mode of operation, both EB and CB junctions are FB and there is low voltage gain .In Reveise Active Mode of operation, EB junction is RB and CB junction is FB and this mode has no ue or value.

Irrespective of fact that VBC is RB, IE is quite high is something interesting in Active Mode of operation.