RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA

NAME **: DARPAN BHATTACHARYA**

COURSE **: B.Sc. Computer Science (Hons.)**

SEMESTER **: 1st Semester**

ROLL NUMBER **: 715**

REGISTRATION NUMBER **: A01-1112-117-014-2021 of 2021-2022**

SUBJECT **: GE1 (Electronics)**

SESSION **: 2021-2022**

BJT COMMON EMITTER CHARACTERISTICS

AIM:

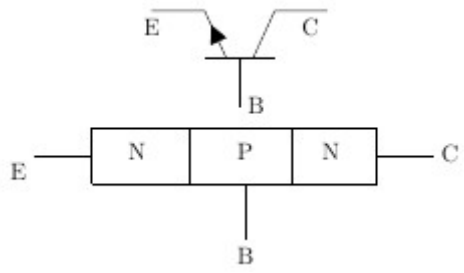
To explain the structure and operations of a Bipolar Junction Transistor and the common emitter characteristics of a BJT.

STRUCTURE OF A BIPOLAR JUNCTION TRANSISTOR:

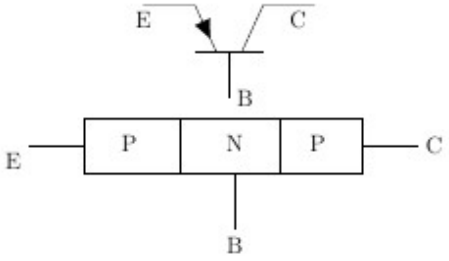
A bipolar junction transistor, BJT, is a piece of silicon with two back-to-back P-N junctions. BJTs can be made either as PNP or as NPN.

They have three regions and three terminals, emitter, base, and collector represented by E, B and C respectively. The direction of the arrow indicates the direction of the current in the emitter when the transistor is conducting normally.

Emitter (E) : It is the region to the left end which supply free charge carriers, i.e., electrons in n-p-n or holes in p-n-p transistors. These majority carriers are injected to the base. Emitter is a heavily doped region to supply a large number of majority carriers into the base.
Base (B) : It is the middle region where either two p-type layers or two n-type layers are sandwiched. The majority carriers from the emitter region are injected into this region. This region is thin and very lightly doped.
Collector (C) : It is the region to the right end where charge carriers are collected. The area of ths region is largest compared to emitter and base region. The doping level of this region is intermediate between heavily doped emitter region and lightly doped base region.

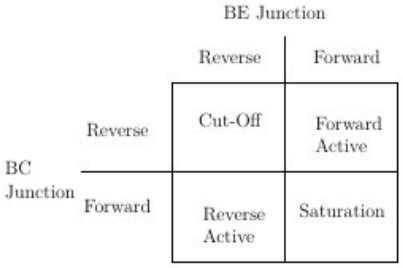


NPN transistor



PNP transistor

OPERATION OF BJT:



Four operating conditions of BJT

Cutoff Region:
In cut-off region, both Base-emitter and Collector-base junctions are reverse biased. With reverse biasing, all currents are zero.

Forward Active Region:

In Forward Active Region Base-emitter junction is forward biased, and Collector-base junction is reverse biased. In this case, the forward bias of the BE junction will case the injection of both holes and electrons across the junction.

Saturation Region:

In Saturation region both Base-emitter and Collector-base junctions are forward biased. Maximum current flows through the transistor with only a small voltage drop across the collector junction.

Reverse Active Region:

In Reverse Active Region, Base-emitter junction is reverse biased and Collector-base junction is forward biased. The operation is just the same as the forward active region, except all voltage sources, and hence collector and emitter currents, are the reverse of the forward bias case.

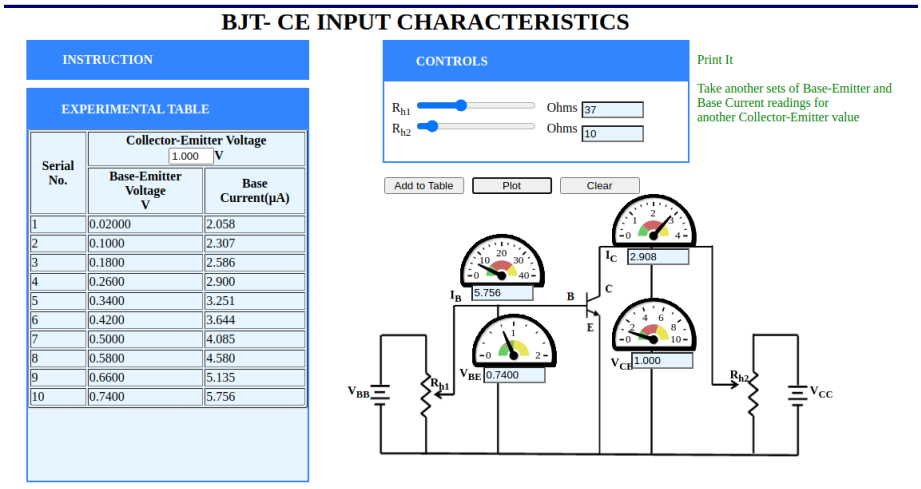
COMMON EMITTER CIRCUIT OF BJT:

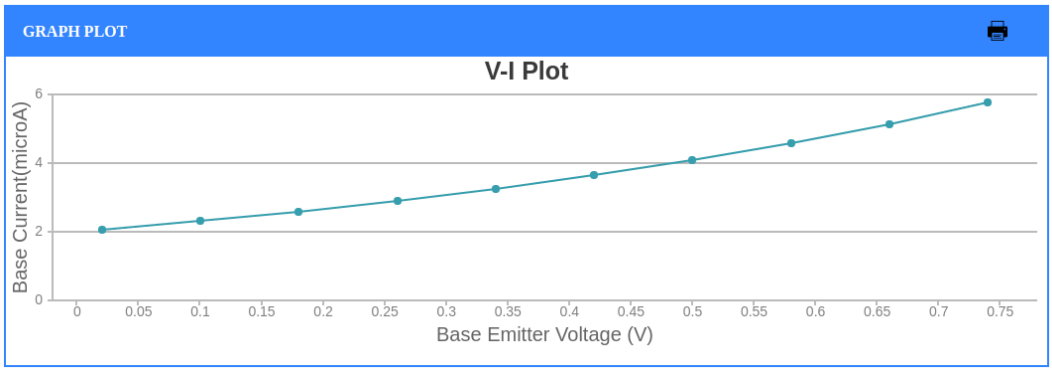
In this configuration, we use emitter as a common terminal for both input and output. The common emitter configuration is an inverting amplifier circuit. Here the input is applied between the base-emitter reigion and the ouput is collected between the base current and the large collector current.
$I_E = I_C + I_B$.

The ratio between the collector current and the emitter current gives the curent gain α in common base configuration, and the ration between the collector and bsae gives the current gain β in common emitter configuration.

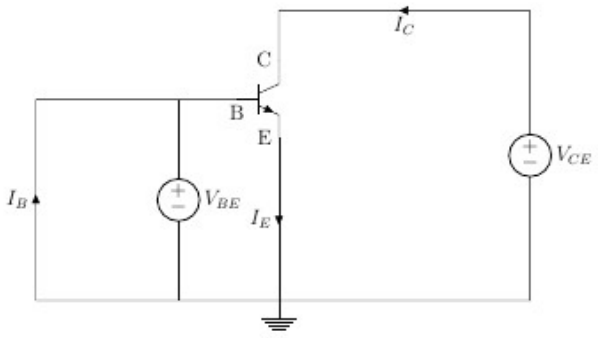
$\alpha = \beta / 1 + \beta$, or
$\beta = \alpha / 1 - \alpha$

BJT – CE INPUT CHARACTERISTICS:



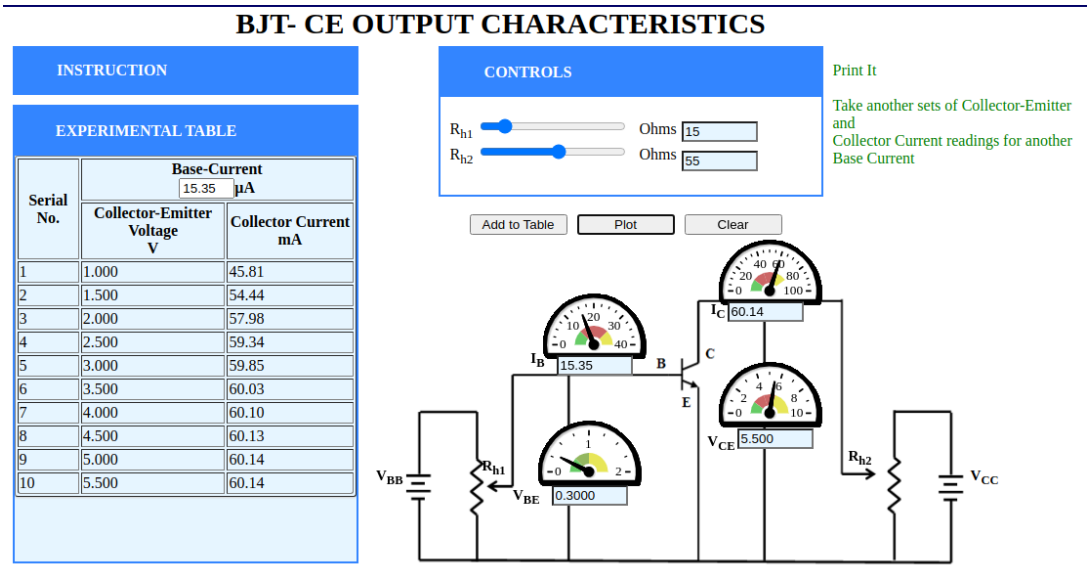


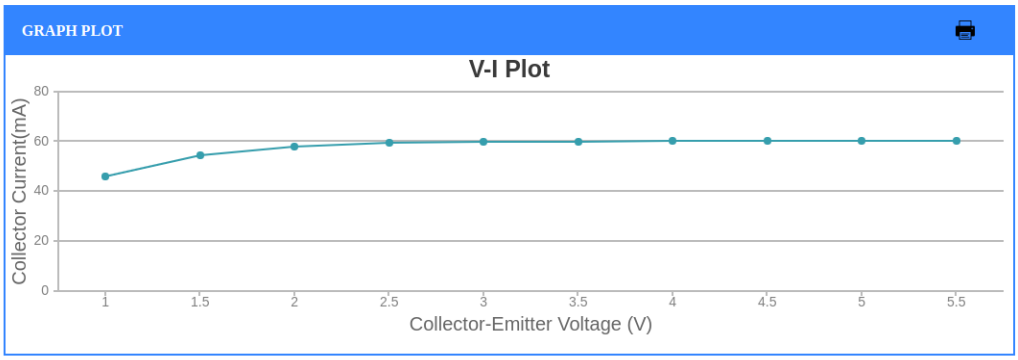
The pictures above are screenshots of a simulation performed and the correspoding V-I graph plot on http://vlabs.iitkgp.ernet.in/be/exp11/bjtcein_ver1.html on BJT-CE Input Characteristics.



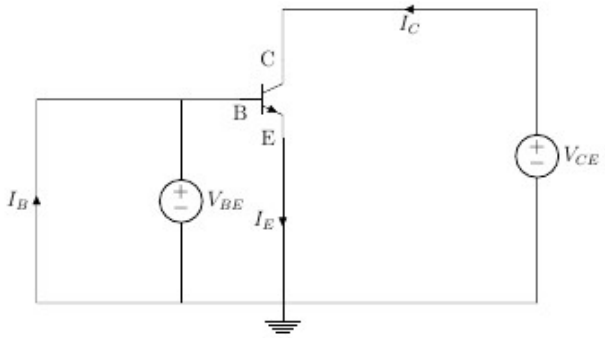
Input Characteristics Circuit

BJT – CE OUPUT CHARACTERISTICS:





The pictures above are screenshots of a simulation performed and the corresponding V-I graph plot on http://vlabs.iitkgp.ernet.in/be/exp11/bjtceop_ver1.html on BJT-CE Output Characteristics.



Output Characteristics Circuit