G.H. Raisoni College of Engineering & Management, Wagholi Pune
F.Y B.TECH
CAE II - 2020 (2020 Pattern)

Department - Information Technology (IT)
Term/Section - Term I
Date of Examination - 05/04/2021
Subject Name/Code - Introduction to Discrete Devices (UECL105)
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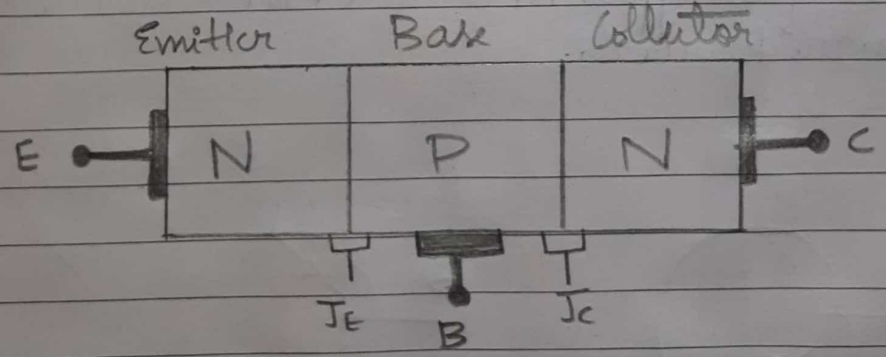
CO2 a) What is BJT and explain its different types with symbol and structure

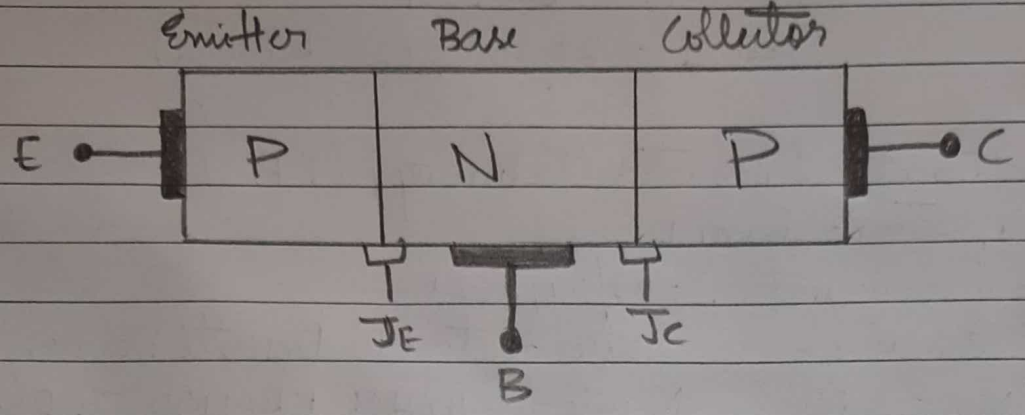
Answer: The BJT or Bipolar Junction Transistor is a semiconductor device which can be used for switching or amplification. This a three-terminal semiconductor device that consist of two p-n junction which are able to amplify or magnify signal.

Bipolar Junction Transistor Symbol:

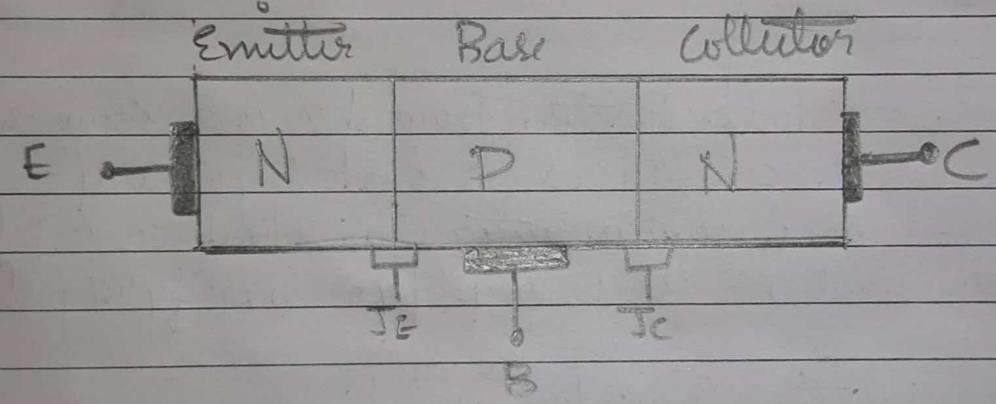


There are two types of bipolar junction transistors:
PNP and NPN Bipolar Junction Transistor.

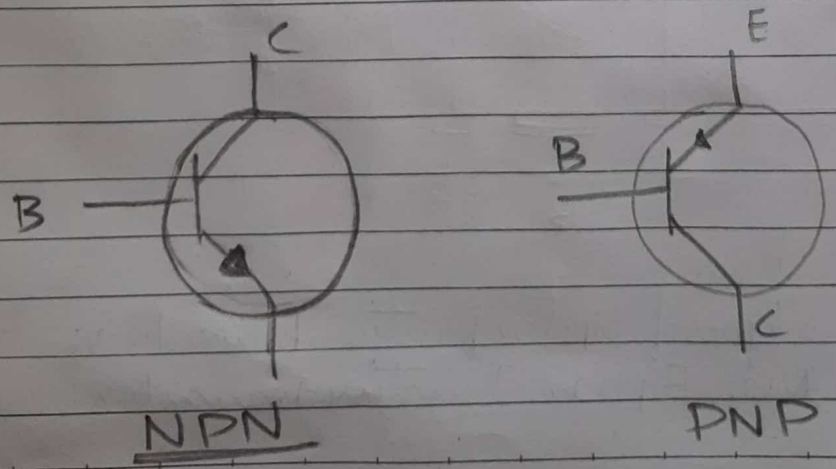
PNP BJT



NPN BJT



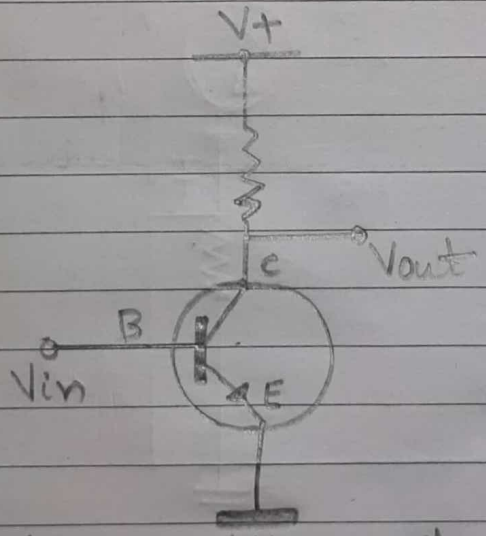
BJTs are of two types NPN and PNP based on doping types of three main terminals.



b) Design single stage CE amplifier and explain in details.

Answer: The most common amplifier configuration for an NPN transistor is that of the Common Emitter Amplifier Circuit.

The common emitter amplifier is a three basic single-stage BJT and is used as a voltage amplifier. The input of this amplifier is taken from the base terminal, the output is collected from the collector terminal and the emitter terminal is common for both the terminals. The basic symbol of the CE amplifier is shown below.



Common Emitter Amplifier

The most frequently used one is common emitter due to its main attributes.

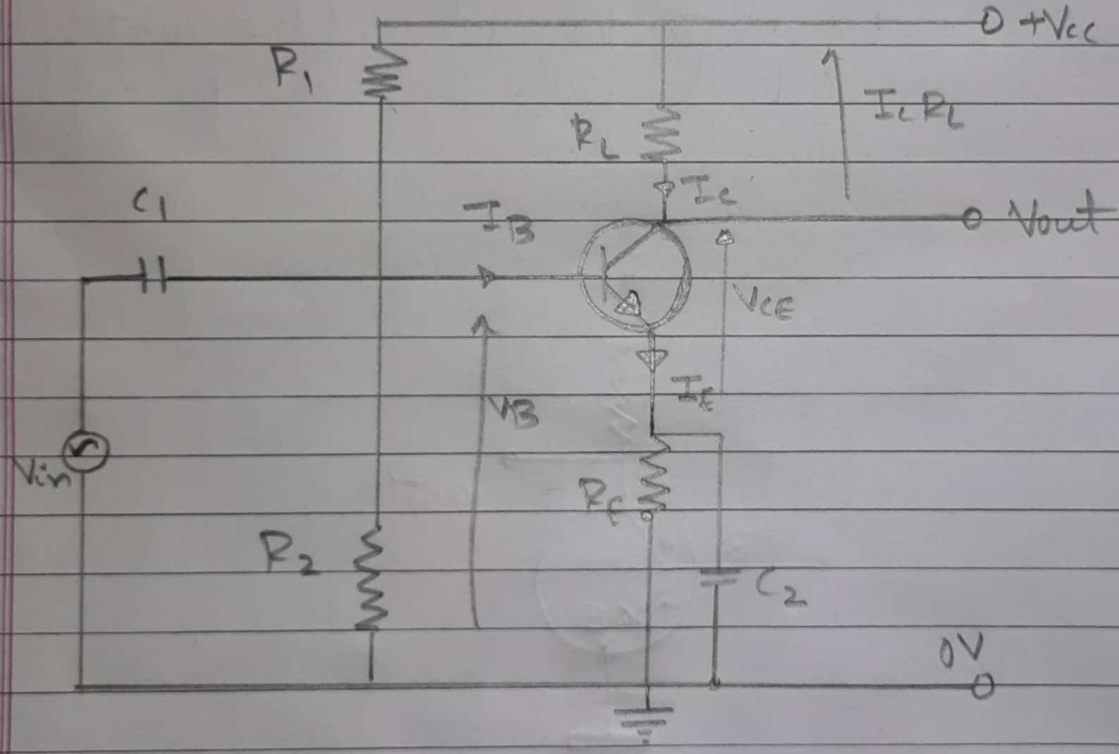
This kind of amplifier includes the signal which is given to the base terminal then the output is received from the collector terminal of the circuit. The main attribute of the emitter circuit.

Qns

is familiar for both the input as well as output.

In CE amplifier, the Emitter of BJT is common to both the input and output. The arrangement is same for a PNP transistor, but bias will be opposite w.r.t NPN transistor.

The below figure shows working of CE Amplifier.



CO3 a) Explain the following terms in details

1) Gain of BJT: The current gain for a CB configuration is called Alpha (α).

In BJT amplifier the emitter current is always greater than the collector as $I_E = I_B + I_C$, the current gain (α) of the amplifier must therefore be less than one unity as I_C is always less than I_E by the value of I_B.

2.) Stability factor

The stability factor, which is measure of the change in collector current with changes in reverse saturation current, is approx. $\beta+1$.

To ensure absolute stability of the amplifier, a stability factor of less than 25 is preferred, and so small-signal transistor have large stability factors.

3.) Need for Stabilization:

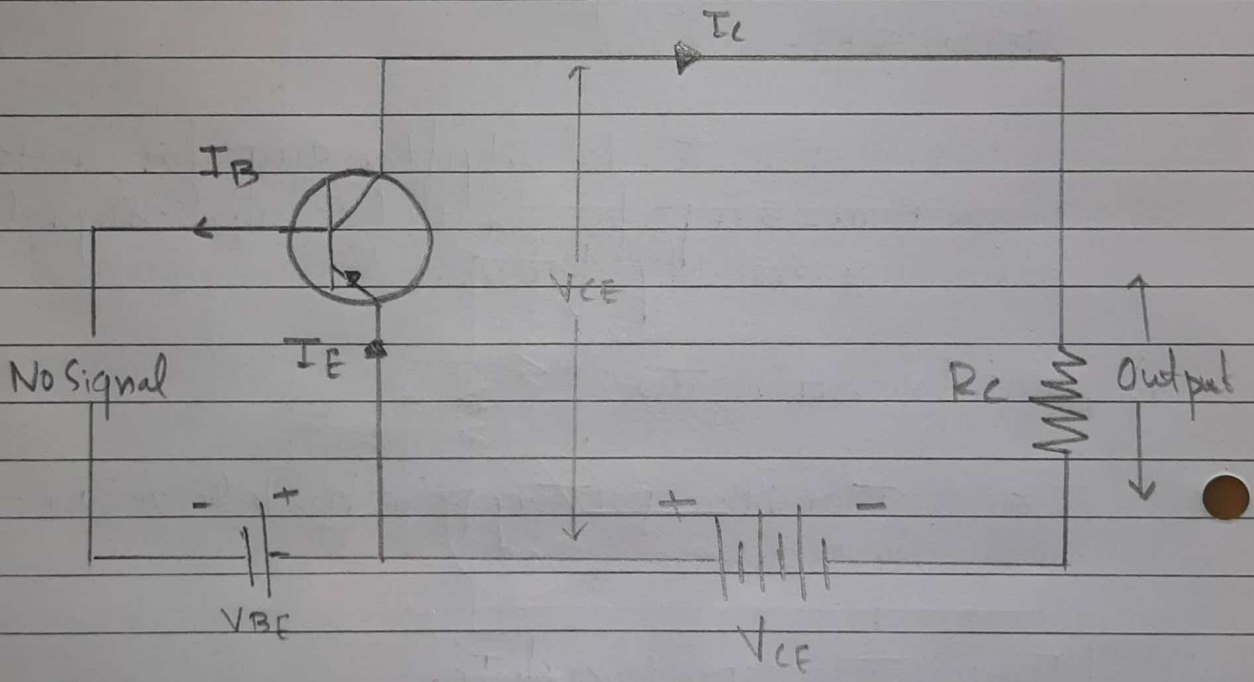
Stabilization of the operating point has to be achieved due to following reasons.

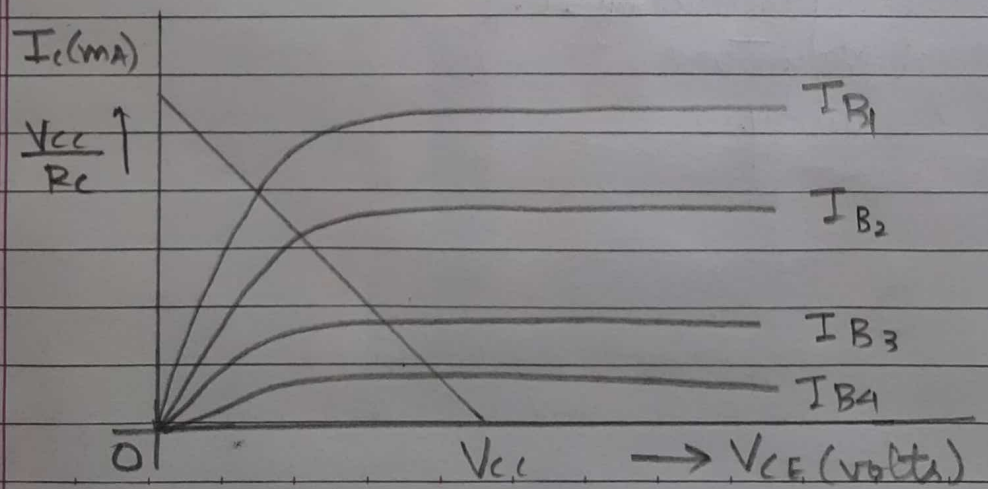
Temperature dependence of I_C.
Individual variations.
Thermal runaway.

b) Define DC load line with proper diagram and explain Q-point.

Answer: The DC load line is a graph that has all possible volumes of output current (I_C) and output voltage (V_{CE}) for a given amplifier.

In case of amplifier, it has two inputs they are AC input and DC input.





By using the direct current load line concept, we can obtain the linear analysis of the circuit for non-linear elements such as diodes or transistors.

The DC load line analysis main intention is to find the Quiescent Point (Q-point)

The Quiescent point obtain by the dc load line at which the parameters voltage and current are equivalent to each other for both the parts of the circuit.

The Q-point obtained is essential while drawing the current load lines.