

Analog and Digital Systems (UEE505)

Lecture # 1

Load Line Analysis and Biasing of BJT



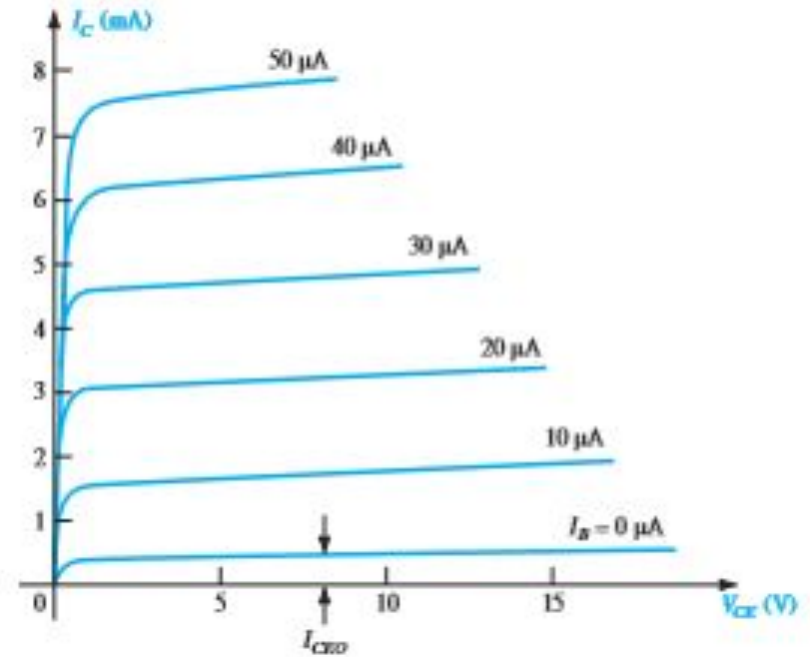
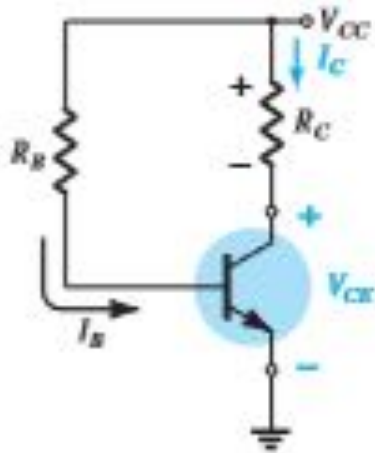
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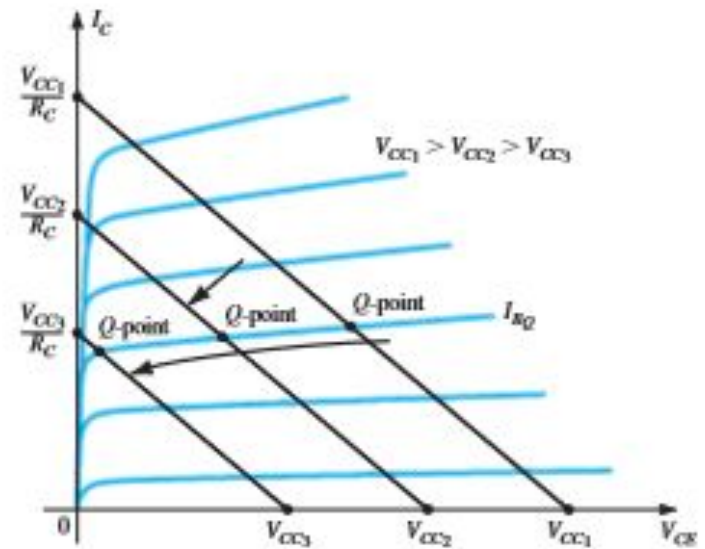
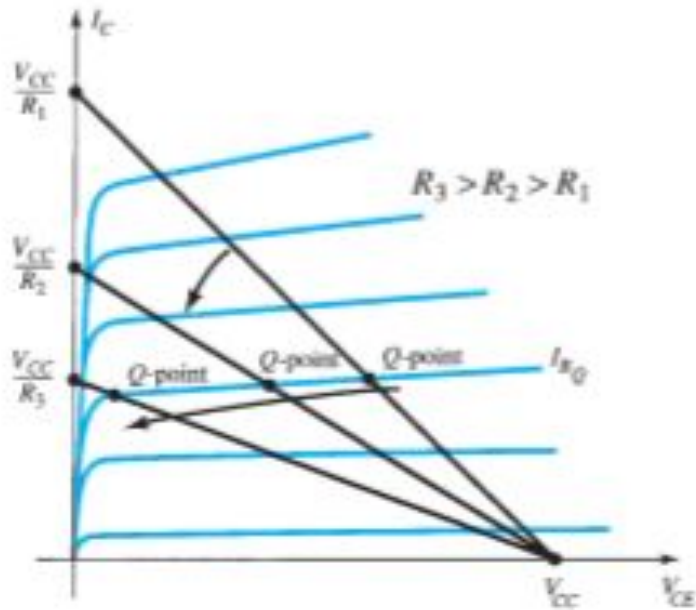
Load Line

- Defined as locus of operating points on the output characteristics of transistor.
- Line on which the operating point(Q pt) moves during the passage of ac signal.
- The Q pt is a point on load line which represent dc collector emitter voltage and collector current in the absence of ac signal.
- Whenever ac signal is applied for amplification, variations in collector emitter voltage and collector current take place about this point.

Load Line Analysis

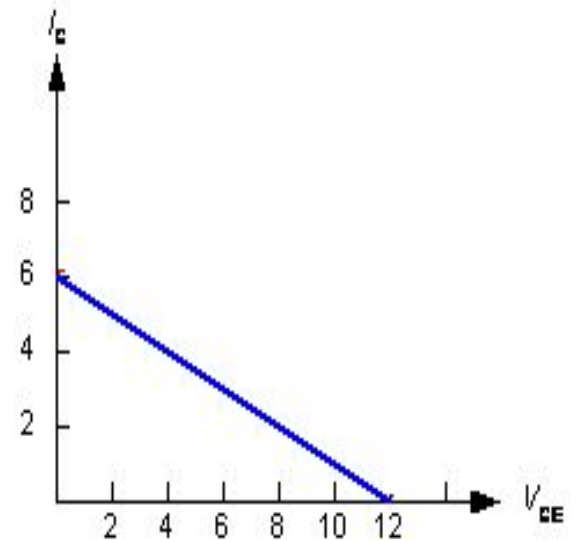
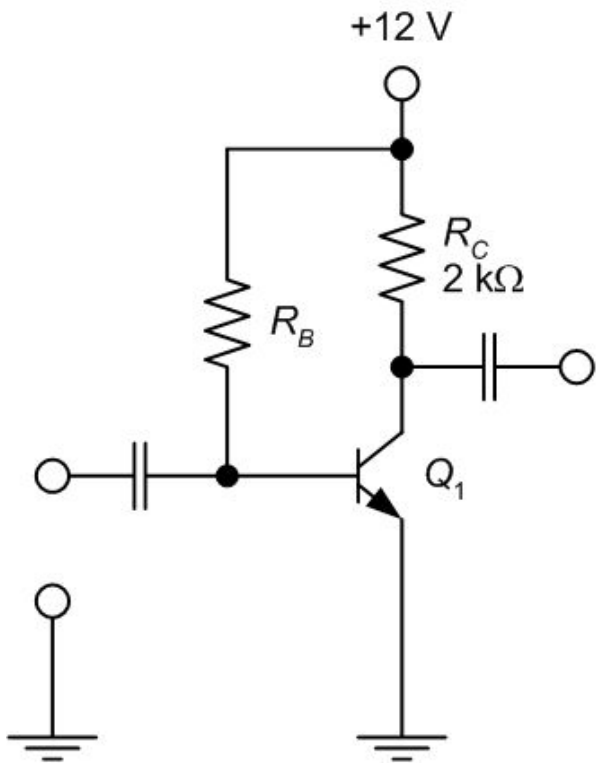


Load Line Analysis



Example

Plot the dc load line for the given circuit:



Transistor Biasing

- The proper flow of zero signal collector current and maintenance of proper CE voltage during the passage of signal is known as transistor biasing.
- If the transistor is not biased properly, it would produce unfaithful amplification in the output signal.
- Conditions that must be satisfied to achieve Faithful amplification :

--- Proper zero signal collector current

This current must be greater than
equal to maximum collector current
due to signal alone.

Transistor Biasing

---- Minimum proper BE voltage at any instant

BE voltage should not fall below 0.5V for Ge and 0.7V for Si

---- Minimum proper CE voltage at any instant

CE voltage should not fall below 0.5V for Ge and 1V for Si

Need for Bias Stabilization

- Temperature dependence of collector current and individual parameters of Transistor.
- Parameters changes from unit to unit.

If Q pt is not stabilized, then there can be phenomenon called Thermal Runway.

Requirements of a Biasing Circuit

- Establish the Q pt in middle of active region of the transistor characteristics.
- Stabilize Collector Current against temperature variations.
- Make Q pt independent of transistor parameters.

References

- Boylestad R. L., Electronic Devices and Circuit Theory, Pearson Education.
- *NN Bhargava, DC Kulshreshtha and SC Gupta, Basic Electronics and Linear Circuits, McGraw Hills.*