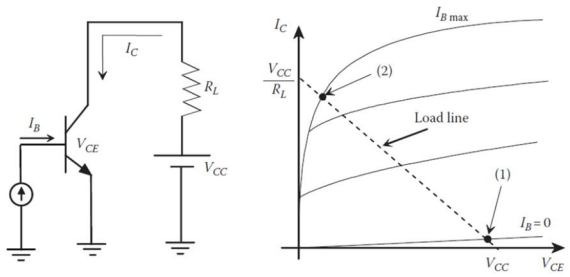
ELEC-E8422 An Introduction to Electric Energy

Exercise Session 4: Power Electronics

EX 1 Bipolar Transistor

A bipolar transistor is used in the circuit below, V_{CC} = 40 V and the load resistance R_L = 10Ω. In the saturated region, the collector-emitter voltage V_{CE} = 0,1 V and the current gain of the base β = 5. Calculate the following numerical values

a) The current and power of the load.
b) The losses in the collector circuit.
c) The losses in the base circuit, when the base-emitter junction is a diode with a voltage drop V_{BE}=0,7 V
d) The efficiency of the whole circuit.



EX 2 Bipolar Transistor

In the previous circuit the system is working in an operating point where the collector current I_c = 2 A. Calculate the power of the load resistance and the efficiency of the system.

EX 3 Diode Bridge

A single-phase diode bridge is supplied from 50 Hz ac system where the rms value of the voltage is 230 V and its peak value $\sqrt{2} * 230$ V. The load of the rectifier is a 10 Ω resistance.

a) Draw the waveforms of the dc voltage and current and calculate their average values.
b) Calculate the power delivered to the resistance.

EX 4 Diode Bridge

A single-phase diode bridge is supplied from 50 Hz ac system where the rms value of the voltage is 230 V. The load of the rectifier is a 10 Ω resistance. However, now we are assuming that the dc side has a large filtering inductance and therefore the dc side current is ideal dc. With this assumption, repeat the questions in EX 3, i.e.

a) Draw the waveforms of the dc voltage and current and calculate their average values.
b) Calculate the power delivered to the resistance.