University of Biskra
Faculty of Sciences and Technology
Department of Electrical Engineering
3rd Year LMD/3 ING electrotechnique

Series 1

Exercise 1

A single-phase half-wave rectifier is supplied by a sinusoidal voltage source vs(t) = Vm sin(ωt) with Vm = 100 V and a frequency of 50 Hz. The load is inductive Z = (10 + j10) Ω.

1. Draw the circuit diagram.
2. Draw the waveforms of the input voltage $V_s(t)$, the output voltage $v_c(t)$ across the load, the current $i_c(t)$ through the load, and the voltage $V_D(t)$ across the diode D.
   2.1 For a resistive load R,
   2.2 For the load Z with a current extinction angle $\beta = \frac{5\pi}{4} rad$
3. Determine the mathematical expression of the load current.
4. Calculate the average and RMS values of the load voltage.
5. A freewheeling diode is inserted in anti-parallel with the load
   1. Draw the waveforms of $v_c(t)$, $i_c(t)$, and $V_D(t)$.
   2. What is the role of the freewheeling diode?

Exercise 2

The single-phase rectifier shown in Figure 2 supplies an inductive load from a sinusoidal source Vs = 220V / 50Hz, Z = $(5 + j10\sqrt{3})\Omega$, E = 180V.

Given the current extinction angle β = 190°

1. If α = π/3
   a) Draw the waveforms of uc, ic, and VT.
   b) Calculate the average load voltage..

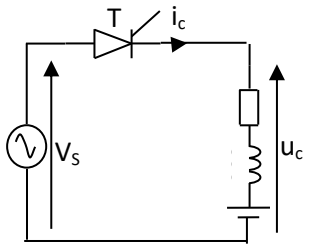

Figure 2

Exercise 3

A battery E = 12V is charged by the uncontrolled single-phase bridge rectifier shown in Figure 3; Vs = 120V / 50Hz and R = 10Ω.

1. Draw the waveforms of uc, V_{D1}, and i_c.
2. Calculate the average value of the load voltage.
3. Calculate the average value of the load current.

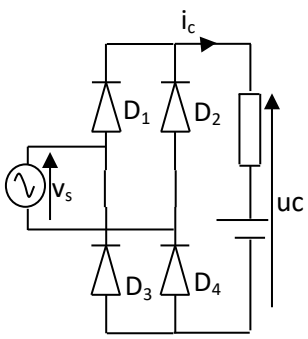

Figure3