Power Electronics and Electromechanics (EEE213)

Course Work – Assignment

Deadline: 05-MAY-2025, 17:00 hours @ SC431

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1) A single-phase full-bridge diode rectifier is considered as shown in Figure. 1 and is supplied from 220 V rms, 50 Hz AC supply. It consists of four diodes (assume all are ideal), a load resistance of $R = 20\ \Omega$, and supplies a highly inductive (L) load so that the load current is constant.

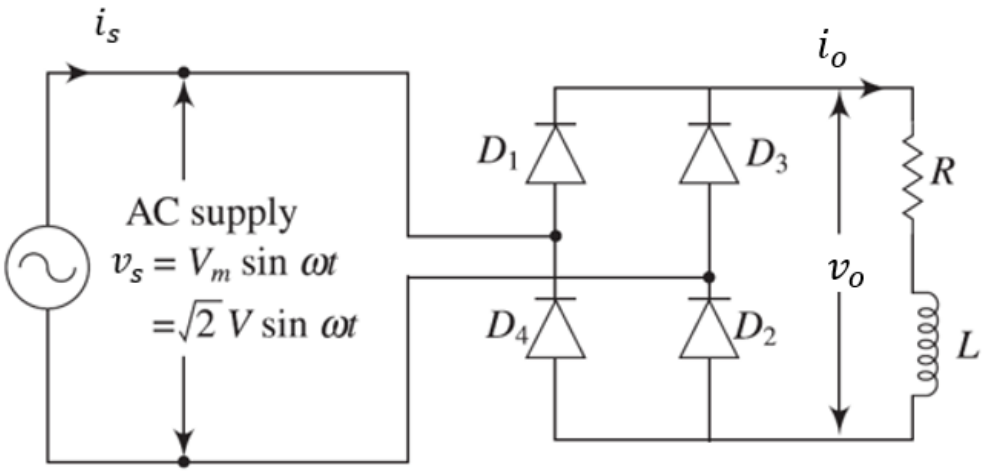


Figure. 1

a) Draw the waveforms of output voltage, output current, and diode current.
b) Determine the average or dc output voltage.
c) Determine the average load current.
d) Determine the average value of diode current.
e) Determine the rms value of diode current.
f) Determine the DC output power.

2) A single-phase half-wave controlled rectifier with $R = 10\ \Omega$ load is supplied from a 220 V, 50 Hz ac source. Determine (a) average dc output voltage, (b) rms output voltage, (c) form factor (d) ripple factor, (e) rectification efficiency, (f) transformer utilization factor, and (g) peak inverse voltage. Consider firing angle $\alpha = 45°$.

3) Consider the single-phase asymmetrical controlled bridge rectifier with *RL* load as shown below Figure. 2 & draw the waveforms of a) output voltage and current, b) voltage across T_1.

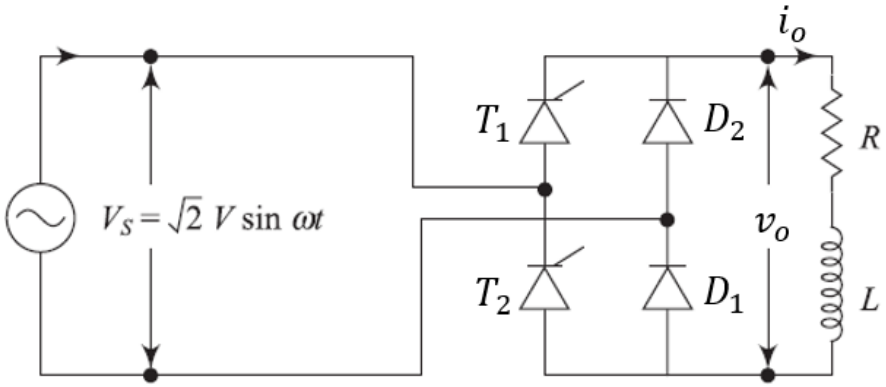
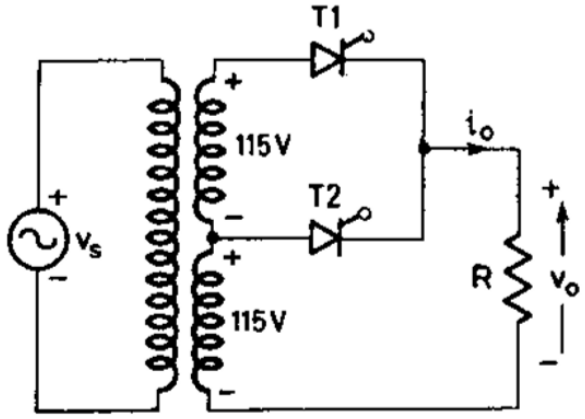


Figure. 2

4) Derive expressions for the average and rms output voltages of a 3-phase half-wave controlled rectifier by using cosine function fort the supply voltage. Assume continuous conduction.

5) Consider circuit shown in the below figure and sketch the waveforms of output voltage and current for the following values of firing angles.

a) Only T2 is triggered at $\omega t = 0, 2\pi, 4\pi$ etc.
b) Only T1 is triggered at $\omega t = 0, 2\pi, 4\pi$ etc.
c) T2 is triggered at $\omega t = 0, 2\pi, 4\pi$ etc. But T1 is triggered at $\omega t = \alpha, 2\pi + \alpha, 4\pi + \alpha$ and so on. Take $\alpha = 40^0$.



6) A boost chopper has input voltage of 20 V and output voltage of 60 V with switching frequency equal to 1 kHz. Calculate:

a) The duty cycle.

b) The ON and OFF period for the constant switching frequency operation.

c) Output current if the resistance load equal to 10 Ω.

d) Average input inductor current.

e) The maximum and minimum currents via the input inductor if the inductance is 10 mH.

7) A single-phase full bridge inverter feeds a resistive load of 10 Ω. Determine the following when the input dc source voltage is 200 V

a) A rms value of the fundamental component of output voltage.

b) The output power.

c) The lowest order harmonics and the corresponding harmonic factor.

d) Third order harmonic distortion factor.

8) A 220 V, 1000 rpm, 60 A separately-excited dc motor has an armature resistance of 0.1Ω. It is fed from a single-phase fully-controlled rectifier with an ac source voltage of 230 V, 50 Hz. Assuming continuous conduction, compute

a) Firing angle for rated motor torque at 600 rpm.

b) Firing angle for rated motor torque at (-500) rpm.

c) Motor speed for $\alpha = 150^0$ and half rated-torque.