Introduction to Power Electronics *** Midterm I *** Sample problems

P1 (30) This problem is about classification of the power semiconductor switching devices used in the power electronics applications. Note that you have been informed about total 6 devices in the class. Answer the following the questions:

- a) Draw the circuit symbol of each switching device.
- b) Explain the turn-on and turn-off mechanisms of each switching device.
- c) In many power electronics applications, a device that has "bipolar conduction and bipolar blocking" capabilities is desired. Explain what you understand from this definition. Create a device combination that has bipolar conduction and bipolar blocking capability using any combination of above 6 devices.

P2 (30) The following circuit is a full-wave rectifier. Assume all components are ideal and the source voltage is equal to $v_s = V_s \sin \omega t$ volt.

- a) Sketch the waveform of $v_d(t)$ in the following circuit on to the graph given below.
- b) Determine the average output voltage and the power in terms of the circuit parameters.
- c) Sketch the waveform of source current i_s on to the graph given below.



P3 (25) The thyristor shown in the figure is triggered 90° after every zero-crossing of the input voltage $v_s(t)$. We assume that the thyristor presents ideal device characteristics.

a) Sketch the waveform of the voltage across the resistor $v_R(t)$ and the voltage across the thyristor $v_{AK}(t)$. Make your sketching on the graph below.



b) Sketch the waveform of $v_R(t)$ on to the graph below if a continuous current is applied to gate of the Tyhristor.



P4 (15) For the circuit shown below,



- **a**) Draw the output voltage, $v_{out}(t)$, and
- **b**) Find the average output voltage in terms of V_s .