Name:………………………………….

**Problem 1:** Consider a single phase 240 V, 60 Hz, linear load that draws fixed real power of 3 kW and a reactive power that varies between $1-3$ kVAR.

1. Design a fixed FCTCR for this particular application that continuously supplies the needed reactive power (i.e., to correct the displacement power factor to unity at all time). Verify your design through PSpice simulation at 1, 1.5, 2, 2.5 and 3 kVAR load requirements (by plotting the source current waveform and its harmonic content up to the 9th harmonic). The results should be that the peak value of the fundamental current is nearly equal to 17.5 A at all times.

2. For graduates only: Through PSpice, determine the rms value of the source current, its THD, and overall power factor for a load reactive power demand of 1.5, 2, and 2.5 kVAR.

**Problem 2:** Consider the three-phase thyristor rectifier circuit below with $I_d = 50$ A

![Thyristor Rectifier Circuit](image)

- Nominal Values: $V_{LL}(\text{rms}) = 208$ V at 60 Hz
  - $L_{a1} = 0.2$ mH
  - $L_{a2} = 1.0$ mH
  - $L_d = 16$ mH
  
  Delay angle = 45°

1) Determine the Short circuit current ratio at PCC, determine the harmonic content of the source current and compare it to the recommended IEEE Std. 519 limits.

2) Find the real power and reactive power (at 60 Hz) supplied by each phase.

3) Design a filter to reduce both the 5th harmonic current and supply the reactive power found in 2) above. Verify your results the computer simulations.

4) For graduates only: Determine the impact the filter has on higher order harmonics and on the THD of the source current and on the THD of the line voltage at PCC.