1- A 3 phase, 5 KVA, 208 V, four pole, 60 Hz, star-connected synchronous machine has negligible stator winding resistance and synchronous reactance of 8 ohms per phase at rated terminal voltage. The machine is operated as generator in parallel with a 3 phase, 208 V, 60 Hz power supply.

a) Determine the excitation voltage and power angle when the machine is delivering rated KVA at 0.8 PF lagging. Draw the phasor diagram.

b) If the field excitation current is increased by 20 percent (without changing the prime mover power), find the stator current, power factor and reactive KVA supplied by machine.

2- A three phase, 14 KV, 10 MVA, 60 HZ two pole, 0.85 PF lagging, star-connected synchronous generator has X_s = 20 ohms per phase and R_s = 2 ohms per phase. The generator is connected to an infinite bus. Determine the excitation voltage at rated condition as well as synchronous speed. Draw phasor diagram.

3- The synchronous machine discussed in first example is operated as synchronous motor from a 3 phase, 208 V, 60 HZ power supply. The field excitation is adjusted such that the power factor is unity when the machine is drawing 3 KW from the supply.

   a) Find the excitation voltage and power angle. Draw the phasor diagram.

   b) If the field excitation is held constant and the shaft load is slowly increased, determine the maximum torque that motor is able to deliver.