Fall 2011

EE320 CIRCUIT ANALYSIS II
Laboratory Experiment #9
"Synchronous Motor Operation"

Background: Although commonly used as a generator, a synchronous machine has some unique properties when operated as a motor. Specifically, reactive power flow can be manipulated by adjusting the field current for the synchronous motor. Thus, the motor can be operated as a variable reactor to perform power factor correction.

Part 1. Synchronous Motor Configuration

1. Connect the synchronous machine (8241-00) as a wye connected motor using the three-phase 208 V supply. Ensure that the machine is disconnected from the dynamometer and will operate with no-load.

2. Connect the 120 V DC power supply to the field coil of the machine, ensure that the exciter rheostat is at its full CW position, and that the coil switch is closed.

3. Connect and configure the power meter to record the power supplied to the motor from the three-phase supply. Connect and configure a DMM to measure the field current.

   Have the instructor verify your setup: _____

4. Measure and record the meter readings to complete Table 1 on the following page. ***Gradually*** increase the DC voltage applied to the rotor to ***slowly*** increase the field current in 100mA increments.

5. From the results of Table 1, calculate the reactive power at maximum field current. At this data point, is the power factor leading or lagging?

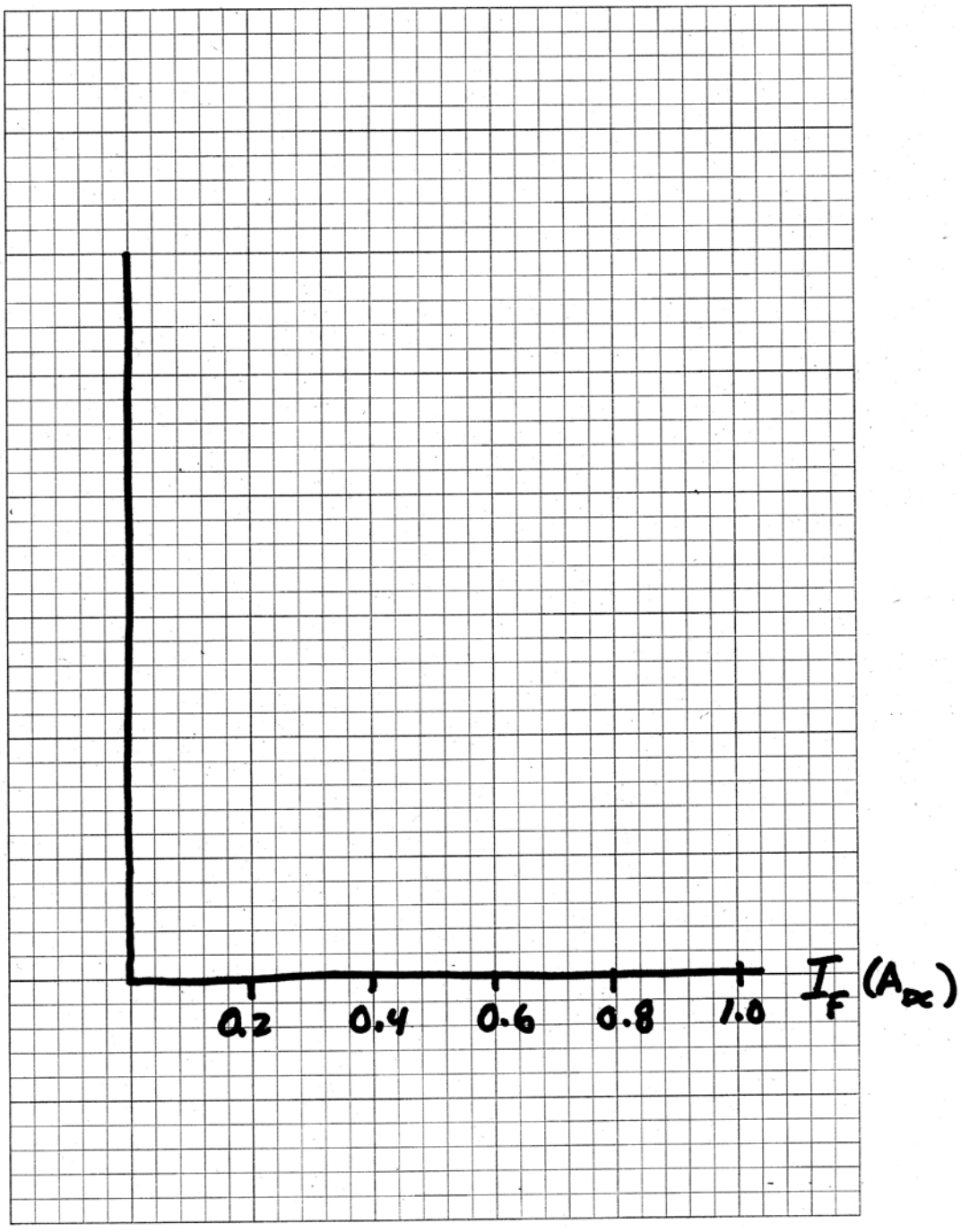
Table 1

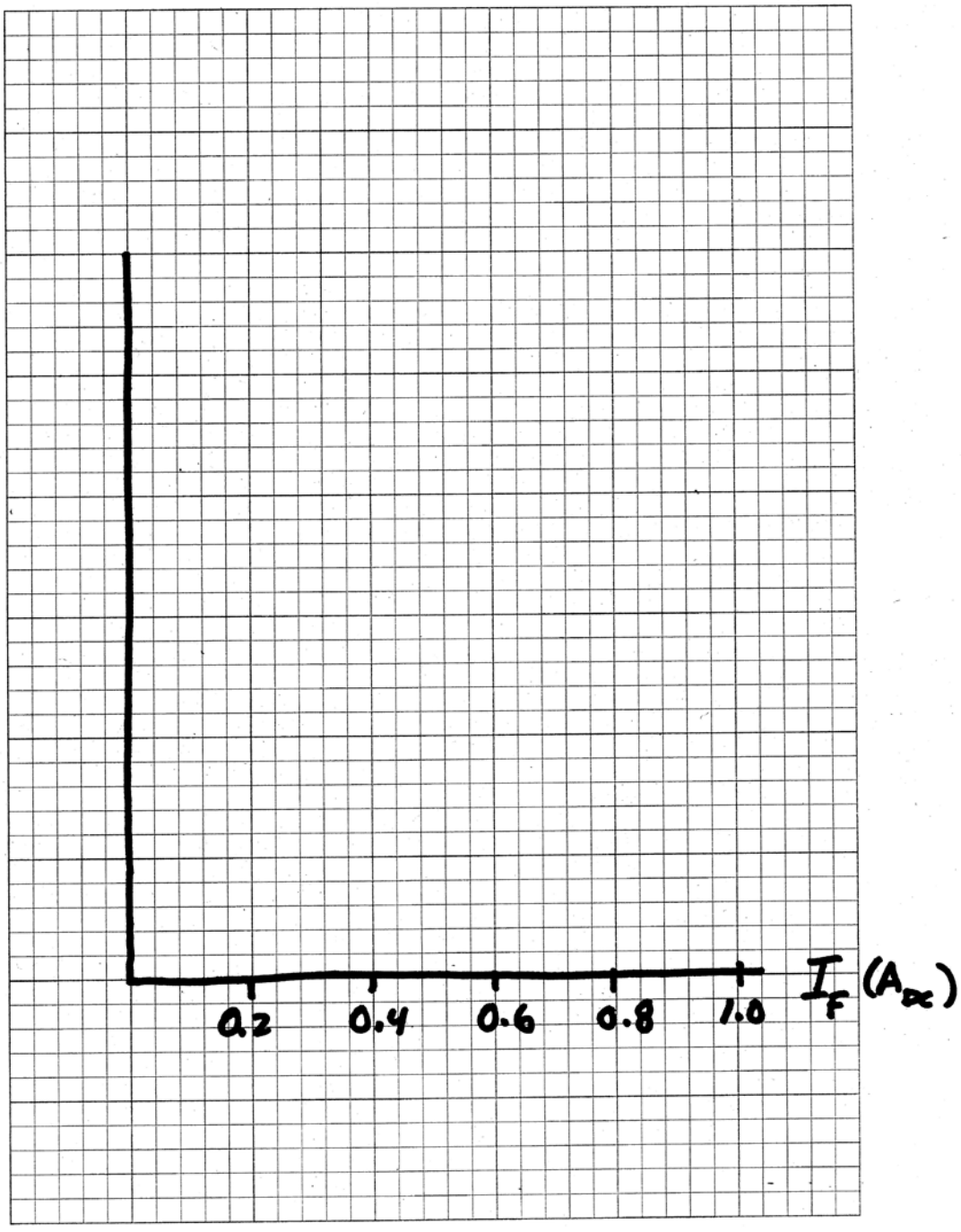
I_F (A)	I_{stator} (A)	V_1 (V)	V_2 (V)	W_1 (W)	W_2 (W)	P_T (W)	Q_T (VAR)	pf
0								
0.1								
0.2								
0.3								
0.4								
0.5								
0.6								
0.7								
0.8								
0.9								

6. Plot the stator current vs rotor current for your data.

7. Plot the power factor vs rotor current for your data.

8. From your results, discuss whether a synchronous machine operating as a motor under no-load conditions should be termed a synchronous capacitor or a synchronous inductor or either.


0.2
0.4
0.6
0.8
1.0
I_F (A$_{DC}$)


0.2
0.4
0.6
0.8
1.0
I_F (A$_{DC}$)