Synchronous Motor Characteristics

Objective:

The purpose of this experiment is to obtain the performance characteristics of synchronous motor operating from infinite bus. The performance is to be studies with

1. Constant excitation & variable load
2. Variable load and excitation with constant input power factor
3. Constant input power and variable excitation

Starting

The motor can be started as an induction motor and then 'pulled into step' by switching on the excitation. The synchronous motor /DC generator set is connected as in FIG.1. The motor is started as an induction motor with a star-delta switch. Since the starting current will be large the triple -pole short-circuiting switch SCS is closed before switching on the 3-phase mains switch and also the load on the DC generator is kept zero. Switches S1 & s2 are closed. Then the star-delta switch is operated. The switch should be put on to the delta position only after allowing the machine to come up to speed in star position for sometime thereby reducing the current. In delta position, the excitation is arranged to be automatically on and the excitation is controlled by the SG6 potentiometer.

Procedure

1. **Constant excitation, variable load**

a. Start & run the synchronous motor on no load. Adjust the excitation If for normal excitation and keep this constant. Vary the load slowly and note V1,I1,W1 and W2,
b. Repeat for an under-excitation & an over -excitation.

2. **Constant power factor and variable load excitation**

a. Keep zero load on the generator. Adjust the excitation so that the power factor is unity (by making wattmeter reading W1 equal to W2, both readings being positive). Load the machine gradually, each time adjusting the power factor to unity. Note the field current If and the motor current I_L
b. Repeat for constant 0.5 p.f lagging & constant 0.5 p.f leading. Since the phase sequence is RYB, 0.5 p.f leading is obtained when W2 is zero and 0.5 p.f lagging is obtained when W1 is zero.

3. **V-curves with constant input power**

a. **Load the synchronous motor and keeping the a.c input power (W1 +W2) constant , vary the excitation and note** I_L and If
b. **Repeat for another value of a.c input power.**

Report:

a. Calculate the power factor using the readings of W1 and W2 (for Part 1 of the experiment). Plot I_L and power factor separately against a.c power input on x-axis.
b. For Part 2 of he experiment, plot If against I_L on x-axis.
c. For Part 3 of he experiment, plot I_L against $I_{f\ on}$ x-axis.
d. By using the general locus diagram (e.m.f loci) and O.C.C show how the V-curves can be obtained theoretically.
e. Using phasor diagrams, prove the statement made in 2(b) above.

FIG.1

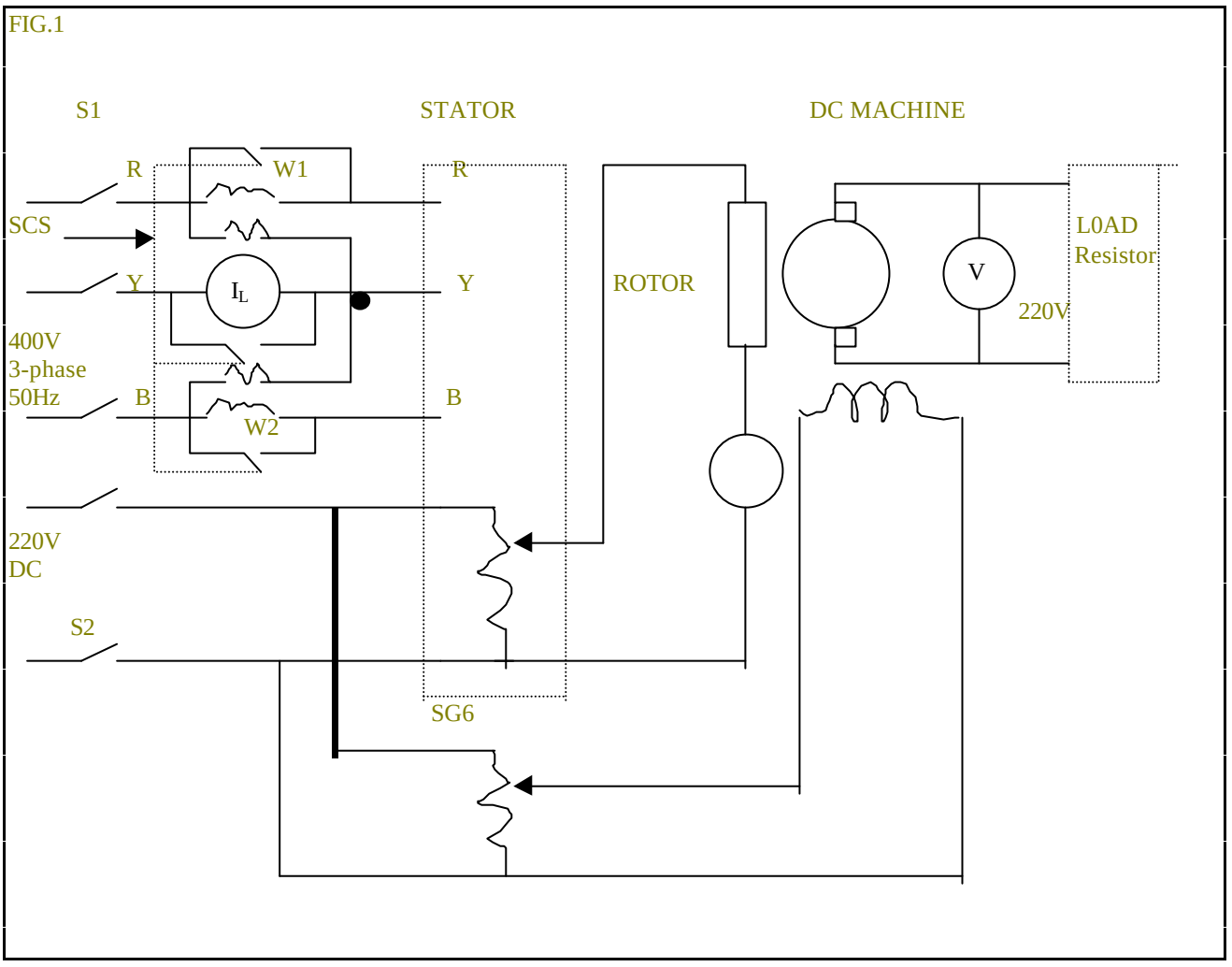
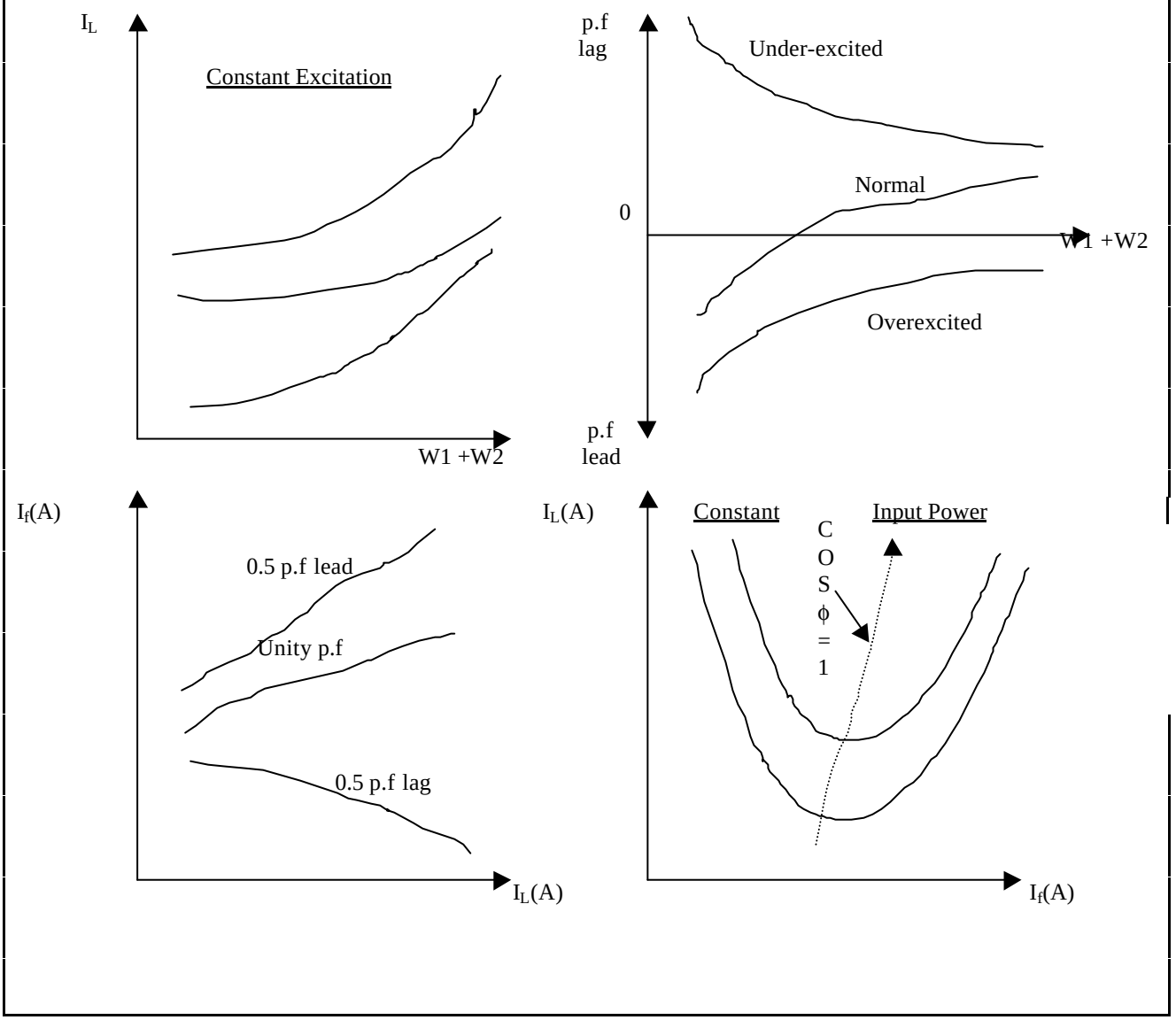


FIG.2


I_L
Constant Excitation
W1 +W2
p.f lag
Under-excited
Normal
0
W1 +W2
Overexcited
p.f lead
I_f(A)
0.5 p.f lead
Unity p.f
0.5 p.f lag
I_L(A)
I_L(A)
Constant
Input Power
COS ϕ = 1
I_f(A)