Date:___________________

Name: _________________

ID: _________________

**LABORATORY
EXPERIMENT
NO. 8**

INDUCTION MOTOR/GENERATOR

OBJECT

1. To determine the general performance of a squirrel motors
2. To observe the characteristics of induction generators.

THEORY

Three-phase AC motors are commonly used in industry and electric power companies normally supply three-phase power to industrial users. In the 3-phase system, a rotating magnetic field is generated in three phases. When the stator of a three-phase motor is connected to a three-phase power source, current flows in the three stator windings and a revolving magnetic field is established. These three exciting currents supply the reactive power to establish the rotating magnetic field.

The speed of the rotating magnetic field is entirely determined by the frequency of the three phase power source, and is known as the synchronous speed. There are two types of rotors in the induction motor.

Squirrel Cage Rotor

The simplest and most widely-used rotor for induction motors is the squirrel cage rotor, from which the squirrel cage induction motor gets its name. The squirrel cage rotor consists of a laminated iron core which is slotted lengthwise around its periphery. Solid bars of copper or aluminum are tightly pressed or embedded into the rotor slots. At both ends of the rotor, short-circuiting rings are welded or brazed to the bars to make a solid structure.

Compared to the intricately wound and arranged wound rotor, the squirrel cage rotor is relatively simple and essentially trouble-fee in actual service.

When power is applied to the stator, a rotating magnetic field is created and as the field revolves, its flux lines cut the shorted turns embedded around the surface of the squirrel cage rotor and generate voltages by electromagnetic induction. Because, these turns are short-circuits with very low resistance, the induced voltage cause high currents to circulate in the rotor bars. The circulating rotor currents then produce their own strong magnetic poles, which are attracted to the rotating field. Thus, the rotor revolves with the main field.

As the rotor starts turning, the difference in speed between rotor and rotating field, of ***slip***, goes from a maximum 100 % (s=1.0) to some intermediate value, say 50 % (s=0.5). As the slip decreases in this manner, the frequency of the voltages induced in the rotor decreases, because the rotating field cuts conductors at a decreased rate; this, in turn, causes the overall inductive reactance decreases, the power begins to increases. (Since, at rest the rotor has a relatively large inductive reactance with respect to its resistance. Rotor current lags rotor voltage by 90 degrees.) Therefore, the power factor begins to increase. This improvement is reflected as an increase in torque and a subsequent increase in speed.

When the slip drops to some value between 0.02 and 0.1, the motor speed stabilizes.

INSTRUMENTS:

Squirrel Cage Induction Motor Module
Prime Mover-Dynamometer Module
Three-phase Watt and Var Meter
AC Metering Module
Tachometer

PROCEDURE

We have two sub-labs: (A) squirrel cage induction motor and (B) Induction generator

EXPERIMENTS

A. Squirrel Cage Induction Motor

Caution: High voltages are present in this experiment. Do not make any connections with the power on. The power should be turned off after completing each individual measurement.

8-1. Examine the construction of the squirrel cage rotor induction motor. Identify the stator windings, cooling fans, end rings, and rated speed and horsepower of the motor.

8-2. Connect a circuit as shown in Fig. 8-1. (Even though Fig.1. does not indicate clearly, remember that phase A comes from terminal 5, Phase B from terminal 4, and Phase C from terminal 6. So make A-B-C connection to the 1-2-3 of Watt-Var meter.)

8-3. Turn on the power supply and adjust the voltage so that the speed of the induction motor is set at 1700 rpm.

8-4. Measure the 3 phase currents and Watt and Var, and the voltage. Record them in Table I.

Table I

Ia	Ib	Ic	Watt	Var	Vac

8-5 Return the voltage to zero and turn off the power supply.

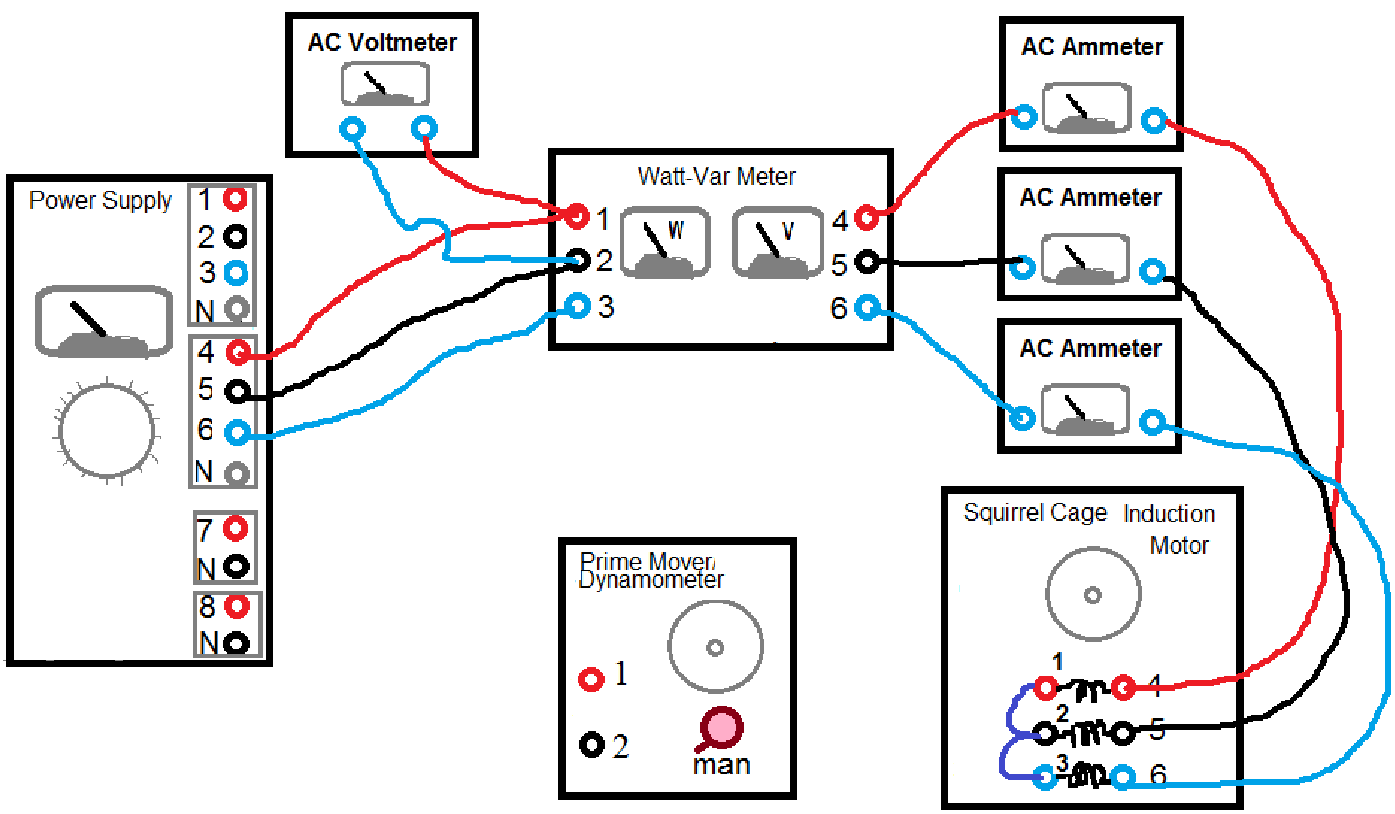

Fig. 8-1

B. Induction Generator
(Read and proceed very carefully)

8-6. Now we are going to energize the prime mover as in Fig. 8-2 to increase the induction machine speed, but do **not** connect the DC source 7-N (**from Power Supply 2**) to the Prime mover **yet**.

8-7. (Without energizing the prime mover) Run the induction motor at a very low speed and record the direction of its rotation. Then reduce the motor supply voltage to zero.

8-8. (Without energizing the induction machine) Connect DC source 7-N (from another power supply) to the Prime Mover and check that the prime mover is turning in the same direction as the induction motor. If not, reverse the polarity of the voltage of DC source 7-N (of Power Supply 2) that is applied to the prime mover field winding.

8-9. At this moment, both power supplies, to induction machine and the prime mover, are now connected and ready to energize. Now, increase the voltage for the induction machine until the speed of the induction motor reaches at 1700 rpm.

8-10. While the induction machine is running at 1700 rpm speed, gradually raise DC 7-N voltage (of Power Supply 2) to increase the speed to a indicated value in Table II. At each speed, record the real (W) and reactive power (Var) of the induction motor. Pay special attention to the sign (polarity) of them. Complete Table II.

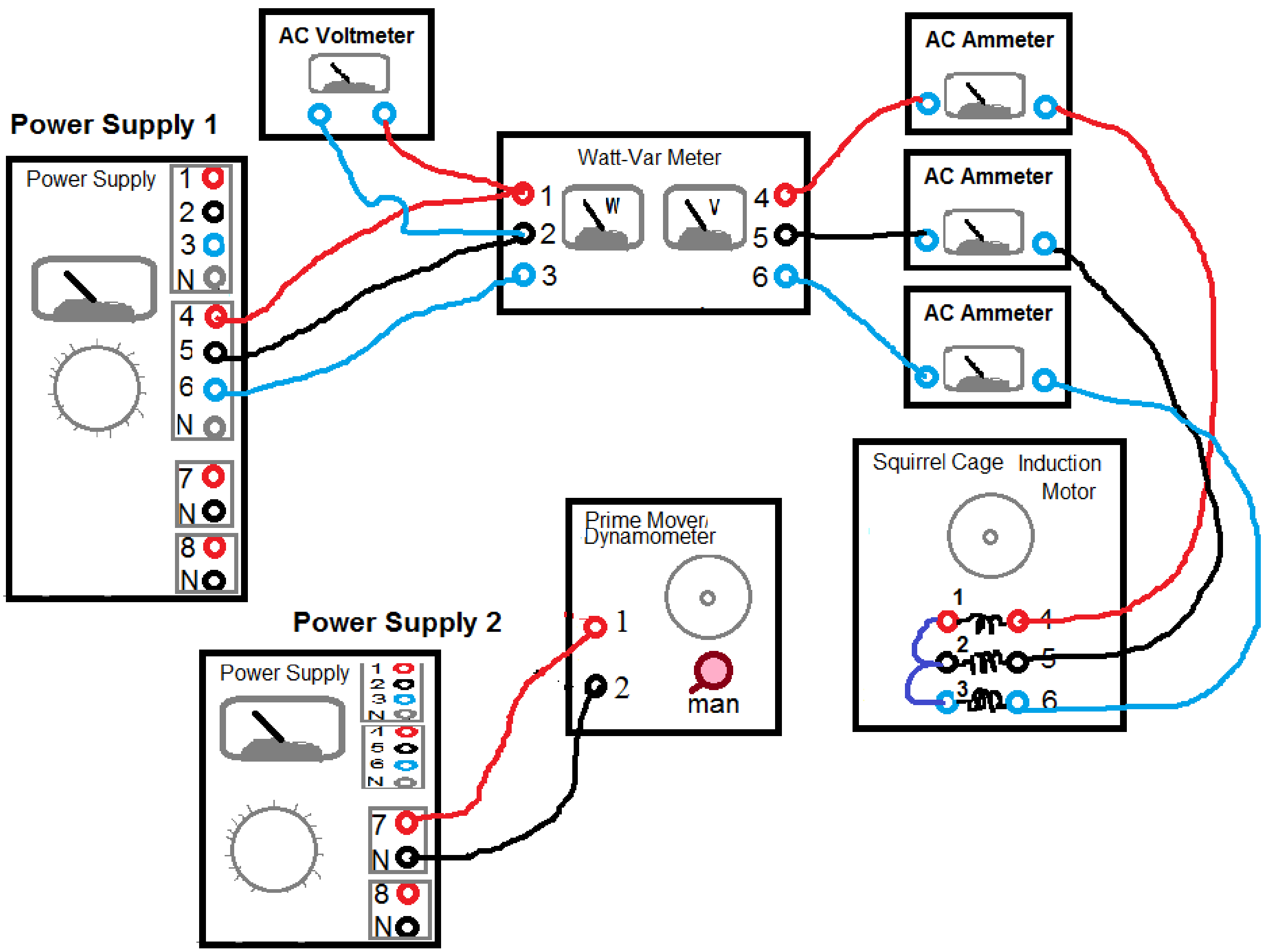

Fig. 8-2

Table II.

Speed (RPM)	I_a	I_b	I_c	W	Var	V
1700						
1750						
1800						
1900						
2000						

QUESTION (fill out the blanks):

1. An induction machine as a motor (   ) real power and (   ) reactive power from a source.

2. An induction machine as a generator, when the speed is (   ) than the rated speed of the machine, (   ) real power and (   ) reactive power.