SYNCHRONOUS GENERATOR CHARACTERISTICS

Objective:

To determine the compounding curve & the volt-ampere curve of a synchronous generator

Theory:

The synchronous machine is one in which a.c flows in the armature winding and D.C. is applied to he field winding. The armature winding is usually on the stator.

Synchronous generators are usually rated in terms of the maximum kVA loads at the specified voltage and power factor, which they carry continuously without overheating.

The main steady-state operating characteristics are:

I. Field current versus armature current

II. Terminal voltage versus armature current.

Consider a synchronous generator delivering power at constant frequency to a unity power factor (i.e. resistive) load. The curve showing the field current required to maintain rated terminal voltage as the constant power factor load is varied is known as the *compounding* curve. The compounding curve at any other power factor can also be determined.

If the field current is held constant while the load varies, the terminal voltage will vary. Characteristic curves of terminal voltage can be plotted against armature current for any constant power factor load. The curve can be drawn for one value of field current which is usually the value required to give rated terminal voltage at rated armature current.

The variation of terminal voltage with load is due to the influence of armature reaction. When the power factor of the load is unity, the fall in voltage with increase of load is comparatively small. With an inductive load, the demagnetising effect of armature e reaction causes the terminal voltage to fall much more rapidly.

In many industrial installations, fluctuations of load are heavy. Due to rapid variations of load from instant to instant, the voltage also fluctuates considerably, because of the varying voltage drop in the armature circuit. To overcome this unsatisfactory feature, automatic voltage regulators are usually provided to maintain the generator voltage reasonably constant in spite of the fluctuating load. The voltage is increased when the load is high and decreased when the load comes down.

Procedure:

I. Compounding Curve

Maintain motor speed constant throughout the experiment

1. Read the nameplate data and connect as shown in FIG.1
2. Start the prime mover D.C. Motor and bring the set to rated synchronous speed.
3. Adjust the field current to give rated voltage at the open circuit terminals of the synchronous generator.
4. Connect a resistive load and measure field current (required to maintain rated terminal voltage) for various load currents. Vary the load current in steps up to the rated armature current
5. Repeat item 4 above for an inductive load.

II. Volt-ampere Curve

Maintain motor speed constant throughout the experiment

1. Connect a resistive load.
2. Adjust the field current required to give rated terminal voltage at rated armature current
3. Measure the terminal voltage for various load currents, keeping the field current constant. Vary the load current in steps up to the rated armature current
4. Repeat for an inductive load.

Observations;

I. Compounding Curve

Terminal voltage =

Resistive load			Inductive load		
S.No.	Ia (A)	If(A)	S.No.	Ia (A)	If(A)

II. Volt-ampere Curve

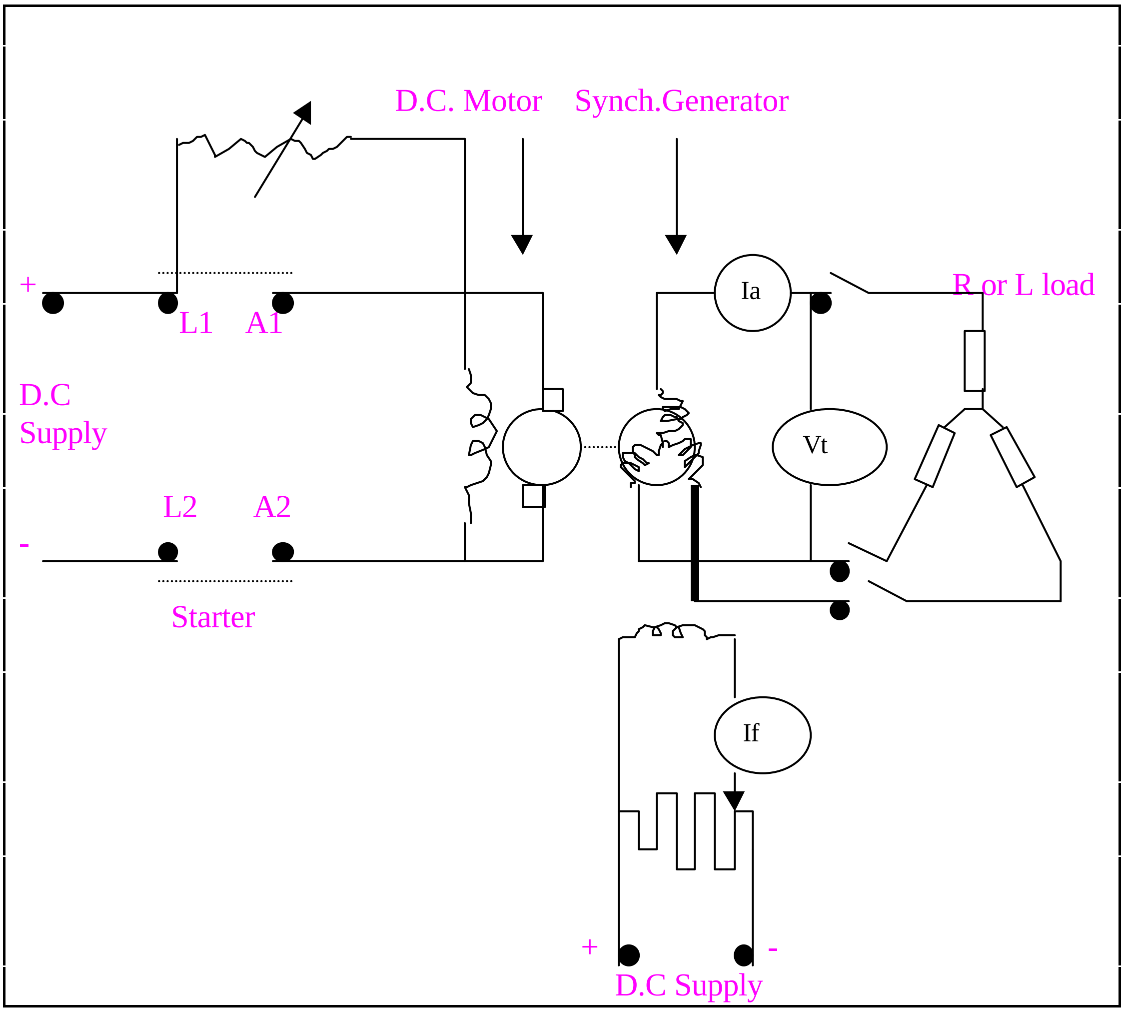
Field current =

Resistive load			Inductive load		
S.No.	Ia (A)	Vt (V)	S.No.	Ia (A)	Vt (V)

Report:

1. Plot the compounding curve and the volt-ampere characteristic of the synchronous generator and discuss their nature.
2. What practical steps are adopted to ensure that the voltage at the generator terminals, under varying voltage conditions, remain constant?
3. What is the effect of load power factor on the voltage regulation of the synchronous generator?

Fig. 1 is given below


D.C. Motor
Synch.Generator
+
L1
A1
D.C
Supply
L2
A2
-
Starter
Ia
R or L load
Vt
If
+
-
D.C Supply