EXPERIMENT NO. : MC/EE-591/ 7

TITLE: Determination of regulation of Synchronous machine by

a. Potier reactance method.
b. Synchronous Impedance method.

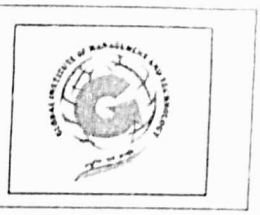
OBJECTIVE:

1. To predetermine the regulation of a given 3Φ alternator at full load condition and different power by ZPF method.
2. To predetermine the regulation of a given 3Φ alternator at full load condition.

THEORY:

Voltage Regulation: The voltage regulation of an alternator is defined as " the rise in voltage from full-load to noload and (field excitation and speed remaining the same) divided by the rated terminal voltage" . percent regulation 'up'= X 100. Where E0 and V are respectively the no Load voltage and full load voltage. Regulation of an alternator by synchronous impedance method: Ra per Phase: It is obtained from direct voltmeter and ammeter method by applying DC supply or by using multimeter to the stator winding. The effective value of Ra is increased due to skin effect, Ra=1.3 x Ra(D.C) O.C.C: O.C.C is plotted from the given data as in D.C Machines, this is plotted by running the machine on no-load and by noting the values of induced voltage and field excitation current.

It is just like a B-H curve.



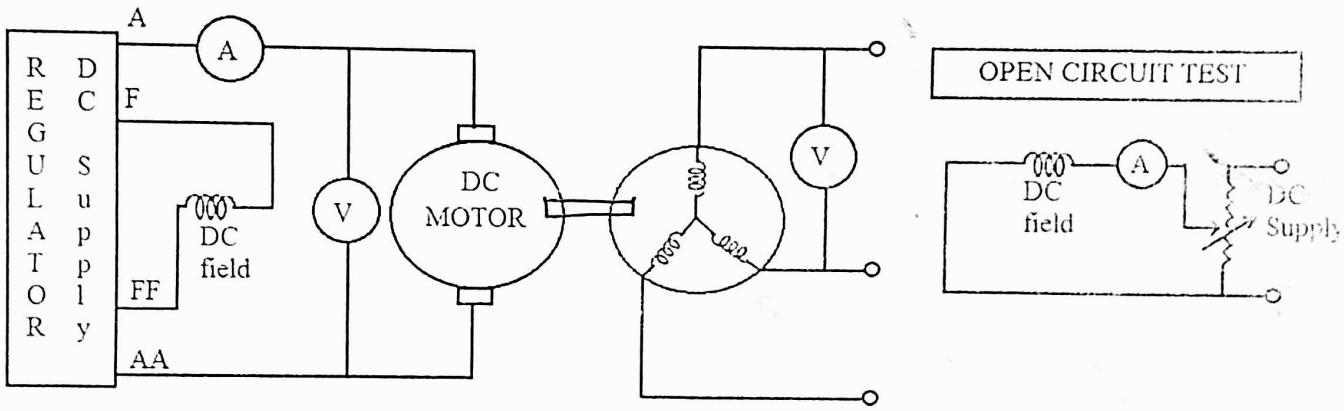
S.C.C: S.C.C is drawn from the data given by the short-circuit test as shown in Fig. It is obtained by short circuiting the armature (i.e. Stator) windings through a low resistance ammeter. The excitation is so adjusted as to give the rated full load current. Both these curves are drawn on a common field - current base. At rated field current I, of the alternator, draw a horizontal line which intersects the S.C.C. at a point. Now draw a perpendicular on to the X - axis from this point which gives the necessary field current for O.C. voltage E1 . It may be assumed that the whole of this voltage E1 is being used to circulate the armature short circuit current I1 against the synchronous impedance Zs. Zs= E1 = I1Zs Since Ra can be found as discussed earlier, the synchronous reactance Xs is given by

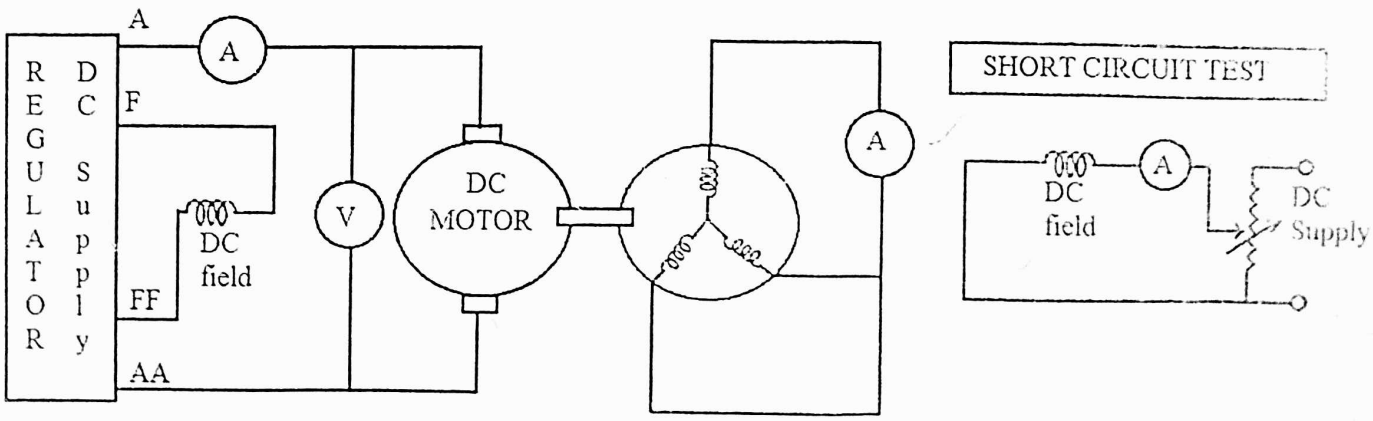
$$Xs = (Zs^2-Ra^2)$$

0.C. and S.C characteristics of alternator Knowing Ra and Xs Phasor diagram can be drawn for any load. No load voltage E0 is given by E0 =((vcosϕ +IRa)² +(VsinϕIXs) ²)0.5 When V is the rated terminal voltage per phase and I is rated load current per phase cosϕ is power factor. Regulation by mmf method: This method also utilizes o.c. and s.c. test data and the armature leakage reactance is treated as an additional armature reaction. In other words it is assumed that the change in the terminal potential difference on load is due to entirely armature reaction and due to ohmic resistance drop which in most cases is negligible. Field AT required to produce a voltage of V(or Ra is to be taken into account, then V+IRa cosϕ)•Now field AT required to produce a voltage of V on full load is the vector sum of the following. Field AT required to overcome the demagnetizing effect of armature reaction on full load. This•on no load. value is found from SC test. In other-words the demagnetizing armature AT on full load are equal and

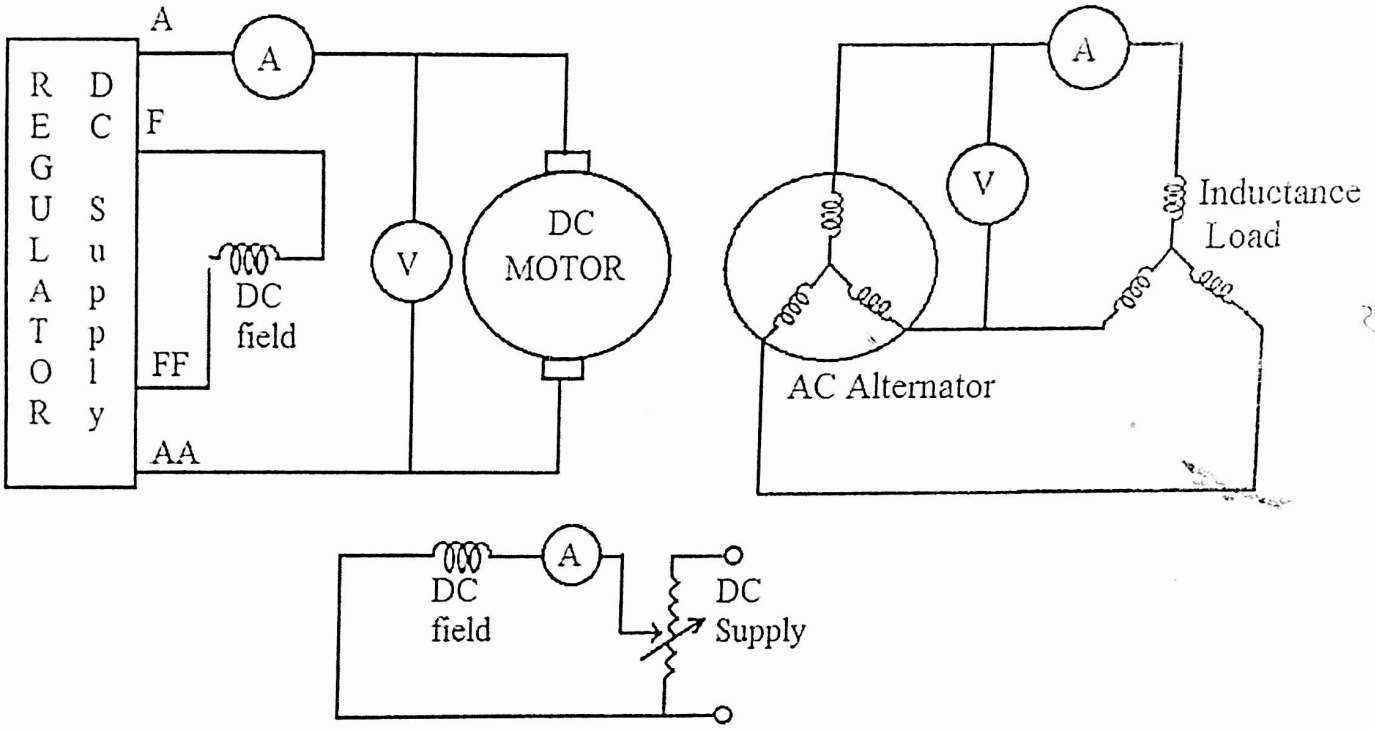
opposite to the field AT, required to produce a full load current on short circuit.

From the complete diagram of O.C and S.C characteristics, OA represents If for normal voltage V. OC represents If required for producing full load current on S.C vector AB=OC is drawn at an angle of (90+ϕ) to OA. (if the p.f is lagging and 90-ϕ if pf is leading). The total field current is OB for which the corresponding O.C voltage is E0. :. percentage regulation= X 100.





CIRCUIT DIAGRAM FOR POTIER REACTANCE METHOD



APPARATUS TABLE:

SL NO.	ITEM NAME	RANGE / RATING	QT.	REMARKS
1.				
2.				
3.				
4.				

EXPERIMENT TABLE:

(SHORT CIRCUIT TEST)

SL NO.	TERMINAL VOLTAGE (V)	LINE CURRENT (AMP)	FIELD CURRENT(AMP)	SPEED (RMP)
1.				
2.				

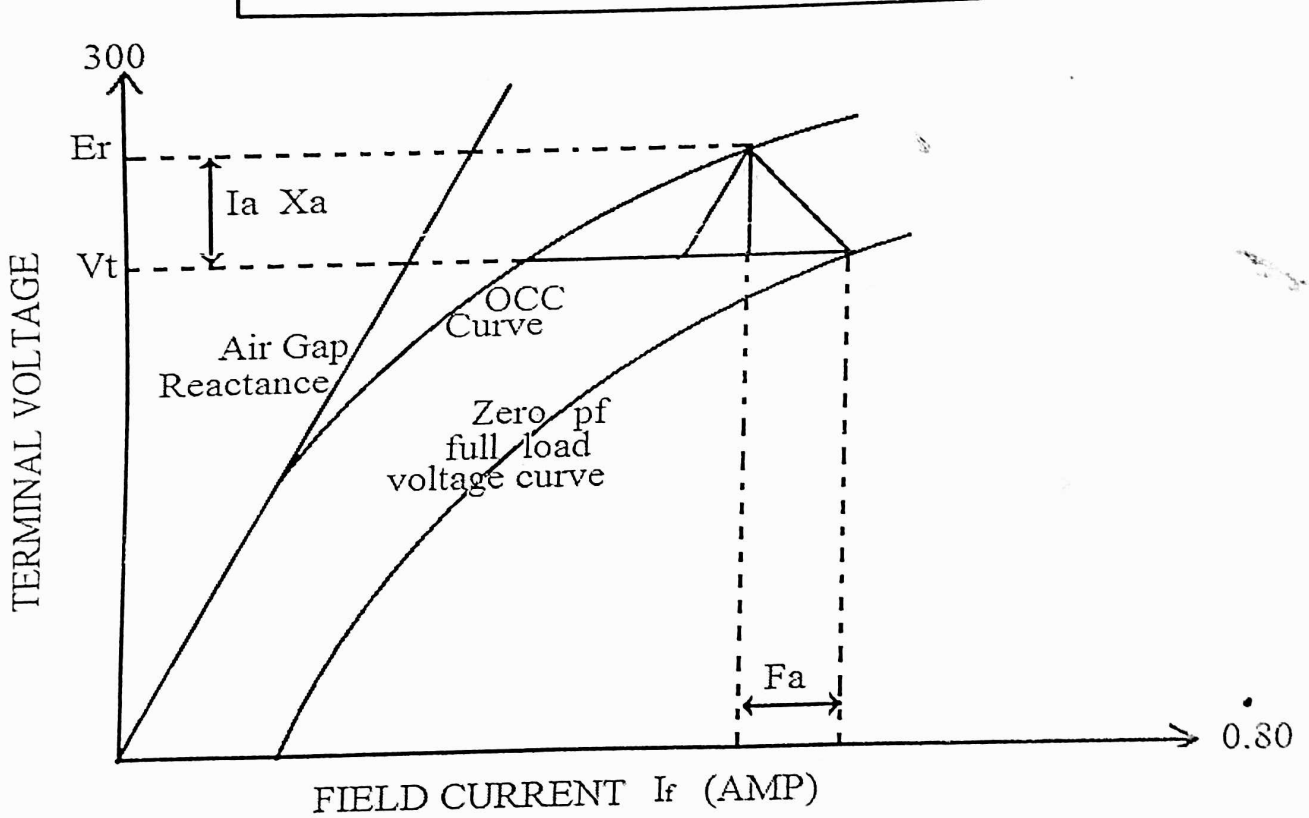
(OPEN CIRCUIT TEST)

SL NO.	TERMINAL VOLTAGE (V)	LINE CURRENT (AMP)	FIELD CURRENT (AMP)	SPEED (RMP)
1.				
2.				

(FOR ZPF METHODS)

SL NO.	TERMINAL VOLTAGE (V)	LINE CURRENT (AMP)	FIELD CURRENT(AMP)	SPEED (RMP)
1.				
2.				
3.				
4.				

TERMINAL VOLTAGE Vs FIELD CURRENT



STUDENT'S SIGNATURE

TEACHER'S SIGNATURE