Single-phase Induction Motor Characteristics

Objective:

To plot the torque, current, efficiency, input power, speed, and power factor against the motor power output

Apparatus:

Suitable ranges of he following instruments:

1 A.C ammeter
1 A.C Voltmeter
1 DC voltmeter
3 DC ammeters
Rheostat
Resistive load
Speedometer

Theory:

The operating characteristics of single-phase induction motor are less satisfactory than those of the polyphase induction motor. Its main drawbacks are lack of starting torque, reduced power factor and low efficiency. The torque speed characteristics of different types of single-phase induction motors are shown in FIG.1. The starting torque is higher in split-phase motor as compared to shaded pole. The use of capacitor gives even greater starting torque, as shown in FIG.1 (c). If the capacitor is removes the speed -torque curve would be as shown by the dotted line.

Procedure:

1. Make the connections as shown in FIG.2
2. The shaft of the motor should be connected to a DC generator for loading purposes.
3. Run the induction motor by connecting to a single-phase supply of rated voltage & frequency.
4. Load the motor through the shunt generator by means of the resistive load in steps and take observations in the following tabular form in steps of 10%,25%,50%,75%,100%,110%,

Observations:

Armature resistance, Ra =
Shunt field resistance, Rsh =

Motor side						Generator side		
S. No.	Speed N (rpm)	Motor input Voltage,V1 (V)	Input current, I1(A)	Input Power W1	Power factor, Cosϕ = W1 /V1.I1	Output voltage, V2(V)	Output current, I2(A)	Output Power V2I2 (W)
1	2	3	4	5	6	7	8	9

(Observation table continued)

Generator side					Motor		
Field current, Ish(A)	Armature current, Ia(A)	Shunt field loss , Ish^2Rsh(W)	Armature loss ,Ia^2Ra (W)	Constant iron loss(Gen.),Wi (W)	Motor output, Pm = sum of 9+12+ 13+14 (W)	Motor efficiency =Pm(15)/ W1(5)	Motor torque,T= 60Pm/2πN (N-m)
10	11	12	13	14	15	16	17

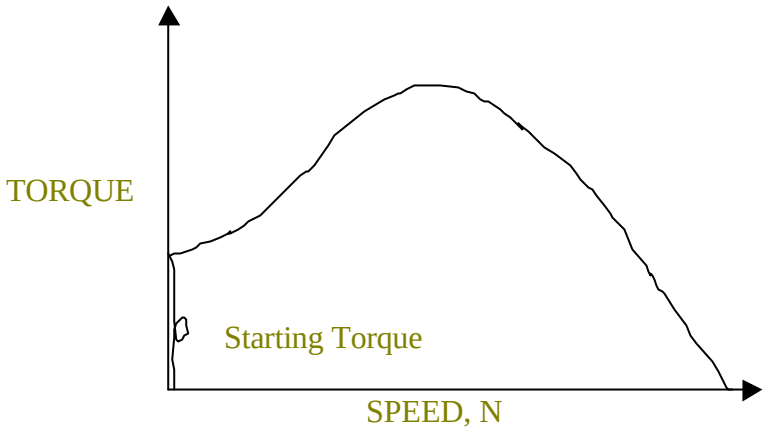
5. Constant iron loss of DC generator Wi is as recorded in column 14 is estimated in the following way:
Decouple the generator and find out motor intake under no load condition (i.e. Motor lightly loaded)
Iron loss, Wi = (Motor intake when generator coupled and unloaded)-(motor intake when generator decoupled) - Shunt field loss (W)

Report:

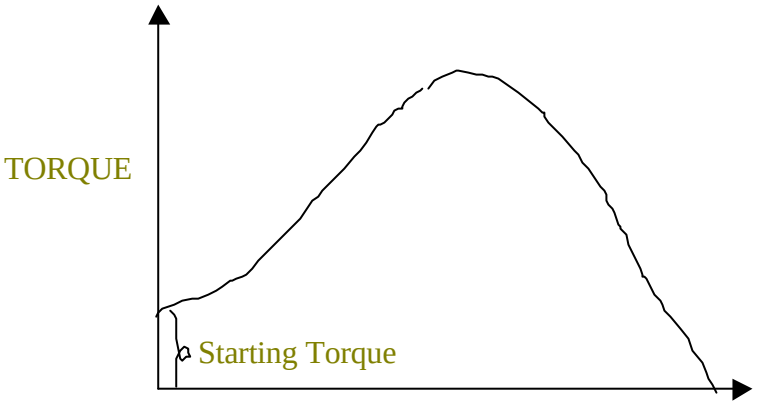
Plot motor torque, current, efficiency, input power, and speed and power factor against power output of the motor.

1. Why single - phase motors are not self-starting?
2. Why the starting torque is less in split-phase motor than in capacitor motor and is further less in shaded-pole type?

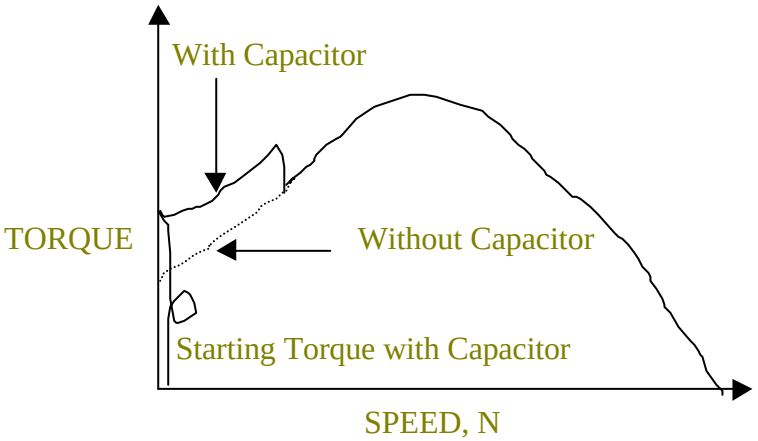
FIG.1



(a) Shaded Pole

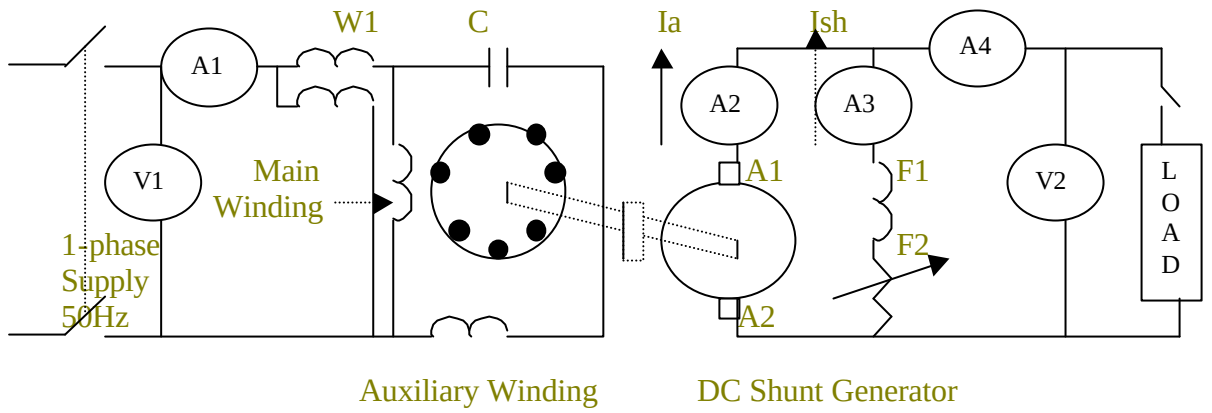


(b) Split-phase



(c) Capacitor -Start

FIG.2


W1
C
Ia
Ish
A4
A1
A2
A3
V1
Main
Winding
A1
F1
V2
L
O
A
D
1-phase
Supply
50Hz
F2
A2
Auxiliary Winding
DC Shunt Generator