Experiment –1
Brake Test on a Slip Ring Induction Motor

Objective:
To perform the brake test on a 3-ϕ slip ring induction motor and obtain its performance characteristics.

Nameplate details:
AC slip ring induction motor

	Stator	Rotor
Voltage	415V	200v
Current	7.5A	11.0A
Winding	Star	Star
Power	5.0 h.p	
Speed	1440 r.p.m	

Apparatus:

Voltmeter 0-300V ac digital	01
Ammeter 0-10A ac digital	01
Wattmeter 0-5KW digital	01
Tachometer 0-9999rpm digital	01

Theory:

The slip ring induction motor consists of two main parts. They are stator and rotor.

Stator: It is a star connected 3- ϕ winding. Each phase winding is separated by 120^0 electrical. degrees. 3- ϕ supply is connected to the stator, it produces a rotating magnetic field in the stator core.

Rotor: It is also a star connected 3- ϕ winding and wound for the same number of poles as the stator. Its external terminals are short-circuited. Due to the relative speed between the rotating flux in the stator and the stationary flux in the rotor. The rotor rotates nearer to the synchronous speed maintaining a low slip.

The synchronous speed of the rotating flux in the stator $N_s = \frac{120f}{P}$

Where 'f is the supply frequency in Hz and 'P' is the number of poles.

Slip: It is the relative speed of the rotor with respect to synchronous speed of the rotating magnetic field.

$$\text{Percent Slip} = \frac{(Ns - N)}{Ns} X100$$

Torque $\tau = 9.81(\tau_1 - \tau_2)$. R, Where R is at the radius of the brake drum.

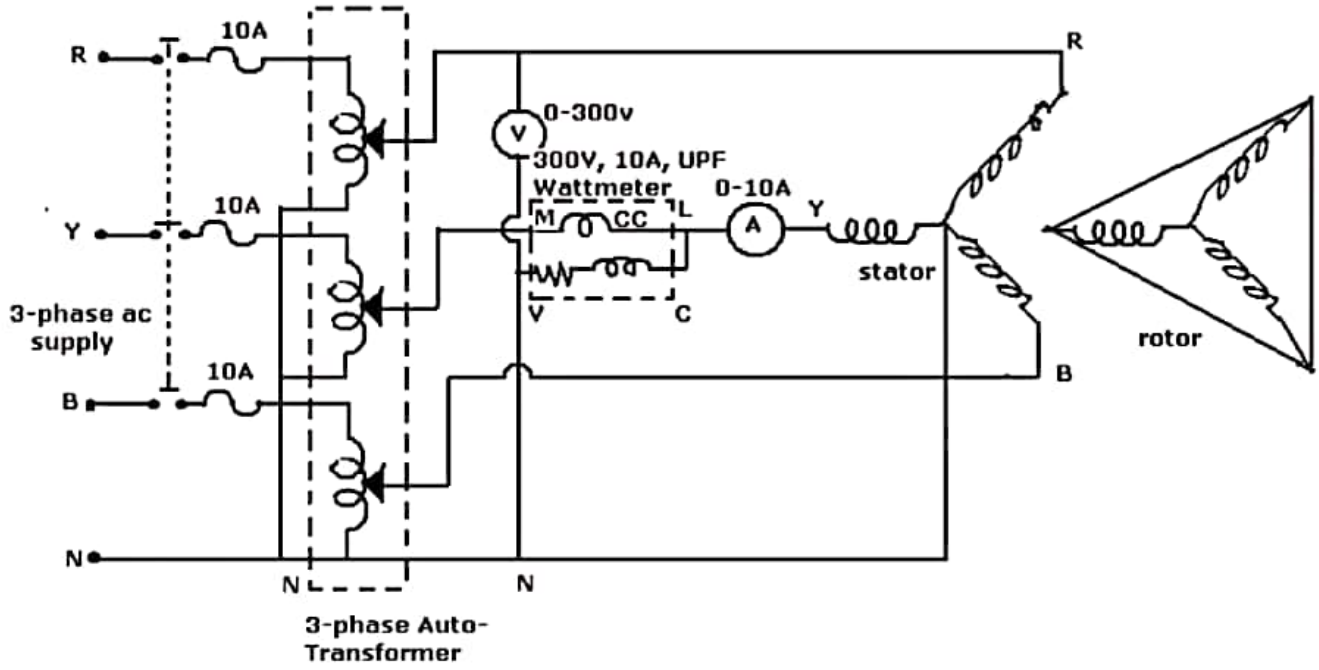
$$\text{Output} = \frac{2\pi N\tau}{60} watts$$

$$\%\eta = \frac{output}{input} x100$$

$$\text{Power factor} = \cos\phi = \frac{Pph}{Vph.Iph}$$

(Where 'P_{ph}' is the input power per phase)

Circuit Diagram:



Procedure:

* Connect the circuit diagram as shown in the fig 4.1
* Keep the 3-ϕ auto transformer at zero voltage position.
* Loosen the rope on the brake drum and set the tension meters at zero position.
* Switch - ON the motor and increase the auto - transformer gradually till the voltmeter reads the rated phase voltage 230V.
* Note down the readings of the voltmeter, ammeter, tachometer, spring balances and wattmeter readings at no-load.
* Now increase the load gradually by tightening the rope till the ammeter reads the rated current. Pour some water inside the break drum for cooling.
* Note down V_{ph}, I_{ph}, P_{ph}, T_1, T_2 and speed.
* Switch – OFF the supply and adjust the 3-ϕ auto - transformer at zero position.

Sample Observations: N_s = 1500 rpm

S.No.	V_{ph} (Volts)	I_{ph} (amp)	$P_{ph}=W_0$ (KW)	N (rpm)	T_1 (Kg)	T_2 (Kg)	P_{in}(kw) =3 P_{ph}
1	241	4.17	0.16	1409	0	0	0.48
2	241	4.27	0.26	1403	1.75	0	0.78
3	241	4.4	0.39	1391	3.2	0	1.17
4	241	4.5	0.46	1387	4.1	0	1.38
5	241	4.71	0.57	1381	5.8	0	1.71
6	241	4.9	0.64	1373	6.4	0	1.92
7	241	5.05	0.72	1367	7.4	0	2.16
8	241	5.66	0.90	1356	9.8	0	2.7
9	241	6.0	0.99	1356	10.8	0	2.97

Practical Observations:

S.No	V_{ph}(V)	I_{ph}(A)	$P_{ph}=W_0$(KW)	N(rpm)	T_1(Kg)	T_2(Kg)	P_{in}(Kw)=3P_{ph}

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Sample Calculations:

$\tau = 1.5 \times (T_1 - T_2)$ (N-m)	$\omega = \frac{2\pi N}{60}$	$P_{out} = \tau \times \omega$ (K watts)	$\%\eta = \frac{P_{out}}{P_{in}} \times 100$	$\cos\phi = \frac{W_o}{VI}$
0	0	0	0	0.15921
2.625	147.55	0.387	49.615	0.25266
4.8	146.9	0.705	60.25	0.367786
6.15	145.66	0.8958	64.9	0.4242
8.7	145.25	1.2636	73.9	0.5022
9.6	144.62	1.388	72.33	0.542
11.1	43.152	1.588	73.51	0.592
14.7	141.99	2.087	77.3	0.6598
16.2	141.99	2.30	77.4	0.685

Practical Calculations:

$\tau = 1.5 \times (T1 - T2)$ (N-m)	$\omega = \frac{2\pi N}{60}$	$Pout = \tau \times \omega$ (K watts)	$\%\eta = \frac{Pout}{Pin} \times 100$	$Cos\phi = \frac{Wo}{VI}$

Graph:

Draw the graph for

(i) I_{ph} Vs τ (ii) I_{ph} Vs η (iii) I_{ph} Vs N (iv) I_{ph} Vs slip

Conclusion:

The performance characteristics of the slip ring induction motor are drawn from the readings obtained from the brake test.