KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Electric Engineering Department

EE 306   Electric Energy Engineering - Experiment#8

Torque Speed Characteristics of 3Φ Induction Motors

Objectives:

1. To determine the torque speed characteristics.
2. To determine slip-torque characteristics.
3. To observe variation of efficiency.

APPARATUS:

1 3Φ induction motor
1 Prony brake
2 Wattmeters
1 3Φ variable power supply
1 Tachometer
1 Single pole switch
1 Digital Torquemeter

Theory:

The slip of an induction motor is defined as

$$s = \frac{n_s - n_r}{n_s}$$

where

n_s is the synchronous speed
n_r is the rotor speed

The efficiency of the motor is calculated from the ratio of the output mechanical power to input electrical power as

$$\eta = \frac{P_{out}}{P} x100\%$$

Procedure:

1. Record the rated values of the induction motor. Note the synchronous speed.
2. Couple the induction motor to the prony brake as shown in fig.1, adjust the prony brake belt so that it is not very tight.
3. Connect the two wattmeters to read the total power.
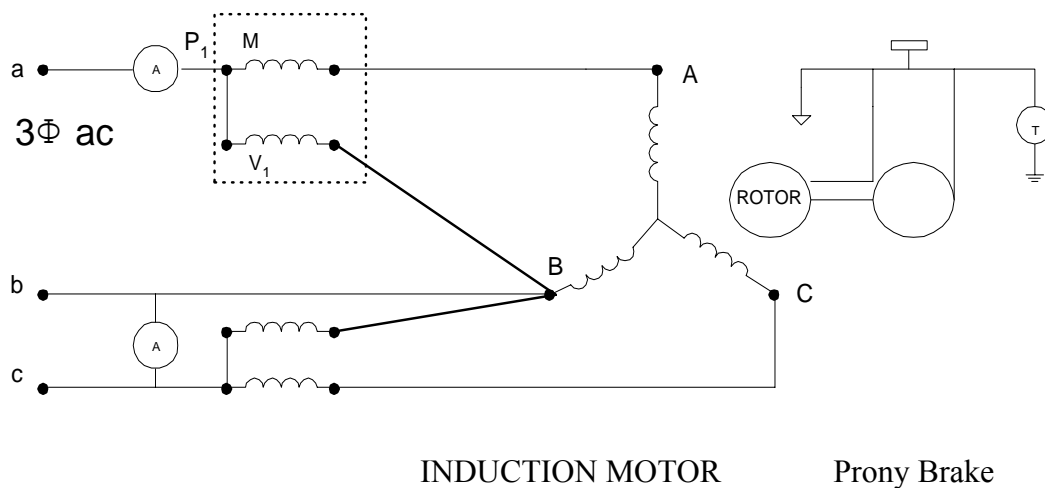4. Start the motor and perform a load to 5 Nm in steps of 0.5 Nm.

INDUCTION MOTOR   Prony Brake

Fig.1: Connection of 3Φ Induction Motor

5. Prepare a table similar to table.1 on a separate sheet of paper. Record the motor speed n (rpm) and load T(Nm) and the wattmeter readings P_1 and P_2 (watts).

Report

1. Calculate the total input power, the slip and the output power for each reading.

$$P_{out} = 2 (\pi / 60) Tn \quad \text{watts}$$
$$\text{Slip } s = (n_s - n) / n_s$$

$$n_s = 1800 \text{ rpm (syn. Speed)}.$$

2. Plot torque vs speed and torque vs slip.
3. Calculate efficiency of the motor and enter it in table.1.
4. Plot efficiency vs torque.
5. Find maximum torque and slip conditions.

Table.1

Torque-T	Speed	P₁	P₂	P_total (P₁+P₂)	Slip	P_out (watts)
0.0						
0.5						
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0						
4.5						
5.0						