Fakulti:	FAKULTI KEJURUTERAAN ELEKTRIK	
Nama Matapelajaran : MAKMAL TAHUN TIGA UMUM Kod Matapelajaran : **SKEE 3732**	Semakan Tarikh Keluaran Pindaan Terakhir No. Prosedur	: **1** : **Sept 2013** : **August 2013** : **PK-UTM-FKE-(O)-08**

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FAKULTI KEJURUTERAAN ELEKTRIK
UNIVERSITI TEKNOLOGI MALAYSIA
KAMPUS SKUDAI
JOHOR

SKEE 3732
BASIC MACHINE LABORATORY
(Experiment 1)
INDUCTION MACHINE

Disediakan oleh: PEDG members	
1. Prof Dr. Abdul Halim Mohd Yatim 2. P.M. Dr Awang Jusoh 3. P.M. Dr Azhar Khairudin 4. P.M. Dr Naziha Ahmad Azli 5. P.M. Dr Nik Rumzi Nik Idris 6. Dr Mohd Junaidi Abdul Aziz 7. Dr Mohd Rodhi Sahid 8. Dr Shahrin Md Ayob 9. Dr Tan Chee Wei 10. En Abd. Jaafar Shafie. 11. En Mohd Zaki Daud 12. En Nik Din Mohamad	Tandatangan P.A.M: Cop: Tarikh: Disahkan oleh: Tandatangan K.J.: Cop: Tarikh:

Recommended References:

i. P.C. Sen, *'Principles of Electric Machines and Power Electronics'*, 2nd Edition, John Wiley and Sons

Name:
Group:
Date:

I. PRELIMINARY EXERCISE SET A. (15 marks)

1. What is the different between rotor speed and synchronous speed?
[3 marks]

2. Sketch the simplified equivalent circuit of induction motor during the no load test. Label all the circuit parameters.
[4 marks]

3. Sketch the simplified equivalent circuit of induction motor during the block rotor test. Label all the circuit parameters.
[4 marks]

4. Sketch the power flow diagram of an induction machine.
[4 marks]

Name:
Group:
Date:

II. PRELIMINARY EXERCISE SET B. (15 marks)

1. What is the purpose of performing no load test and block rotor test?

[3 marks]

2. Sketch the IEEE-recommended per phase equivalent circuit of an induction motor.

[4 marks]

3. What is slip? Write the expression for slip.

[4 marks]

4. Given the slip, s = 4%, supply frequency, f = 50 Hz, number of poles, p = 4, determine the rotor speed.

[4 marks]

Name:
Group:
Date:

III. PRELIMINARY EXERCISE SET C. (15 marks)

1. What is slip? Write the expression for slip.

[4 marks]

2. Sketch and state the relationship between line voltage, phase voltage, line current, phase current and three-phase power for three phase delta connection load.

[7 marks]

3. Sketch the IEEE-recommended per phase equivalent circuit of an induction motor.

[4 marks]

Kertas Ujikaji Makmal Mesin Asas SKEE 3732 *http://fke.utm.my/makmal/mesin*

INDUCTION MOTOR

Fakulti Kejuruteraan Elektrik Universiti Teknologi Malaysia

INDUCTION MOTOR

Objectives

1. To obtain the IEEE equivalent circuit of an induction motor.
2. To study the characteristics of a three phase induction motor.

Introduction

The induction motor is one of ac machines, in which there are alternating currents in both stator and rotor windings. The alternating current is supplied directly to the stator winding and by induction, i.e. transformer action, to the rotor winding. The rotor may be either squirrel-cage or wound-rotor types. You are required to study:

> P. C. Sen, Principles of Electric Machines and Power Electronics, Second Edition, Chapter 5. Pp 207-233.

Procedure

In this laboratory, there are four experiments need to be performed.

A. Stator resistance and dc generator armature resistance measurement

Make sure all supplies are switched off. Measure the resistance between any two stator terminals of induction motor. Obtain the average dc resistance per stator phase. Then measure the dc generator armature resistance.

B. No load test

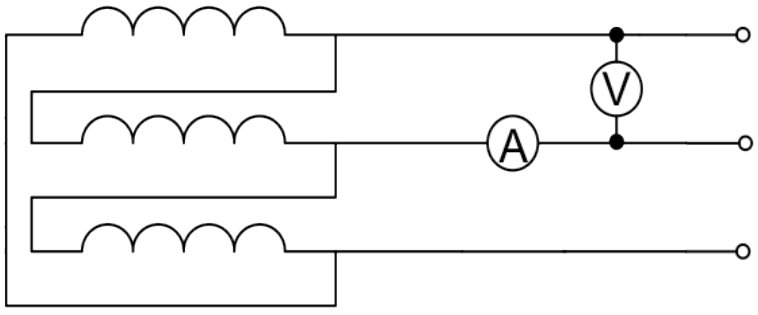

Figure 2. Stator circuit for no-load and blocked-rotor tests.

Figure 3: NanoVIP Plus Wattmeter

Make sure all supplies are switched off. Do the circuit connection as shown in Figure 2 and measure the power using the wattmeter shown in Figure 3 (search the user manual from internet). Make sure that the induction motor is connected to a 415 V, 50 Hz, 3-phase supply through the circuit breaker, push button starter and variac transformer.

ASK THE LAB SUPERVISOR/TECHNICIAN TO VERIFY YOUR CIRCUIT CONNECTION BEFORE YOU PROCEED

Start the motor using the supply from the variac transformer by slowly increasing to its rated voltage (415 V) and then record the readings of the voltage V_{NL}, current I_{NL} and power P_{NL}.

C. Blocked-rotor test

Make sure all supplies are switched off. Block the rotor of induction motor. **Slowly** increase the current to its rated value by increasing the supply voltage and then record the readings for the voltage V_{BL}, current I_{BL} and power P_{BL}.

(CAUTION: DO NOT EXCEED ITS RATED CURRENT, YOU WILL GET ZERO MARK)

D. Load test

Make sure all supplies are switched off and unblock the rotor. Use the stator winding delta-connected as shown in Figure 2, and connect the dc generator as a compounded generator. Then connect the resistance load from the resistor bank to the output of the dc generator.

ASK THE LAB SUPERVISOR TO VERIFY YOUR CIRCUIT CONNECTION BEFORE YOU PROCEED

Run the induction motor by increasing the supply voltage gradually until it reaches 415 V. By increasing the armature (load) current from 0 until the rated current (refer the dc generator spec.) in steps of around 1 A while at the same time maintain the 220 V load voltage. Record the readings for stator current, armature current, input power and speed of induction motor.

Data analysis

1. Determine the parameters of the IEEE-recommended equivalent circuit of induction motor based on the results obtained from no-load test (415 V) and blocked-rotor test (rated current).

2. Using the parameters obtained in 1 and from measurement of the dc resistance of the stator winding, draw the per-phase IEEE-recommended equivalent circuit of the induction motor.

For long report.

1. In your own words, explain the production of rotating magnetic flux.
2. Sketch the IEEE recommended equivalent circuit and write down values of all parameters for of induction motor.
3. Based on the results of the load test. Plot the speed, input power, power factor and efficiency as a function of mechanical output power (alternatively - armature current). Analyze the plot and discuss the effect if the load is higher than the motor power rating.

4. What is the function of dc generator in this experiment?

5. Given that the slip, s = 4%, at rated voltage, calculate the efficiency of the motor.