TKE213103

Electric Machinery 1

Mesin Listrik 1

BASIC INFORMATION

Course Credit	2 / 100 minutes per Week
Course Type	Required
Course Classification	Engineering Topics
Prerequisites	AC and DC Circuits Analysis; Classical Mechanics; Fluid, Heat, and Waves; Electricity and Magnetism

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Development of Engineering Solution (KP.2) Engineering Design (KP.3)

Learning Outcomes

LO1 Students are able to understand the basic principles, the physical construction, mathematical model and calculations, and practical implementations of DC machines.

LO2 Students are able to understand the basic principles, the physical construction, mathematical model and calculations, and practical implementations of transformers.

COURSE DESCRIPTION

This course studies the fundamental principle, the physical construction, mathematical model and calculations, and practical implementations of DC machines and transformers.

TOPICS

1. Fundamental of electricity and magnetism

1.1 Sinusoidal voltage and phasor representation
1.2 Magnetic field intensity and flux density
1.3 B-H curve, residual flux, hysteresis
1.4 Faraday's law
1.5 Voltage induced in a conductor
1.6 Lorentz force
1.7 Linear DC machine

2. Fundamental of mechanics and heat

2.1 Force
2.2 Torque
2.3 Mechanical work
2.4 Power
2.5 Transformation of energy
2.6 Kinetic energy

2.7 Torque, inertia, and change in speed
2.8 Speed of a motor/load system
2.9 Power flow in a mechanically coupled system
2.10 Motor driving a load having inertia
2.11 Electric motors driving linear motion loads
2.12 Heat

3. DC machinery fundamentals

3.1 A simple rotating loop between curved pole faces
3.2 Commutation in a simple four-loop DC machine
3.3 Commutation and armature construction in real DC machine
3.4 Problems with commutation in real machines
3.5 The internal generated voltage
3.6 Construction of DC machine
3.7 Power flow and losses in DC machines

4. DC generators

4.1 Generating AC voltage
4.2 DC generator
4.3 DC vs AC generators
4.4 Induced voltage
4.5 Armature reaction
4.6 Separately excited generator
4.7 No-load operation and saturation curve
4.8 Shunt generator
4.9 Controlling the voltage of a shunt generator
4.10 Equivalent circuit
4.11 Compound generator
4.12 Construction of DC generator

5. DC motor

5.1 Counter-electromotive force
5.2 Acceleration of the motor
5.3 Mechanical power and torque
5.4 Speed of rotation
5.5 Shunt motor under load
5.6 Series motor
5.7 Compound motor
5.8 Reversing the direction of rotation
5.9 Armature reaction

6. Transformer

6.1 Practical transformer
6.2 Ideal transformer

6.3 Single phase transformer
6.4 Equivalent circuit
6.5 Perunit systems
6.6 Voltage regulation
6.7 Auto-transformer
6.8 Special transformer
6.9 Three-phase transformer

REFERENCES

[1] Chapman, Stephen J., 2005, Electric Machinery Fundamentals, 4th., McGraw-Hill
[2] Wildi, Theodore. 2002. Electrical Machines, Drives, and Power Systems, 5th., Prentice Hall