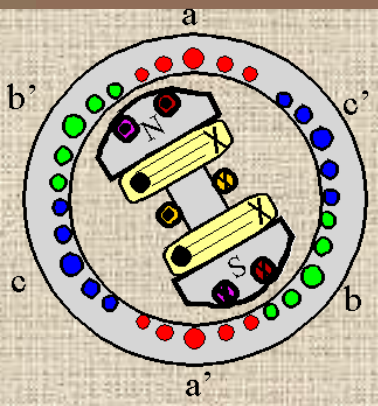
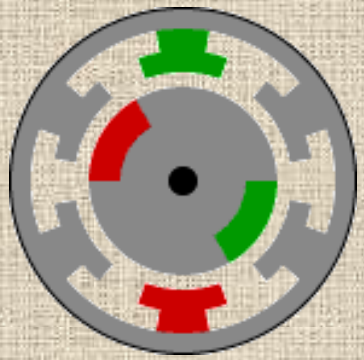
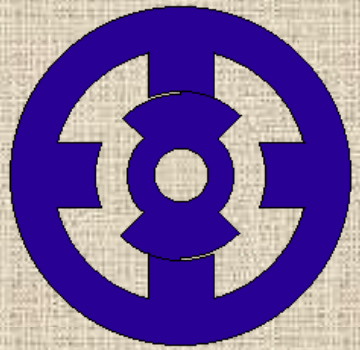
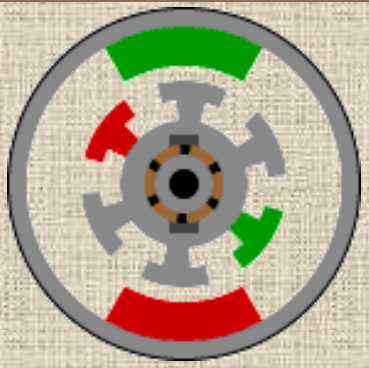
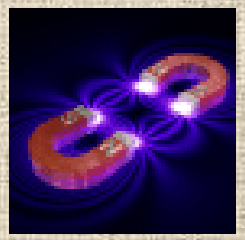




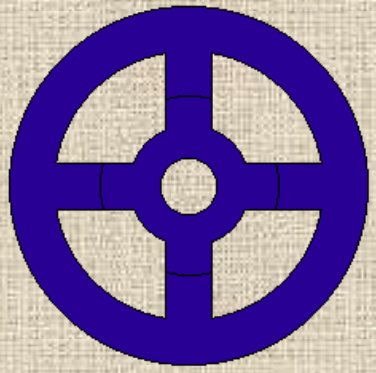


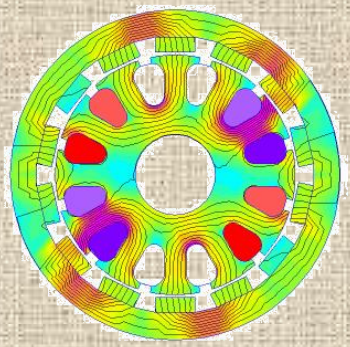


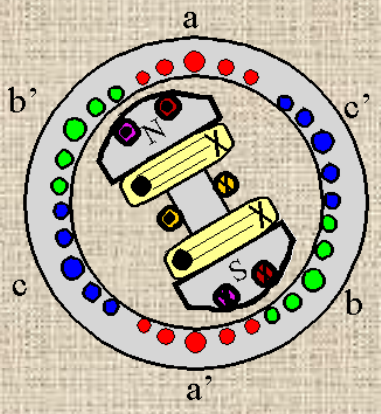
EE552 ELECTRICAL MACHINES III



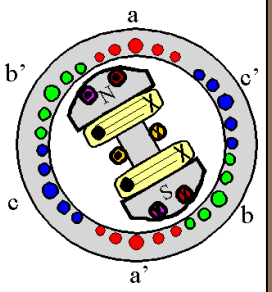
LECTURE 1



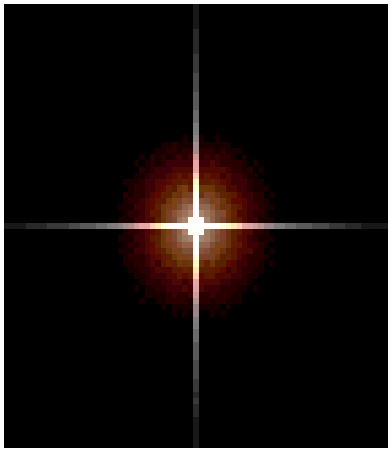




LECTURE NOTES



ELECTRICAL MACHINES III



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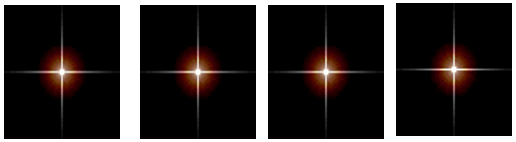
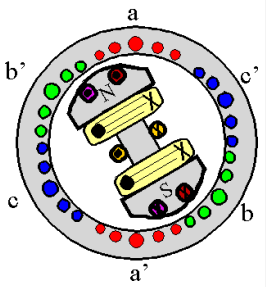


SPRING 2018

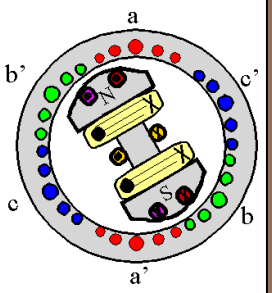
Dr : MUSTAFA AL-REFAI



END LECTURE 1

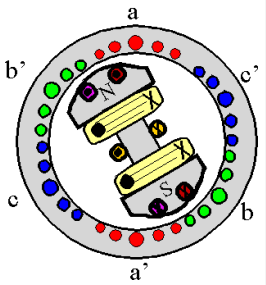
INTRODUCTION

AIMS OF THIS COURSE



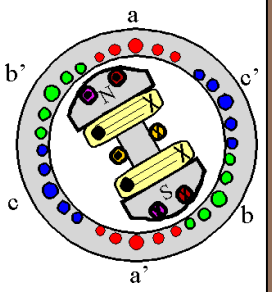
- To provide students a general knowledge on common types of electric machines.
- To provide students the basic techniques of steady-state electric machine analysis.
- To introduce the construction, and principle of action of synchronous machines.
- To introduce the equivalent circuits, characteristics, and different calculations of synchronous machine.

AIMS cont..



- To introduce physical construction of synchronous machines and To explore the students the requirement for paralleling synchronous generators and the behaviour of synchronous generators operated in parallel.
- To equip the students with basic experimental and modelling skills for synchronous machines.
- To prepare the students to apply the equivalent circuits and mathematical models of synchronous machine in different applications.
- To introduce the students the basic design consideration for synchronous machines.

Intended Learning Outcomes

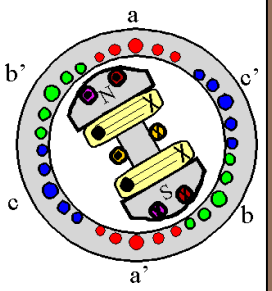


Upon completion of the subject, students will be able to:

- **Explain the construction, operating principles, performance characteristics, and applications of Synchronous machines and major types of Synchronous machines.**

- **Analyse the steady-state performance of Synchronous machines using appropriate equivalent circuit models.**

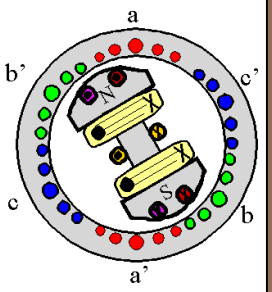
Intended Learning Outcomes cont…



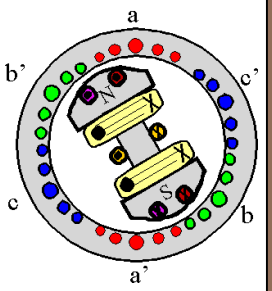
- Operate practical Synchronous machines and to conduct relevant tests and experiments.

- Present results of electric machine studies in the form of tables, graphs, and written reports.

Course Topics			WEEK
Introduction to electrical machines			1
LECTURES	CHAPTER 4 AC MACHINER FUNDAMENTALS		
1st LECTURE	4.1	A SIMPLE LOOP IN A UNIFORM MAGNETIC FIELD	1
	4.2	THE ROTATING MAGNETIC FIELD	
2nd LECTURE	4.3	MAGNETOMOTIVE FORCE AND FLUX DISTRIBUTION ON AC MACHINES	1
3rd LECTURE	4.4	INDUCED VOLTAGE IN AC MACHINES	2
	4.5	INDUCED TORQUE IN AN AC MACHINE	
4th LECTURE	4.6	WINDING INSULATION IN AN ACMACHINE	3
5th LECTURE	4.7	AC MACHINE POWER FLOWS AND LOSSES	4
	4.8	VOLTAGE REGULATION AND SPEED REGULATION	
	4.9	SUMMARY	
	CHAPTER 5 SYNCHRONOUS GENERATORS		
6th LECTURE	5.1	SYNCHRONOUS GENERATOR CONSTRUCTION	4
7th LECTURE	5.2	THE SPEED OF ROTATION OF A SYNCHRONOUS GENERATOR	5
8th LECTURE	5.3	THE INTERNAL GENERATED VOLTAGE OFASYNCHRONOUSGENERATOR	5
9th LECTURE	5.4	THE EQUIVALENT CIRCUIT OF A SYNCHRONOUS GENERATOR	6
10th LECTURE	5.6	THE PHASOR DIAGRAM OF A SYNCHRONOUS GENERATOR	6
11th LECTURE	5.7	POWER AND TORQUE IN SYNCHRONOUS GENERATORS	7
12th LECTURE	5.8	MEASURING SYNCHRONOUS GENERATOR MODEL PARAMETERS	7
13th LECTURE	5.9	THE SYNCHRONOUS GENERATOR OPERATING ALONE	8
14th LECTURE	5.10	PARALLEL OPERATION OF AC GENERATORS	8
15th LECTURE	5.11	SYNCHRONOUS GENERATOR TRANSIENTS	9
16th LECTURE	5.12	SYNCHRONOUS GENERATOR RATINGS	9
	5.13	SUMMARY	10
	CHAPTER 6 SYNCHRONOUS MOTORS		
17th LECTURE	6.1	BASIC PRINCIPLES OF MOTOR OPERATION	10
18th LECTURE	6.2	STEADY-STATE SYNCHRONOUS MOTOR OPERATION	11
19th LECTURE	6.3	STARTING SYNCHRONOUS MOTORS	11
20th LECTURE	6.4	STARTING SYNCHRONOUS MOTORS	12
21th LECTURE	6.5	SYNCHRONOUS GENERATORS AND SYNCHRONOUS MOTORS	12
	6.6	SUMMARY	



Text Book



ELECTRIC
MACHINERY
FUNDAMENTALS

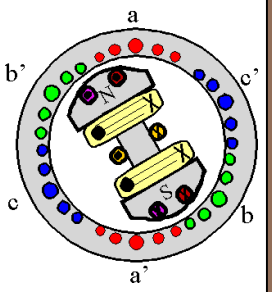
FOURTH EDITION

Stephen J. Chapman
BAE SYSTEMS Australia

Higher Education

Boston Burr Ridge, IL Dubuque, IA Madison, WI New York
San Francisco St. Louis Bangkok Bogota Caracas Kuala Lumpur
Lisbon London Madrid Mexico City Milan Montreal New Delhi
Santiago Seoul Singapore Sydney Taipei Toronto

References



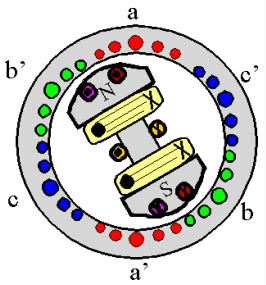
- **The following book can be used as further reference for this course,**

Electric Machinery

Sixth Edition

A. E. Fitzgerald
Late Vice President for Academic Affairs
and Dean of the Faculty
Northeastern University
Charles Kingsley, Jr.
Late Associate Professor of Electrical
Engineering, Emeritus
Massachusetts Institute of Technology
Stephen D. Umans
Principal Research Engineer
Department of Electrical Engineering and
Computer Science
Laboratory for Electromagnetic and
Electronic Systems
Massachusetts Institute of Technology

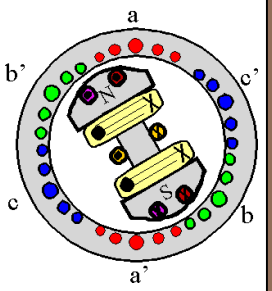
Mc Graw Hill



Tests

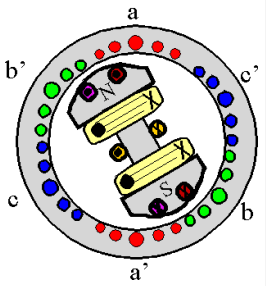
- Three (3) tests are scheduled. Each test has theoretical questions and problems.
  - The dates of the tests are:
  - FIRST TEST WILL BE HELED DURING FIRST LECTURE ON THE FIRST EXAM WEEK
  - SECOND TEST WILL BE HELED DURING FIRST LECTURE ON THE SECOND EXAM WEEK

Introduction To Ac Machines



Classification of AC Rotating Machines

- **Synchronous Machines:**
  - **Synchronous Generators : A primary source of electrical energy.**
  - **Synchronous Motors : Used as motors as well as power factor compensators (synchronous condensers).**

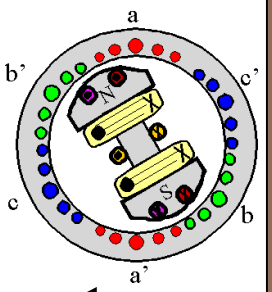


❑ Asynchronous (Induction) Machines:

- **Induction Motors : Most widely used electrical motors in both domestic and industrial applications.**

Induction Generators : Due to lack of a separate field excitation, these machines are rarely used as generators.

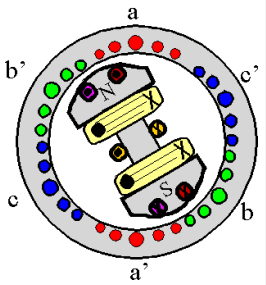
Energy Conversion



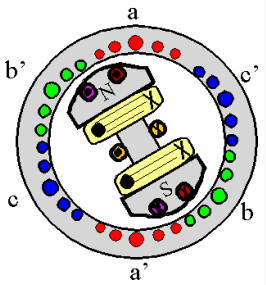
- Generators convert mechanical energy to electric energy.
- Motors convert electric energy to mechanical energy.
- The construction of motors and generators are similar.
- Every generator can operate as a motor and vice versa.
- The energy or power balance is :

– **Generator:** Mechanical power = electric power + losses

– **Motor:** Electric Power = Mechanical Power + losses.



PresenterMedia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END OF LECTURE 1