

Faculty of Engineering & Technology

Special Electrical Machines

Information :

Course Code : EPR 542

Level : Undergraduate

Course Hours : 3.00- Hours

Department : Specialization of Electrical Power Engineering

Instructor Information :

| Title | Name | Office hours |
|--------------------|----------------------------------|--------------|
| Professor | Hany Mohamed Hasanien Mohamed | 2 |
| Assistant Lecturer | Mohamed Abdallah Mahmoud Shaheen | 1 |
| Teaching Assistant | Abeer Tharwat Said Awad | 4 |

Area Of Study :

Upon successful completion of the course, the student should be able to:

- Develop the students' knowledge about the construction, theory of operation, equivalent circuit, develop voltage, current, power and torque equations, and basic characteristics of single- and two-phase induction motors.
- Develop the students' knowledge about the construction, theory of operation, and basic characteristics of universal motors, control motors, and variable speed synchronous motor drive systems.
- Develop the students' knowledge about the construction, theory of operation, equivalent circuit, develop voltage, current, power and torque equations, and basic characteristics of: reluctance; permanent magnet; stepper, and brushless dc motors;
- Train students to perform experiments on performance of the previous machines.

Description :

two-phase induction motors, windings and connections. Methods of starting of single-phase induction motors: Split phase motors; Capacitor-start motors; Two-value capacitor motors. Shaded pole motors: Construction and operation. Universal motors. Control motors. Synchronous motors, variable speed drive system. Reluctance motors; Permanent magnet motors. Stepper motors. Selecting motors for required operations.

Course outcomes :

a.Knowledge and Understanding: :

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| 1 - | Demonstrate the construction theory of operation, equivalent circuit, and characteristics of single- and two-phase motors |
| 2 - | Describe the starting methods and speed control of single-phase induction motors. |
| 3 - | Demonstrate the construction theory of operation, equivalent circuit, and characteristics of universal motors, control motors, and servo motors. |
| 4 - | Demonstrate the theory of operation, equivalent circuit, and characteristics of synchronous motors, and performance of variable speed synchronous motor drive systems. |
| 5 - | Develop equivalent circuit, and voltage, current, power and torque equations, and basic characteristics of reluctance, permanent magnet, stepper, and brushless dc motors. |

b. Intellectual Skills: :

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| 1 - | Analyze operating conditions of single- phase and two-phase induction motors. |
| 2 - | Analyze operating conditions of single- phase and two-phase induction motors. |
| 3 - | Evaluate the performance of universal motors, control motors, and servo motors. |
| 4 - | Evaluate the performance of synchronous motors, and variable speed synchronous motor drive systems. |
| 5 - | Evaluate the performance of reluctance, permanent magnet, stepper, and brushless dc motors.. |

c. Professional and Practical Skills: :

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| 1 - | MATLAB simulations or research report on a topic assigned by the course instructor. |
| 2 - | Implement an experimental set-up to evaluate the load characteristics a single-phase induction motor. |

d. General and Transferable Skills: :

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| 1 - | Work coherently and successfully as a part of a team in the Lab. |
| 2 - | Work in stressful environment and within constraints. |
| 3 - | Communicate effectively. |
| 4 - | Manage tasks, time, and resources effectively. |

Course Topic And Contents :

| Topic | No. of hours | Lecture | Tutorial / Practical |
|--|--------------|---------|----------------------|
| Revision of 3-ph induction motors and synchronous machines. | 4 | 3 | 1 |
| Construction, theory of operation, equivalent circuit, and characteristics of single-phase and two-phase motors. | 4 | 3 | 1 |
| Starting methods and speed control of single-phase induction motors. | 8 | 6 | 2 |
| Construction, theory of operation, equivalent circuit, and characteristics of universal motors, control motors: DC and AC tachometers, and servo motors. | 4 | 3 | 1 |
| Characteristics and performance of synchronous motors and variable speed synchronous motor drive systems. | 8 | 6 | 2 |
| Reluctance motors: Construction, theory of operation, equivalent circuit, governing equations, and characteristics. | 8 | 6 | 2 |
| Permanent magnet motors: Construction, theory of operation, equivalent circuit, governing equations, and characteristics. | 8 | 6 | 2 |
| Stepper motors: Construction, theory of operation, equivalent circuit, governing equations, and characteristics. | 8 | 6 | 2 |
| Brushless dc motors: Construction, theory of operation, equivalent circuit, governing equations, and characteristics. | 4 | 3 | 1 |
| Testing of single-phase induction motor. | 4 | | 4 |

Teaching And Learning Methodologies :

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| Interactive Lecturing |
| Discussion |
| Problem solving |
| Report |

Experiential learning

Course Assessment :

| Methods of assessment | Relative weight % | Week No | Assess What |
|--------------------------|-------------------|---------|-------------|
| • Final exam | 40.00 | | |
| o assignment | 10.00 | | |
| o In Class Quizzes | 10.00 | | |
| o Mid-Term exams | 30.00 | | |
| o Report(s)/computer Lab | 10.00 | | |

Recommended books :

1. Chapman, S. J., "Electric Machinery fundamentals", McGraw Hill Co., 5th edition, 2006 (Text Book).
2. M. E. El-Hawary, "Principles of Electric Machines with Power Electronic Applications", Wiley-IEEE Press, 2nd Edition, 2002.
3. Theodore Wildi, "Electric Machines, Drives and Power Systems", Prentice Hall, 6th Edition, 2006.