G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE
(For Women)

(AUTONOMOUS)
Shaikpet, HYDERABAD - 500 104

II Year B.Tech.EEE I-Semester

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ELECTRICAL MACHINES-I

Prerequisites: Basic Electrical Engineering

Course Objectives:

1. To Introduce the concepts of magnetic circuits.
2. To Impart knowledge on working and applications of DC machines.
3. To gain an understanding on analysis and performance of DC Machines and Transformers.

Unit 1: (~8 Lecture Hours)

Electromagnetic force and torque

Linear and Nonlinear magnetic circuits; Energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency.

Unit 2: (~10 Lecture Hours)

DC Machines – Principle & Operation

Principle of operation of Generator and Motor – construction of DC machine- Function of commutator – armature winding –EMF equation – Torque equation – Armature reaction – Cross magnetizing and de-magnetizing AT/pole-compensating winding –commutation – reactance voltage –methods of improving commutation.

Unit 3: (~10 Lecture Hours)

DC Machines –Characteristics & Testing

Armature circuit equation for motoring and generation, Types of field excitations -separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control methods. Losses, Efficiency- Testing of DC machines - direct, Indirect and regenerative tests, field's test, separation of losses test, retardation test, Hopkinson's Test.

Unit 4: (~10 Lecture Hours)

1-ϕ Transformers:

Principle of operation, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses;

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13) G.Reddy

Autotransformers - construction, principle of operation applications - comparison with two winding transformer.

Unit 5: (~8 Lecture Hours)

3-ϕ Transformers:

Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of transformers, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, Open delta connection, three-phase to six-phase conversion, Tap-changing transformers -No-load and on-load tap-changing of transformers, Three-winding transformers.

Text Books:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. J.B. Gupta" Theory & Performance of Electrical Machines" Published by S.K. Kataria& Sons, Latest edition.
3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984. 6. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of magnetic circuits.
2. Understand the operation and control of dc machines.
3. Analyze the differences in operation of different dc machine configurations.
4. Analyze single phase and three phase transformers circuits.
5. Identify proper type of motors suitable for a given application.
6. Extend the concepts of single phase transformer in fabricating and analyzing various configurations of three phase transformer.

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