ELECTRICAL MACHINES – I

Course Code: 15EE1102

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Prerequisites:

Network Analysis-I

Course Outcomes:

At End of course, a student will be able to

CO 1 Distinguish between different types of transformers and compute their equivalent circuit parameters.

CO 2 Determine the performance of characteristics Transformers by conducting different tests.

CO 3 Outline different types of electromechanical energy conversion and determine dynamic equation for rotating machines.

CO 4 Identify and Define different types of dc generators, interpret their performance under different load conditions.

CO 5 Describe the construction and working principle of various types of DC motors.

UNIT-I

TRANSFORMERS

Constructional details of core and shell type transformers – Types of windings – Principle of operation – emf equation – Transformation ratio – Transformer on no-load – Parameters referred to HV / LV windings – Equivalent circuit – Transformer on load – Efficiency and Regulation Effect of variations of frequency & supply voltage on iron losses, Auto transformer, comparison with two winding transformers.

UNIT-II
PARALLEL OPERATION &TESTING OF TRANSFORMERS

Parallel operation of single phase transformers – Poly phase connections - Y/Y, Y/$\triangle$, $\triangle$/Y, $\triangle$/$\triangle$ $\triangle$and open $\triangle$, Third harmonics in phase voltages three phase transformers.

Testing of transformers – Polarity test, load test, open circuit and short circuit tests, Scott connection – All day efficiency.

UNIT-III
BASIC CONCEPTS OF ROTATING MACHINES

EMF induced in DC machine-wave shape of induced EMF - flux distribution curve, direction of induced EMF-force on conductor carrying current-power developed by armature-torque developed by armature-the laws of the magnetic circuit-units-relative permeability-magnetization curves for iron-magnetic circuit of dc machine.

UNIT-IV
DC GENERATORS

Constructional details– Armature Reaction – methods to Reduce Armature Reaction - commutation – methods of Improving Commutation: Inter-pole winding Methods of excitation – Self and Separately Excited Generators – Shunt Generator- Effect of speed upon self excitation- failure of Excite-reversed polarity-Series Generator-Compound. Wound Generator-Field Windings-Calculation of Shunt Coils- calculation of Series Coils-External Characteristics of Separately Excited and Shunt Generator-Series Generator characteristics-Compound Generator Characteristics-Generator in Parallel-Equalizing Connection.

UNIT-V
DC MOTORS &TESTING OF DC MACHINES

Back EMF induced in DC motor armature-load characteristics of shunt, series, and compound motors-speed-voltage characteristics of motors- parallel operation- series operation-speed control of dc motors-Ward Leonard control

Losses – Constant & Variable losses Brake test, Swinburne's test, Retardation test and Hopkinson's test –separation of iron and friction loss- separation of hysteresis and eddy current losses.

TEXT BOOKS

1. I. J. Nagrath & D.P.Kothari, Electric Machines, Tata McGraw-Hill Publishers, 4th Edition, 2010.

2. AE Clayton and NN Hancock, *"The Performance and Design of Direct Current Machines"*, CBS Publishers, 3rd Edition, 2004.

REFERENCE:

1. M.G. Say, *"Performance and Design of A.C. Machines"*, ELBS and Pitman & Sons, 3rd Edition, 2008.