

MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

UNIT I

PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION 8

General expression of stored magnetic energy - co-energy and force/torque - example using single and doubly excited system.

UNIT II

BASIC CONCEPTS OF ROTATING MACHINES 9

Calculation of air gap M.M.F. - per phase machine inductance using physical machine data - voltage and torque equation of D.C. machine - three phase symmetrical induction machine and salient pole synchronous machines in phase variable form.

UNIT III

INTRODUCTION TO REFERENCE FRAME THEORY 11

Static and rotating reference frames - transformation relationships - examples using static symmetrical three phase R, R-L, R-L-M and R-L-C circuits - application of reference frame theory to three phase symmetrical induction and synchronous machines - dynamic direct and quadrature axis model in arbitrarily rotating reference frames - voltage and torque equations - derivation of steady state phasor relationship from dynamic model - generalized theory of rotating electrical machine and Kron's primitive machine.

UNIT IV DETERMINATION OF SYNCHRONOUS MACHINE DYNAMIC EQUIVALENT CIRCUIT PARAMETERS 8

Standard and derived machine time constants - frequency response test - analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

UNIT V SPECIAL MACHINES 9

Permanent magnet synchronous machine - surface permanent magnet (square and sinusoidal back E.M.F. type) and interior permanent magnet machines - construction and operating principle - dynamic modeling and self controlled operation - analysis of switch reluctance motors.

Total: 45

TEXT BOOKS

1. Charles Kingsley, A.E. Fitzgerald Jr. and Stephen D. Umans, 'Electric Machinery', Tata McGraw-Hill, Fifth Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modelling, Analysis and Control', Prentice Hall of India, 2001.

REFERENCES

1. C.V. Jones, 'The Unified Theory of Electrical Machines', Butterworth, 1967.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives' Clarendon Press, 1989