NIRMA UNIVERSITY
Institute of Technology
B. Tech. in Electrical Engineering
Semester – VI

L	T	P	C
3	0	0	3

Course Code	**2EEDE04**
Course Title	**Modelling of Electrical Machines**

Course Outcomes (COs):

At the end of the course, students will be able to-

1. evaluate the parameters of various electromechanical systems
2. develop mathematical model for electrical machines
3. make use of reference frame theory in electrical machines
4. examine the performance of electrical machine

Syllabus **Teaching Hours: 45**

Unit-1: Basics of Electric Machine Analysis **04**

Magnetically coupled circuits, electromechanical energy conversion, machine windings and air-gap mmf, winding inductances and voltage equations

Unit-2: Modelling of D.C Machines **05**

Elementary direct current machine, voltage and torque equations, dynamic characteristics of various dc machines, time-domain block diagrams and state equations

Unit-3: Reference Frame Theory **06**

Basic concept of reference frame, equations of transformation: change of variables, stationary circuit variables transformed to the arbitrary reference frame, commonly used reference frames, transformation between reference frames

Unit-4: Modelling of Induction Machines **12**

Voltage and torque equations in machine variables, equations of transformations for rotor circuits, commonly used reference frames, equivalent per unit model, voltage and torque equations in arbitrary reference frame variables, analysis of steady state operation, free acceleration characteristic viewed from various reference frames, mathematical model / block diagram to predict dynamic response during sudden change in load torque, concepts of computer simulation in various reference frames

Unit-5: Modelling of Synchronous Machines **12**

Voltage and torque equations in machine variables, Stator voltage equations in arbitrary reference frame variables, voltage equations in rotor reference frame variables: Park's equations, torque equations in substitute variables, rotor angle, dynamic performance during a sudden change in input torque, dynamic performance during a fault at the machine terminals

Unit-6: Modelling of Permanent Magnet Machines **06**

Introduction, voltage and torque equation in machine variables and rotor reference frame variables

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:

1. Paul C. Krause, Analysis of Electric Machinery, Tata McGraw Hill.
2. Kimbark E W, Power System Stability, Vol III, Wiley Interscience.
3. Bernard Adkins, The General Theory of Electrical Machines, Chapman & Hall Ltd.
4. R. Krishnan, Electric Motor Drives: Modeling, Analysis, and Control, Prentice Hall India.
5. Ned Mohan, Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB / Simulink, Wiley.
6. C.V. Jones, Unified Theory of Electrical Machines, Butterworth Publishers.
7. D. C. White and H. H. Woodson, Electromechanical Energy, Conversion, Tata McGraw Hill.
8. P. Kopylov, Mathematical Models of Electric Machines, Mir Publisher Moscow.
9. C. M. Ong, Dynamic Simulation of Electric Machines, Prentice – Hall, NJ
10. NPTEL Lectures / Swayam Courses by Prof. A. M. Kulkarni.
11. Recent literature, journal articles

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2020-21 and onwards