NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**B. Tech.**
Semester:	**VII**
Course Code:	4EE307IE25
Course Title:	**Advanced Electric Drive Systems**
Course Type:	**Interdisciplinary Minor - (Elective Course-II)**
Year of Introduction:	**2025 – 26**

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Course Learning Outcomes (CLOs):

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

1. comprehend purpose of electric drives and its control aspects (BL2)
2. analyse the performance of dc motor drives and ac motor drives (BL4)
3. suggest a suitable control technique for electric drives (BL4)
4. design a drive based on application. (BL6)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Selection of Motor Power Rating** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short-time, and intermittent duty, equivalent current, torque, and power methods of determination of rating for fluctuating and intermittent loads, effect of load inertia & current, environmental factors	06
Unit-II	**DC Motor Drives** Closed –loop control of DC drives, sensorless operation of DC Drives, DC Motor drives using PWM rectifiers	05
Unit-III	**Induction Motor Drives** Introduction to induction motor drives, stator voltage control of induction motor, rotor resistance control of induction motor, slip power recovery schemes, vector control of induction motor, concept and operating principle of Direct Torque Control (DTC), advantages and disadvantages of DTC based drive, VSI fed induction motor drive using DTC and its optimum switching table	15
Unit-IV	**Flux Oriented Control of Synchronous Motor** Concept and operating principle, advantages and disadvantages, performance comparison with induction motor drives, case studies	04
Unit-V	**Switch Reluctance Motor Drive** Introduction, construction and working, converter topologies, SRM drive using sensors, closed-loop speed control of SRM drive, torque pulsations in SRM drive, various methods to reduce torque pulsations.	07

Unit-VI	**Permanent Magnet Brushless Motor Drive** Fundamentals of permanent magnet brushless motors, control strategies for permanent magnet brushless motors, vector control of the permanent magnet brushless motor drive, direct torque control of permanent magnet brushless motor drive, sensorless control of permanent magnet brushless motor drive	08

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.

Tutorial Work:

This shall consist of at least 06 tutorials based on the above syllabus.

Suggested Readings:

1. G. K. Dubey, *Power semiconductor controlled drives*, Prentice-Hall.
2. P. Vas, *Vector control of AC machines*, Clarendon Press, Oxford.
3. B. K. Bose, *Modern Power Electronics & AC Drives*, Prentice-Hall.
4. R. Krishnan, *Electric Motor Drives: Modeling Analysis: Modeling, Analysis, and Control*, Pearson Education India
5. W. Leonhard, *Control of Electrical Drives*, Springer
6. N. Mohan, *Electrical Machines and Drives- A First Course*, Wiley
7. D.W. Novotny and T. A. Lipo, *Vector Control and Dynamics of AC Drives*, Clarendon Press
8. T. Wildi, *Electrical Machines, Drives and Power Systems*, Pearson Education
9. T. J. E. Miller, *Brushless PM and Reluctance Motor Drives*, Clarendon Press, Oxford.
10. Latest publications from peer-reviewed journals and renowned conferences.