# NIRMA UNIVERSITY

| | |
|---|---|
| **Institute:** | **Institute of Technology** |
| **Name of Programme:** | **B.Tech. in Electrical Engineering** |
| **Semester:** | **VII** |
| **Course Code:** | **2EEDE15** |
| **Course Title:** | **Control of Electric Drives** |
| **Course Type:** | ( □ Core/ □ Value Added Course / √ **Department Elective**/ □ Institute Elective/ □ University Elective/ □ Open Elective/ □ Any other ) |
| **Year of Introduction:** | **2021 – 22** |

**Credit Scheme**

| L | T | Practical component | | | | C |
|---|---|---|---|---|---|---|
| | | LPW | PW | W | S | |
| 3 | 0 | 0 | - | - | - | 3 |

**Course Learning Outcomes (CLOs):**

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

1. comprehend purpose of electric drives and its control aspects
2. select appropriate control strategy for given application
3. integrate schematic blocks to control electric drives
4. analyze performance of electric drives for applications concerned

**Syllabus:** **Total Teaching hours: 45**

| Unit | Syllabus | Teaching hours |
|---|---|---|
| **Unit-I** | **DC Motor Drives**<br>Closed –loop control of DC drives, sensorless operation of DC Drives, DC Motor drives using PWM rectifiers. | **04** |
| **Unit-II** | **Introduction to Induction Motor Drives**<br>Role of drive, principle of soft starting, loss minimization techniques in induction motor drives, conventional closed loop control schemes, operation of induction motor using inverters, concept of shaft voltages and bearing current and its mitigation. | **05** |
| **Unit-III** | **Field Oriented Control of Induction Motor**<br>DC drive analogy, equivalent circuit & phasor diagram, principle of vector control, rotor flux oriented control- direct flux control, indirect flux control, stator flux control, sensorless control, adaptive control. | **16** |
| **Unit-IV** | **Direct Torque Control of Induction Motor**<br>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. | **04** |
| **Unit-V** | **Flux Oriented Control of Synchronous Motor**<br>Concept and operating principle, advantages and disadvantages, performance comparison with induction motor drives, case studies and discussion on control strategies. | **03** |
| **Unit-VI** | **Switch Reluctance Motor Drive**<br>Basic of SRM working and its construction , different converter topologies for SRM ,SRM drive using sensor, various methods to | **05** |

| | | |
|---|---|---|
| | eliminate sensor and case study on sensor less SRM drive, torque pulsations and various methods to reduce torque pulsations in SRM drive. | |
| **Unit-VII** | **Permanent Magnet Brushless Motor Drive**<br>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, reduction of torque pulsations in permanent magnet brushless motor drives, parameter sensitivity of permanent magnet brushless motor drives. | **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.

**Suggested Readings/ References:**


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.


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

w.e.f. academic year 2021-22 and onwards