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|-----------------------|-------------------------------------------------------|
| <b>INSTITUTE</b>      | <b>FACULTY OF TECHNOLOGY</b>                          |
| <b>PROGRAM</b>        | <b>MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING</b> |
| <b>SEMESTER</b>       | <b>1</b>                                              |
| <b>COURSE TITLE</b>   | <b>INDUSTRIAL DRIVES</b>                              |
| <b>COURSE CODE</b>    | <b>01PE1102</b>                                       |
| <b>COURSE CREDITS</b> | <b>4</b>                                              |

**Objective:**

- 1 To introduce basic concepts of load and drive interaction, speed control concepts of ac and dc drives, speed reversal, regenerative braking aspects, design methodology

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Appreciate significance of speed-torque characteristics of electrical drives and methods to modify the characteristics
- 2 Evaluate the performance of AC Voltage Controller fed induction motor drive.
- 3 Implement VSI fed v/f controlled AC motor drive
- 4 Explain concept of Field Oriented Control of an induction motor.
- 5 Determine the speed control methods of synchronous motor based on application.
- 6 Analyse the general – and special-Purpose diode circuits

**Pre-requisite of course:**Electrical Machines, Power Electronics

**Teaching and Examination Scheme**

| <b>Theory Hours</b> | <b>Tutorial Hours</b> | <b>Practical Hours</b> | <b>ESE</b> | <b>IA</b> | <b>CSE</b> | <b>Viva</b> | <b>Term Work</b> |
|---------------------|-----------------------|------------------------|------------|-----------|------------|-------------|------------------|
| 3                   | 0                     | 2                      | 50         | 30        | 20         | 25          | 25               |

| <b>Contents : Unit</b> | <b>Topics</b>                                                                                                                                                                                                             | <b>Contact Hours</b> |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 1                      | <b>Basics of Power Electronic Drive system and components.</b><br>Basics of Power Electronic Drive system and components.,<br>Different types of loads, shaft-load coupling systems, Stability of power electronic drive. | 6                    |
| 2                      | <b>Chapter - 2</b><br>Conventional methods of D.C. motor speed control, , single phase and three phase converter fed D.C motor drive., . Four quadrant operation using dual converter fed DC motor drives.                | 8                    |
| 3                      | <b>Chapter - 3</b><br>Chopper fed drives, input filter design, Braking and speed reversal of DC motor drives using choppers, Multiphase choppers.                                                                         | 6                    |

| Contents :<br>Unit | Topics                                                                                                                                                                                                                                                                                                                                | Contact<br>Hours |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 4                  | <b>Chapter - 4</b><br>Conventional methods of induction motor speed control., Solid state controllers for Stator voltage control., soft starting of induction motors., Rotor side speed control of wound rotor induction motors., Voltage source and Current source inverter fed induction motor drives, Principle of Vector Control. | 12               |
| 5                  | <b>Chapter - 5</b><br>Speed control of synchronous motors, load commutated inverter drives., switched reluctance motors and permanent magnet motor drives, Field Oriented Control of PMSM.                                                                                                                                            | 10               |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                       | <b>42</b>        |

#### Suggested List of Experiments:

| Contents :<br>Unit | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Contact<br>Hours |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 1                  | <b>Experiment List</b><br>Operation of separately excited DC motor under varying load torque condition, Simulation of single phase fully controlled converter fed DC drive, Simulation of three phase fully controlled converter fed DC drive, Simulation of Chopper fed separately excited DC drive, Simulation of stator voltage control of induction motor using AC voltage controller, Simulation of rotor resistance control of wound rotor induction motor., Verification of V/f profile of induction motor using variable frequency drive., Verification of torque speed characteristics of variable frequency drive. | 16               |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>16</b>        |

#### Textbook :

- 1 Modern Power Electronics and AC Drives, Bimal K Bose, Pearson Education Asia, 2002
- 2 Electric Drives – Concepts and Applications, Vedam Subramanyam,, Tata McGraw Hill, 1994
- 3 Control of Electrical Drives, W. Leonhard, Narosa Publishing House, 1992

#### References:

- 1 Thyristor Control of AC Motors, Thyristor Control of AC Motors, Murphy J.M.D and Turnbull, Pergamon Press, Oxford, Delhi, 2001
- 2 Vector control of ac machines, Vector control of ac machines, P. Vas, Clarendon Press, Oxford, -
- 3 Power Semiconductor Controlled drives, Power Semiconductor Controlled drives, G. K. Dubey, Prentice-Hall, Eaglewood cliffs, -
- 4 Power Electronic Control of Ac Motors, Power Electronic Control of Ac Motors, J. Murphy, Pergamon Publication, -

#### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery and evaluation |            |       |         |          |                                  |
|-----------------------------------------------------------|------------|-------|---------|----------|----------------------------------|
| Remember / Knowledge                                      | Understand | Apply | Analyze | Evaluate | Higher order Thinking / Creative |
| 5.00                                                      | 10.00      | 15.00 | 30.00   | 20.00    | 30.00                            |

#### Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

#### Supplementary Resources:

- 1 <https://nptel.ac.in/courses/108108077>