COURSE TITLE	**SOLID STATE DRIVES**
COURSE CODE	**01EE1601**
COURSE CREDITS	**4**

Objective:

1 Introduce learner to provide fundamental knowledge in dynamics and control of Electric Drives and familiarize the various semiconductor-controlled drives employing various motors.

2 Introduce learner to provide fundamental knowledge in dynamics and control of Electric Drives and familiarize the various semiconductor controlled drives employing various motors.

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

1 Model a basic drive system and analyze its behavior under various operating conditions.

2 Classify types of electric drives systems based on nature of loads, control objectives, performance and reliability.

3 Analyse the performance of drives for various operating conditions.

4 Select appropriate power electronics converter for drive applications.

5 Develop the control logic and generate the gating signals for a specified power electronic converter used in an electric drive.

Pre-requisite of course: Power Electronics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to Electric Drives** Block diagram, Concept, Classification, Parts and Advantages of electric drives, Dynamics of motor load system, fundamental equations, Types of Loads, classification and component of load torque, Four quadrant operation of drives, Equivalent value of drive parameters for loads with rotational and translation motion, Steady state stability of an electric drive systems	8

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Contents : Unit	Topics	Contact Hours
2	**DC motor drives** Constant torque and constant power operation of separately excited dc motor drive, Separately excited dc motor drive using controlled rectifier, single phase full converter controlled dc drive, three phase fully controlled converter fed dc drives, Single phase and three phase dual converter controlled dc drives, Analysis of single quadrant chopper drive, Two quadrant chopper drives, drives, Four quadrant chopper drives, Multiphase chopper drive	12
3	**Scalar Control of Induction motor drive** Control of three phase induction motor by stator voltage and frequency control scheme for speeds below and above synchronous speed, Stator voltage and frequency control (V/F Control), Static rotor resistance control, Slip power recovery control scheme – Static Kramer, Scherbius drives (Sub synchronous and super synchronous speed variations)	10
4	**Vector Control of Induction motor drive** Introduction, Comparison between scalar and vector control, DC drive analogy, equivalent circuit and phasor diagram, Principle of vector control, Block diagram of vector control	6
5	**Special drive** Permanent magnet synchronous motor drive, Stepper motor and Switched reluctance motor drive, Brushless DC motor drive, Introduction to solar and battery powered drive, Traction Drive	6
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment No. 01** To simulate the speed control of separately excited dc motor using single phase fully controlled bridge converter.	2
2	**Experiment No. 02** To simulate the speed control of separately excited dc motor using three phase fully controlled bridge converter.	2
3	**Experiment No. 03** To simulate speed control of separately excited dc motor using chopper control in motoring and braking modes	2
4	**Experiment No. 04** To simulate the speed control of separately excited dc motor using single phase dual converter	2
5	**Experiment No. 05** Performance & Operation of a four quadrant Chopper fed D.C. Drive	2
6	**Experiment No. 06** To simulate the speed control of three phase induction motor using three phase ac voltage controller.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
7	**Experiment No. 07** To simulate vector control of three phase induction motor.	2
8	**Experiment No. 08** To simulate the speed control of three phase induction motor using three phase voltage source inverter	2
9	**Experiment No. 09** To simulate and perform the speed control of three phase induction motor using constant/V/F control	2
10	**Experiment No. 10** To study and simulate the speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper	2
11	**Experiment No. 11** To perform the speed control of permanent magnet synchronous motor in open loop.	2
12	**Experiment No. 12** To controlling the stepper motor in full step mode.	2
13	**Experiment No. 13** To perform the speed control of switched reluctance motor drive.	2
14	**Experiment No. 14** To controlling the speed of BLDC motor using PWM.	2
Total Hours		**28**

Textbook :

1 Modern Power Electronics and AC Drives, Bimal K Bose, Prentice Hall India Learning (P) Ltd., 2005

2 Fundamentals of Electrical Drives, G. K. Dubey, Narosa Publishing House, New Delhi, 2001

3 Electric Machines and Drives: A First Course, Ned Mohan, Wiley publication, 2012

4 Electric Motor Drives–Modeling, Analysis and Control, R.Krishnan, Prentice Hall India, 2001

References:

1 Power Semiconductor Controlled drives, Power Semiconductor Controlled drives, G. K. Dubey, Prentice-Hall, Eaglewood cliffs, 1988

2 Thyristor DC Drives, Thyristor DC Drives, P. C. Sen, John Wiley and Sons, 1981

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

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	30.00	25.00	15.00	10.00	0.00

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, case studies etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students
4. Students will use supplementary resources such as online videos

Supplementary Resources:

1. http://www.electrical4u.com/electrical-drives/
2. http://nptel.ac.in/courses/108104011/
3. http://electrical4u.com/types-of-dc-motor-separately-excited-shunt-series-compound-dc-motor/
4. http://electrical-engineering-portal.com/download-center/books-and-guides/siemens-basics-of- energy/basics-of-dc-drives

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