NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**B.TECH. AND ELECTRICAL AND ELECTRONICS ENGINEERING**		
Course Title	**SOLID STATE DRIVES**		
Course Code	**EEPE27**	**No. of Credits**	**3**
Course Code of Prerequisite subject(s)	**EEPC15, EEPC19**		
Session	**July 2022**	**Section (if, applicable)**	**---**
Name of Faculty	**Dr PINKYMOL K.P.**	**Department**	**ELECTRICAL AND ELECTRONICS ENGINEERING**
Official Email	**pinkymol@nitt.edu**	**Telephone No.**	**9526710598**
Name of Course Coordinator(s) (if, applicable)			
Official E-mail		**Telephone No.**	
Course Type (please tick appropriately)	☐ **Core course**	■ **Elective course**	

Syllabus (approved in BoS)

Introduction to solid state drives, various components – power converters, motors, loads, coupling mechanisms – Stability of drive.

Modeling of DC motor drives – Transfer function and state-space models - Experimental determination of drive parameters – Speed control using AC to DC converters- Input performance parameters, Speed reversal schemes.

Chopper fed DC motor drives – Four quadrant operation, Input filters design – Dynamic braking with DC chopper - Type-C chopper fed regenerative braking - Operation with nonreceptive lines.

Power converters for induction motor speed control - Harmonic behaviour of induction motors harmonic currents and harmonic torques using per phase equivalent circuit – Stator voltage control schemes - Speed control of wound type motors.

State-space modeling of induction motors – Voltage source-Inverter fed operation - Field oriented control schemes – Current source-inverter drives – Principle of vector control.

COURSE OBJECTIVES

1. To understand the basic concept of DC and AC Drives.
2. To understand the various control techniques involved with both DC and AC Drives.
3. To brief about the working principle of Special Electrical Drives.

MAPPING OF COs with POs and PSOs

Course Outcomes (CO)	Aligned Programme Outcomes (POs) Programme Specific Outcomes (PSOs) *correlation levels 1, 2 or 3 as defined below:* *1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)* *If there is no correlation, put "-"*																
Upon completion of the course the students would be able to	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PSO 1	PSO 2	PSO 3
1. Learn the fundamental concepts of power electronic converter fed DC and AC machines.	3	2	-	3	-	-	-	2	2	2	2	-	2	1	3	-	3
2. Analyse the converter fed motor under different torque/speed conditions	3	2	-	3	-	2	3	3	2	2	2	3	3	1	3	-	3
3. Design converter fed drives with existing/new control techniques	3	3	1	3	-	2	3	3	3	2	2	3	3	2	3	1	3

COURSE PLAN – PART II

COURSE OVERVIEW :

Modern electrical drive systems are used in a large number of industrial and domestic applications like the transportation system, machine tools, fans, pumps, robots, supervised actuation. In these applications, control of drives covers controlling the starting, speed, braking of the electric drive systems. In this course basic components of an electric drive system including mechanical loads, motor, power converters and controllers will be discussed separately first and various components will be combined later to discuss the complete drive system. Students will be able to explain and analyse industrial motors and power electronics converters from drive perspective and understand why a particular motor and /or a converter is selected for a particular drive application.

In this course, Chapter 1 discusses modern electric drive components and dynamic relations applicable to all types of drives. Chapter 2 is on dc machines their operations, modeling and transfer functions and measurement of drive parameters. Chapter 3 deals with the chopper controlled dc motor drives and its modeling. Principle of operation of the four-quadrant chopper and regeneration analysis also introduced. Power converters for induction motor speed control is introduced in chapter 4. Stator voltage control schemes and speed control of wound rotor machines are also

presented. Chapter 5 deals with state-space modeling of induction motor. VSI fed and CSI fed operations and various control strategies are explained.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	**Week 1** August 10-12, 2022 **(1 Contact Hour)**	**Unit 1** Course plan discussion. Introduction to solid state drives, various components – power converters, motors,	Lecture PPT And C&T
2	**Week 2** August 16-19, 2022 **(2 Contact Hours)**	loads, coupling mechanisms – Stability of drive.	Lecture C&T
3	**Week 3** August 22-26, 2022 **(3 Contact Hours)**	Tutorial	Lecture C&T
4	**Week 4** August 29 September 2, 2022 **(3 Contact Hours)**	Unit 2: Modeling of DC motor drives – Transfer function and state-space models	Lecture C&T
5	Week 5 September 5-9, 2022 **(3 Contact Hours)**	Experimental determination of drive parameters- Speed control using AC to DC converters	Lecture PPT And C&T
6	Week 6 September 12-16, 2022 **(3 Contact Hours)**	Input performance parameters, Speed reversal schemes.	Lecture PPT And C&T
7	Week 7 September 19-23, 2022 **(3 Contact Hours)**	Tutorial questions **Unit 3:** Chopper fed DC motor drives ***First Assessment***	Lecture C&T
8	Week 8 September 26-30, 2022 **(3 Contact Hours)**	Four quadrant operation- Input filters design – Dynamic braking with DC chopper - Type-C chopper fed regenerative braking	Lecture PPT And C&T
9	Week 9 October 3-7, 2022 **(3 Contact Hours)**	Operation with nonreceptive lines. **Unit 4:** Power converters for induction motor speed control - Harmonic behaviour of induction motors harmonic currents and harmonic torques using per phase equivalent circuit	Lecture C&T
10	Week 10 October 10-14, 2022 **(3 Contact Hours)**	Stator voltage control schemes - Speed control of wound type motors.	Lecture C&T
11	Week 11 October 17-21, 2022 **(3 Contact Hours)**	Tutorial Questions ***Second Assessment*** Unit 5: State-space modeling of induction motors –	Lecture C&T
12	Week 12 October 25-28, 2022 **(3 Contact Hours)**	Voltage source-Inverter fed operation -Field oriented control schemes	Lecture PPT And C&T
13	Week 13 October 31 to November 4, 2022 **(3 Contact Hours)**	Current source-inverter drives – Principle of vector control.	Lecture PPT And C&T

14	Week 14 November 7-11, 2022 **(2 Contact Hours)**	Left out topic's	Lecture PPT And C&T
15	Week 15 November 14-18, 2022 **(3 Contact Hours)**	Simulation Assignment- demonstration and evaluation	Individual PPT Presentation
16	Week 16 November 21-25, 2022 **(3 Contact Hours)**	Simulation Assignment -demonstration and evaluation	Individual PPT Presentation
17	Week 17 November 28- December 2 , 2022 **(2 Contact Hours)**	***Compensation Assessment***	

**If any contact hour is NOT handled on the particular day due to unseen reasons, an extra class will be scheduled on the same week based on the time available.*

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	First assessment	Week – 7	90 minutes	20
2	Second assessment	Week – 10	90 minutes	20
3	Surprise tests + Submission of Assignments	Assignments :1 Quizes : 3	Assignment 1:a simulation-based question Quizes: 15 minutes duration	20
CPA	Compensation Assessment (entire syllabus)	Week -17	90 minutes	20
4	Final Assessment	December 13, 2022	120 Minutes	40

ESSENTIAL READINGS: Textbooks, Refernce books, website address, journals,etc Text Books:

1. *P.C.Sen, 'Thyristor DC Drives' John Wiley & Sons Publishers, New York, 2008.*
2. *.R .Krishman, 'Electric Motor Drives - Modeling, Analysis, and Control', Pearson Education Publishers, 1 st Edition, 2011.*
3. *B.K.Bose, 'Modern Power Electronics and AC Drives', Pearson Education Publications, 2nd Edition, 2005.*

Reference Books:

1. *G.K. Dubey, 'Fundamentals of Electrical Drives', Narosa Publishing House, 2nd Edition, 2008.*
2. *T. Wildi, 'Electrical Machines Drives and Power Systems', Pearson Education Publications, 6th Edition, 2013.*
3. *Mohamed A. El-Sharkawi, 'Fundamentals of Electric Drives', Brooks/Cole, 2000.*

Useful web links: *https://nptel.ac.in/courses/108/104/108104140/*

COURSE EXIT SURVEY

1. Feedb1ack from the students during class committee meetings
2. Anonymous feedback through questionnaire (Mid of the semester & End of the semester)
3. End semester feedback on course outcomes

COURSE POLICY

MODE OF CORRESPONDENCE

1. All the students are advised to check their NITT WEBMAIL regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through their webmail only.
2. Queries (if required) to the course teacher shall only be emailed to **pinkymol@nitt.edu**

COMPENSATION ASSESSMENT POLICY

1. CPA will be offered only for the students who could not appear for Assessments 1&2.

ATTENDANCE POLICY

(A uniform attendance policy as specified below shall be followed)

➢ At least 75% attendance in each course is mandatory. ➢ Students with less than 75% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

➢ Possessing carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.

➢ Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.

➢ The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

➢ For more details refer https://www.nitt.edu/home/academics/rules/BTech_Regulations_2019.pdf

➢ The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

The faculty is available for consultation at times as per the intimation given by the faculty. Queries may also be emailed to the Course Coordinator directly at pinkymol@nitt.edu

FOR APPROVAL

Course Faculty _____ **CC- Chairperson** _____ **HOD** _____