DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI

COURSE PLAN – PART I				
Name of the Programme and specialization		M.Tech. Power Electronics, Electrical and Electronics Engineering		
Course Title		PWM CONVERTERS AND APPLICATIONS		
Course Code	EE 693	**No. of Credits**		03
Course Code of Pre-requisite subject(s)		Power Converters		
Session	January 2021	**Section (if applicable)**		-
Faculty	Dr. Pinkymol K.P	**Department**		Electrical and Electronics Engineering
E-mail	pinkymol@nitt.edu	**Telephone No.**		9526710598
Name of Course Coordinator (if applicable)				
Course Type		☑ **Elective course**		

Syllabus (approved in BoS)

- AC/DC and DC/AC power conversion, overview of applications of voltage source converters, pulse modulation techniques for bridge converters, Multilevel Inverter – diode clamped inverter – flying capacitor inverter
- Bus clamping PWM and advanced bus clamping PWM, space vector based PWM, advanced PWM techniques, practical devices in converter; calculation of switching and conduction losses.
- Compensation for dead time and DC voltage regulation; dynamic model of a PWM converter, multilevel converters; constant V/F induction motor drives.
- Estimation of current ripple and torque ripple in inverter fed drives; line – side converters with power factor compensation.
- Active power filtering, reactive power compensation; harmonic current compensation.

Reference Books:

1. Mohan, Undeland and Robbins, 'Power Electronics; Converters, Applications and Design', John Wiley and Sons, 1989.

2. Erickson R W, 'Fundamentals of Power Electronics', Chapman and Hall, 1997.

3. Vithyathil J, 'Power Electronics: Principles and Applications', McGraw Hill, 1995

Useful web link: https://nptel.ac.in/courses/108/108/108108035/

COURSE OBJECTIVES

- To understand the concepts and basic operation of PWM converters, including basic circuit operation and design.
- To understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality..

COURSE OUTCOMES (CO)

Course Outcomes		Aligned Programme Outcomes (PO)			
		PO	CO1	CO2	CO3
On completion of the course, the students are expected to be able to 1. Understand the basic operations of various PWM techniques for Power Converters. 2. Steady-State and transient modelling and analysis of power converters with various PWM techniques. 3. Analysis and Design of Control Loops for PWM power converters along with the applications like solid state drives and power quality.		1	H	H	H
		2	M	M	H
		3	H	H	L
		4	H	H	H
		5	H	H	H
		6	M	H	H
		7	H	L	M
		8	H	M	H
		9	H	L	L
		10	H	H	H
		11	H	H	H
		12	H	H	H
		13	M	M	H
		14	H	H	H

COURSE PLAN – PART II

COURSE OVERVIEW

The main objective of the PWM is to control the inverter output voltage and to reduce the harmonic content in the output voltage. The pulse width modulation (PWM) techniques are mainly used for voltage control. These techniques are most efficient, and they are used in applications like solid state drives and power quality.

The primary goal of this course is to give an in-depth knowledge in various PWM converters and basic and advanced PWM techniques employed in their operation and control. Steady-state and dynamic model of PWM converters and their applications in drives and power quality are also addressed.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week/Contact Hour	Topic	Mode of Delivery
1.	**1st week** 18-01-2021 & 22-01-2021 (3 sessions)	AC/DC and DC/AC power conversion, overview of applications of voltage source converters	Online
2.	**2nd week** 25-01-2021 to 29-01-2021 (3 sessions)	pulse modulation techniques for bridge converters	Online
3	**3rd week** 01-02-2021 to 05-02-2021 (3 sessions)	Multilevel Inverter – diode clamped inverter – flying capacitor inverter	Online
4.	**4th week** 08-02-2021 to 12-02-2021 (3 sessions)	Bus clamping PWM and advanced bus clamping PWM	Online
5.	**5th week** 15-02-2021 to 19-02-2021 (3 sessions)	space vector based PWM, advanced PWM techniques	Online Discussion and Simulation

6.	**6th week** 22-02-2021 to 26-02-2021 (3 sessions) (1Hour Assessment)	space vector based PWM, advanced PWM techniques, ***Assessment -I***	Online
7.	**7th week** 01-03-2021 to 05-03-2021 (3 sessions)	practical devices in converter; calculation of switching and conduction losses	Online
8.	**8th week** 08-03-2021 to12-03-2021 (3 sessions)	Compensation for dead time and DC voltage regulation	Online
9	**9th week** 15-03-2021 to 19-03-2021 (3 sessions)	dynamic model of a PWM converter	Online
10	**10th week** 22-03-2021 to 26 -03-2021 (3 sessions) (1 Hour Assessment)	multilevel converters; constant V/F induction motor drives. ***Assessment - II***	Online
11	**11th week** 29-03-2021 to 02 -04-2021 (3 sessions)	constant V/F induction motor drives.	Online Discussion and Simulation
12	**12th week** 05-04-2021 to 09-04-2021 (3 sessions)	Estimation of current ripple and torque ripple in inverter fed drives	Online
13	**13th week** 12-04-2021 to 16-04-2021 (3 sessions)	line – side converters with power factor compensation	Online
14	**14th week** 19-04-2021 to 23-04-2021 (3 sessions)	line – side converters with power factor compensation.	Online
15	**15th week** 26-04-2021 to 30-04-2021 (3 sessions)	reactive power compensation; harmonic current compensation.	Online Discussion and Simulation
16	**16th week** 03-05-2021 to 07-05-2021 (3 sessions)	***Compensation Assessment***	Online
17	**17th week** 10-05-2020 to 18-05-2020	End Semester Exam ***(Assessment - IV)***	Online

COURSE ASSESSMENT METHODS (Shall range from 4 to 6)

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I – First Class Test	6th Week	1 hour	20%
2	Assessment II – Second Class Test	10th week	1 hour	20%
3	Assessment III (Continuous Assessment)	Surprise test/Seminar/Simulation Projects	Throughout the semester	30%
CPA	Compensation Assessment	16th Week	1 hour	20%
4	Assessment IV- End semester Assessment	17th week	2 hours	30%

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1) Students feedback through class committee meetings
2) Feedback questionnaire from students – twice during the semester
3) Feedback from students on the course outcomes shall be obtained at the end of the course

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

Mode of Correspondence

1. The faculty is available for consultation during the time intimated to the students then and there.
2. All correspondence will be sent to the webmail id of the students, if required.
3. The students will be communicated through the email id: pinkymol@nitt.edu for any academic related issues with respect to this course.

Compensation Assessment Policy

1. Attending all the assessments are mandatory for every student. If any student fails to attend a lab session or weekly internal assessment, the student can repeat that particular experiment with their own effort. No extra slot will be provided

Attendance Policy

1. All the students are expected to attend all the laboratory sessions. Students should maintain 75% minimum physical attendance by the end of the course to attend the end semester examination.
2. Students with less than 75% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' Grade. Student have to REDO the course.
3. A maximum of 10% attendance shall be allowed under On Duty (OD) category. OD is allowed only for the students having minimum attendance of 65%.

Academic Honesty & Plagiarism

1. Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
2. The answer sheet of the student will not be evaluated and ZERO mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
3. 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.

ADDITIONAL COURSE INFORMATION

The minimum marks for passing this course and grading pattern will adhere to the regulations of the institute.

FOR APPROVAL

[Dr. Pinkymol K.P, AP/EEE] **Course Faculty**	**CC-Chairperson**	Approved by Mail **HoD (Dept. of EEE)**