NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech. (Power Electronics)		
Course Title	Power Converters		
Course Code	EE 651	No. of Credits	3
Course Code of Pre-requisite subject(s)	Power Electronics in UG		
Session	July 2022	Section (if, applicable)	A / B
Name of Faculty	N. Kumaresan	Department	EEE
Official Email	nkumar@nitt.edu	Telephone No.	0431-2503257
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)

Analysis of power semiconductor switched circuits with R, L, RL, RC loads, d.c. motor load, battery charging circuit.

Single-Phase and Three-Phase AC to DC converters-half controlled configurations- operating domains of three phase full converters and semi-converters – Reactive power considerations.

Analysis and design of DC to DC converters- Control of DC-DC converters, Buck converters, Boost converters, Buck-Boost converters, Cuk converters

Single phase and Three phase inverters, Voltage source and Current source inverters, Voltage control and harmonic minimization in inverters.

AC to AC power conversion using voltage regulators, choppers and cyclo-converters, consideration of harmonics, introduction to Matrix converters.

References Books:

1. Ned Mohan, Undeland and Robbin, 'Power Electronics: converters, Application and design', John Wiley andsons, Inc, Newyork, 2006.
2. RashidM.H.'PowerElectronics-Circuits DevicesandApplications',PrenticeHall India, NewDelhi, 2009.
3. P.CSen., 'Modern Power Electronics', Wheeler publishing Company, 1st Edition, New Delhi, 2005.

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COURSE OBJECTIVES

To give a systematic approach for transient and steady state analysis of all power electronic converters with passive and active loads

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
Upon completion of the course, the students will be able to	
1. To study and analyze transient response of basic power electronic circuits	
2. To understand the working of commonly used power Converters	
3. To analyze and design various power converter systems	

COs / POs		Course outcomes(COs) 1	2	3
Programme Outcomes (POs)	1	H	H	H
	2	H	H	M
	3	H	H	H
	4	M	M	M
	5	H	H	H
	6	M	M	M
	7	M	M	M
	8	L	L	L
	9	L	L	L
	10	L	L	L
	11	H	H	H
	12	H	H	H
	13	H	H	H
	14	M	M	M

COURSE PLAN – PART II

COURSE OVERVIEW

Power electronics can be considered as the technology associated with the conversion, control and conditioning of electric power from its available form to the desired electrical form, by the application of power semiconductor devices. Power Electronics is one of the fastest developing technologies today, having gone through dynamic changes in the last several decades.

Application of Power Electronics ranges from power supplies to motion control, factory automation, transportation, energy storage, multi-megawatt industrial drives, power quality and electric power transmission / distribution. Further it is expected to evolve in several directions such as integrated systems for electronic power processing, intelligent control and energy management, distributed generation, automotive applications, electric traction, emerging applications in commercial / residential areas. Power Electronics will play a dominant role in the 21st century in industrial and utility applications with increased emphasis on energy saving and efficient control of industrial processes thereby helping to preserve the environment.

Aim of this course is to give the exposure to the students on the analysis, operation and control of typical power converters, namely, dc-dc, dc-ac, ac-dc and ac-ac converters. This course also aims to apply the mathematical skills to a number of practical / design problems. Practical application of typical converters will be presented to the students as case study.

COURSE TEACHING AND LEARNING ACTIVITIES (Add more rows)

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 to Week 3 25th August to 9th September 5 contact hours	Analysis of power semiconductor switched circuits with R, L, RL, RC and RLC loads, d.c. motor load, battery charging circuit.	Lecture - C&T and PPT

2	Week 4 to Week 6 12th September to 30th September 9 contact hours	Single-Phase and 3-Phase AC to DC converters - half controlled configurations - operating domains of 3-phase full converters and semi-converters – Reactive power considerations.	Lecture - C&T and PPT
3	Week 7 to Week 9 3rd October to 21st October 8 contact hours	**Assessment 1 in Week 7** Analysis and design of DC to DC converters - Control of DC-DC converters, Buck converters, Boost converters, Buck-Boost converters, and Cuk converters	
4	Week 10 to Week 12 25th October to 11th November 9 contact hours	**Assessment 2 in Week 12** Single phase and Three phase inverters, Voltage source and Current source inverters, Voltage control and harmonic minimization in inverters.	
5	Week 13 to Week 15 14th November to 2nd December 9 contact hours	AC to AC power conversion using voltage regulators, choppers and cyclo-converters, consideration of harmonics, introduction to Matrix converters.	
6	Week 16 to Week 17 5th December to 16th December	Final Assessment	---

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment 1	Week 7	75 minutes	25
2	Assessment 2	Week 12	75 minutes	25
3	Assessment 3: Seminar / case study / design work	Details will be informed during the course		10
CPA	Compensation Assessment	Week 15	75 minutes	25
4	Assessment 4: Final Assessment	During Week 16 or Week 17	120 minutes	40

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

Feedback from the students during class committee meetings
Anonymous feedback through questionnaire

COURSE POLICY (including compensation assessment to be specified)

Assessment

1. Attending all the assessments (except CPA) are MANDATORY for every student.
2. If any student is not able to Assessment 1 and / or Assessment 2 due to genuine reasons, student is permitted to attend the compensation assessment (CPA) with 25 % weightage (25 marks). At any case, CPA will not be considered as an improvement test.
3. Relative grading will be based on the clusters (range) of the total marks scored for grading by adopting Gap theory / Normalized curve. Letter grades and the corresponding grade points will be as per institute norms.
4. Suggestion (if any) from Class Committee / Office of the Dean (Academic) on the assessment / grading will be honoured with intimation to the students.

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

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, 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.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

1. All the students are advised to check their NITT WEBMAIL regularly.
2. Queries (if required) may be emailed to me / contact me during 4.00 pm to 5.00 pm on Monday with prior intimation for any clarifications

FOR APPROVAL

Course Faculty _____ CC- Chairperson _____ HOD _____