

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE TEMPLATE			
Course Title	POWER CONVERSION TECHNIQUES		
Course Code	EE611	No. of Credits	03
Department	EEE	Faculty	N. Kumaresan
Pre-requisites Course Code	Knowledge on the power semiconductor devices, electronic circuits, circuit theory and mathematics, such as Fourier series analysis and Laplace transform and differential equations, are essential.		
Course Coordinator(s) (if, applicable)	---		
Other Course Teacher(s)/Tutor(s) E-mail	---	Telephone No.	0431-2503257
Course Type	<input type="checkbox"/> Core course	<input checked="" type="checkbox"/> Elective course	
COURSE OVERVIEW			
<p>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.</p> <p>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.</p> <p>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.</p>			
COURSE OBJECTIVES			
<p>The aim of this course to present the concepts of typical power electronic circuits - topologies and control. Converter analysis, modeling, design and control of converters will be presented as relevant to different applications. This course also aims to apply the mathematical skills to a number of practical problems.</p>			

COURSE OUTCOMES (CO)								
Course Outcomes			Aligned Programme Outcomes (PO)					
At the end of the course students will 1. be able to explain the working of various power electronic converters 2. analyze and derive the mathematical relations for typical power converters 3. have ability to design power converters with given specifications 4. able to use data sheet and suggest suitable control and other associated circuits for the operation of power converters.			COs / POs		Course outcomes(COs)			
					1	2	3	4
			Programme Outcomes (POs)	1	M	H	L	L
				2	M	H	H	H
				3	M	M	NA	NA
				4	NA	NA	NA	NA
				5	H	H	H	H
				6	H	H	H	H
				7	M	M	M	M
				8	M	M	M	M
				9	L	L	L	L
				10	H	H	H	H
				11	H	H	H	H
				12	H	H	H	H
				13	H	H	H	H
14	H	H		H	H			

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week	Topic	Mode of Delivery
1	1 st week of August 16 (1 to 5) (2 Contact Hours)	Introduction - Review of power semi-conductor switches and I-V characteristics.	Lecture C&T / Document viewer / PPT or any suitable mode
2	2 nd week of August 16 (8 to 12) (3 Contact Hours)	Review of Fourier series – Analysis of electrical systems with Non-sinusoidal sources. Analysis of step-down chopper – Introduction to switched mode power supplies	
3	3 rd week of August 16 (16 to 19) (2 Contact Hours)	Buck converter	
4	4 th week of August 16 (22 to 26) (3 Contact Hours)	Boost converter and Buck-Boost converter	
5	5 th week of August to 1 st week of Sep. 16 (29.08.16 to 02.09.16) (3 Contact Hours)	Averaged circuit modeling Introduction to inverters Single-phase VSI	
6	2 nd week of Sep. 16 (6 to 9) (3 Contact Hours)	Three-phase VSI Voltage control and harmonic reduction in inverters-standard PWM techniques	
7	3 rd week of Sep. 16 (12 to 16) (3 Contact Hours)	Voltage control and harmonic reduction in inverters-standard PWM techniques – contd. and Single-phase and Three-phase CSI	
8	4 th week of Sep. 16 (19 to 23) (2 Contact Hours + 1 hour Cycle test)	AC-DC converters- Uncontrolled rectifiers Assessment – 1	

S.No.	Week	Topic	Mode of Delivery
9	5 th week of Sep.16 (26 to 30) (3 Contact Hours)	Single-phase fully and semi controlled converters - continuous and discontinuous current conduction	Lecture C&T / Document viewer / PPT or any suitable mode
10	1 st week of October 16 (3 to 7) (3 Contact Hours)	Three-phase fully and semi controlled converters - continuous and discontinuous current conduction	
11	2 nd week of October 16 (10 to 14) (2 Contact Hours)	Continuation of previous content + Reactive compensation, Harmonic compensation techniques	
12	3 rd week of October 16 (17 to 21) (3 Contact Hours)	AC-AC converters-single phase - Phase angle control, on-off control. AC choppers	
13	4 th week of October 16 (24 to 28) (3 Contact Hours)	Three-phase AC-AC converters - Phase angle control	
14	1 st week of Nov. 16 (31.10.16 to 4.11.2016) (2 Contact Hours + 1 hour cycle test)	Device models for loss calculations, ratings, safe operating areas Assessment – 2	Seminars II Cycle Test
15	2 nd week of Nov. 16 (07 to 11) (3 Contact Hours)	data sheets, forward conduction loss, switching losses, heat sink design, snubber design drive and protection circuits, commutation circuits, Soft switching	Seminars
16	3 rd week of Nov. 16 (14 to 18) - CPA	Compensation Assessment (CPA)	Written test
17	1 st week of Dec. 16 or date decided by Class committee / Dean office (3 Hours written test)	End Semester Examination	Written test

C & T : Chalk and Talk and PPT : Power Point

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	I Cycle test (Written examination) (First 2 Units)	4 th week of September 2016	1 Hour	20
2	II Cycle Test (Written examination) (3 & 4 Units)	1 st week of November 2016	1 Hour	20
3	Seminar / case study / design examples	During the contact hours		10
CPA	Compensation Assessment (Written Test)	3 rd week of Nov. 2016	1 Hour	Please refer course policy for more details
4	End Semester Examination (Written test)	1 st week of December 2016	3 Hours	50

Note:

1. Attending all the assessments (except CPA) are MANDATORY for every student.
2. If any student is not able to attend I and / or II Cycle test(s) due to genuine reasons, student is permitted to attend the compensation assessment (CPA) with 20 % weightage (20 marks).
3. At any case, CPA will not be considered as an improvement test.
4. Relative grading will be based on the clusters (range) of the total marks (cycle tests, assignment and semester examination etc. put together for each student) scored for grading by adopting Gap theory / Normalized curve. Letter grades and the corresponding grade points will be as per institute norms.
5. Every student is expected to score minimum 40% (i.e., 40 marks) to pass the course. Otherwise the student would be declared fail and 'F' grade will be awarded. Supplementary examination will be conducted with 100 % weightage for 'F' grade students.
6. Suggestion (if any) from Class Committee / Office of the Dean (Academic) on the assessment / grading will be honoured with intimation to the students.

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. Ned Mohan, Undeland and Robbin, 'Power Electronics: converters, Application and design', John Wiley and sons. Inc, 3rd Edition, 2002.
2. Rashid M.H., 'Power Electronics Circuits, Devices and Applications', Pearson, 3rd Edition, Twelfth impression, 2013.
3. Singh M.D., Khanchandani K. B., 'Power Electronics', Tata McGraw-Hill, 2nd Edition, 2008.
4. Daniel W. Hart, "Power Electronics", Tata McGraw Hill, 2011.
5. Umanand L., 'Power Electronics: Essentials & Applications', Wiley India Pvt. Ltd., 2009.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

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

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

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.
2. Queries (if required) may be emailed to me / contact me during 4.00 pm to 5.00 pm on Monday and Friday with prior intimation for any clarifications.

ATTENDANCE

1. Attendance will be taken by the faculty in all the contact hours. Every student should maintain minimum 75 % physical attendance in these contact hours to attend the end semester examination.
2. Any student, who fails to maintain 75% attendance needs to appear for the compensation assesemnt (CPA). Student who scores more than 60 % marks in the CPA will be eligible for attending the end semester examination.
3. Students not having 75% minimum attendance at the end of the semester and also fail in CPA (scoring less than 60%) will have to RE DO the course.

ACADEMIC HONESTY & PLAGIARISM

1. All the students are expected to be genuine during the course work. Taking of information by means of copying simulations, assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any assessments is considered dishonest.
2. Tendering of information such as giving one's program, simulation work, assignments to another student to use or copy is also considered dishonest.
3. Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.
4. Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD for necessary action.
5. Students who honestly producing ORIGINAL and OUTSTANDING WORK will be REWARDED.

ADDITIONAL COURSE INFORMATION

FOR APPROVAL

Course Faculty Smruti 12/8/16 CC-Chairperson raunzel HOD Jolly