

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE TEMPLATE			
Course Title	POWER CONVERTERS		
Course Code	EE651	No. of Credits	03
Department	EEE	Faculty	N. Ammasai Gounden
Pre-requisites	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.	0431-2503253
Course Type	<input checked="" type="checkbox"/> Core course	<input 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 be able to 1. study and analyze transient response of basic power electronic circuits 2. understand the working of commonly used power converters 3. analyze and design various power converter systems		Course outcomes(COs)				
		COs / POs	1	2	3	
		Programme Outcomes (POs)	1	M	H	H
			2	H	H	H
			3	H	H	H
			4	L	M	H
			5	NA	L	L
			6	NA	L	M
			7	H	H	H
			8	L	H	H
			9	L	M	M
			10	H	H	H
			11	H	H	H
			12	H	H	H
13	L		L	L		
14	NA	NA	H			

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week	Topic	Mode of Delivery
1	5 th week of July to 1 st week of Aug. 17 (31.07.16 to 02.08.16) (3 Contact Hours)	Introduction to power converters & selection of switching devices: features of SCR & its requirements for firing – ZCD and pulse amplifier circuits; Features of power BJT	Lecture C&T / PPT
2	2 nd week of August 17 (7 to 9) (3 Contact Hours)	Linear switched circuits with R, RL and RC loads for ac and dc inputs; Diode circuit with R, RL and battery loads; Tutorial problems	
3	3 rd week of August 17 (14 to16) (2 Contact Hours)	SCR circuit (half wave) with R, RL and battery loads; Tutorial problem; SCR full converter with RL load (single – phase)	
4	4 th week of August 16 (21 to 23) (3 Contact Hours)	Control scheme for single – phase full converter, Effect of source inductance, tutorial problem on overlap angle calculation	
5	5 th week of August t 17 (28 to 30) (3 Contact Hours)	Inverter operation of single- phase full converter , Analysis of single- phase semi converter; Tutorial problems	
6	1 st week of Sep. 17 (4 to 6) (3 Contact Hours)	Three – phase full converter: analysis & design; micro controller based control scheme	
7	2 nd week of Sep. 17 (11 to 13) (3 Contact Hours)	Plotting of waveforms, tutorial problems and case study for application of three – phase full converter in renewable energy systems	

S.No.	Week	Topic	Mode of Delivery
8	3 rd week of Sep. 17 (18 to 20) (2 Contact Hours + 1 hour Cycle Test)	Three – phase semi converter – working and waveforms; analysis and design; Case study for application of single – phase VSI in renewable energy systems Assessment – 1	Lecture C&T / PPT I Cycle Test
9	4 th week of Sep.17 (26 to 27) (2 Contact Hours)	Introduction to inverters Single-phase VSI	Lecture C&T / PPT
10	1 st week of October 17 (3 to 4) (3 Contact Hours)	Three-phase VSI Voltage control and harmonic reduction in inverters-standard PWM techniques	
11	2 nd week of October 17 (9 to 11) (3 Contact Hours)	Voltage control and harmonic reduction in inverters-standard PWM techniques – contd. and Single-phase and Three-phase CSI	
12	3 rd week of October 17 (16 to 17) (2 Contact Hours)	Single – phase ac voltage controller (phase angle control) with R and RL loads, PWM ac voltage controller(single – phase) with single pulse, multiple pulses	
13	4 th week of October 17 (23 to 25) (3 Contact Hours)	Three – phase ac voltage controller & analysis, Case study for the application of three – phase ac voltage controller in SS circuit breaker.	
14	5 th week of Oct. 17 and 1 st week of Nov. 17 (30.10.17 to 1.11.17) (2 Contact Hours + 1 hour Cycle Test)	Analysis of buck, buck boost and SEPIC converter, Design and analysis of boost converter, Integrated cascaded boost converter Assessment – 2	Seminars II Cycle Test
15	2 nd week of Nov. 17 (6 to 8) (3 Contact Hours)	Cuk converter, Control of DC – DC converter; Case study for application of DC – DC converter in renewable energy systems.	Seminar Lecture C&T / PPT
16	3 rd week of Nov. 17 (13 to 15) (3 Contact Hours)	Tutorial Problems & Doubts Clarification	-
17	4 th week of Nov. 17 (20 to 22)	Compensation Assessment (CPA)	Written test
18	1 st week of Dec. 17 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) (Units 1 & 2)	4 th week of September 2017	1 Hour	20
2	II Cycle Test (Written examination) (Units 4 & 5)	1 st week of November 2017	1 Hour	20
3	Seminar / case study / design examples	During the contact hours		10
CPA	Compensation Assessment (Written Test)	3 rd week of Nov. 2017	1 Hour	Please refer course policy for more details
4	End Semester Examination (Written test)	1 st week of December 2017	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. P.C. Sen., 'Modern Power Electronics', Wheeler publishing Company, 1st Edition, New Delhi, 2005.
4. Singh M.D., Khanchandani K. B., 'Power Electronics', Tata McGraw-Hill, 2nd Edition, 2008.

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 Wednesday and Thursday 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.

FOR APPROVAL

Course Faculty  CC-Chairperson  HOD 