

SCHOOL OF ENGINEERING AND TECHNOLOGY		ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT	OPERATIONAL FROM (2013-2014)	FOR STUDENTS ADMITTED STARTING (2012-2013)
1	Course number	EEE312		
2	Course Title	POWER ELECTRONICS (DC)		
3	Credits	5		
4	Contact Hours (L-T-P)	3-1-2		
5	Course Objective	To provide the student with: 1. basic understanding of modern power semiconductor devices, their strengths, and their switching and protection techniques 2. ability to analyze various important topologies of power converter circuits for specific types of applications including controlled and uncontrolled rectifiers, DC-DC converters and inverters 3. ability to understand and analyze the qualities of waveforms at input and output ends of these converters		
6	Course Outcomes	After completion of course student will be able to : 1. analyze the characteristics of semiconductor devices and also know the protection schemes 2. describe the principles of operation of power electronic converters 3. develop simple power electronic converter topologies to meet certain functional specifications 4. analyze power electronic converter operation to develop design guidelines for choice of switching devices 5. differentiate various converter configurations and compare their merits and demerits 6. apply different chopper control strategies for dc-dc power electronic converters 7. discriminate steady state and dynamic behavior of dc-dc power electronic converters using equivalent circuits 8. identify and synthesize general circuit topologies to realize inverters and rectifiers for single phase and three phase applications 9. examine the operation of SCR based power electronic circuits 10. design the power converters 11. analyse the principles of operation of AC converters		
7	Outline syllabus:			
7.01	EEE312.A	Unit A	Power Semiconductor Devices	
7.02	EEE312.A1	Unit A Topic 1	Thyristors : Silicon Controlled Rectifiers (SCR's) , BJT, power MOSFET, power IGBT, triac and their characteristics	
7.03	EEE312.A2	Unit A Topic 2	Static, dynamic and gate characteristics of SCR, turn on and turn off methods.	
7.04	EEE312.A3	Unit A Topic 3	Series and parallel operation of SCRs, snubber circuit, line	

			commutation and forced commutation circuits.
7.05	EEE312.B	Unit B	Phase Controlled Converters
7.06	EEE312.B1	Unit B Topic 1	Principle of phase control, circuit, waveform and analysis of single phase half wave and full wave line commutated converters with R, RL RLE load, inversion mode, Effect of Source inductance.
7.07	EEE312.B2	Unit B Topic 2	Circuit, waveform and analysis of three pulse and six pulse converters with R and RL load.
7.08	EEE312.B3	Unit B Topic 3	Operation of dual converter.
7.09	EEE312.C	Unit C	Choppers
7.10	EEE312.C1	Unit C Topic 1	Principle of operation, time ratio control and current limit control strategies.
7.11	EEE312.C2	Unit C Topic 2	Circuit, operation and analysis of Step down and step up choppers.
7.12	EEE312.C3	Unit C Topic 3	Types of choppers: circuit, waveforms and analysis of type – A,B,C,D and E choppers.
7.13	EEE312.D	Unit D	Inverters
7.14	EEE312.D1	Unit D Topic1	Principle of operation of single phase inverter, basic series inverter bridge inverter.
7.15	EEE312.D2	Unit D Topic 2	Three phase Inverter: 120^0 and 180^0 mode, circuit, operation and analysis.
7.16	EEE312.D3	Unit D Topic 3	Voltage control techniques for inverters, pulse width modulation techniques, principle of operation and analysis of VSI & CSI and their comparison.
7.17	EEE312.E	Unit E	AC voltage controllers & cycloconverters
7.18	EEE312.E1	Unit E Topic1	AC voltage controllers with R and RL loads.
7.19	EEE312.E2	Unit E Topic 2	Cycloconverters: single phase mid-point cycloconverter with resistive and inductive load.
7.20	EEE312.E3	Unit E Topic 3	Bridge configuration of single phase cycloconverter.
7.21	EEE312.L1	Lab expt. 1	To obtain VI Characteristics of SCR.
7.22	EEE312.L2	Lab expt. 2	To control the thyristor using different gate firing circuits.
7.23	EEE312.L3	Lab expt. 3	To observe the output voltage waveforms and to find the average and rms output voltages of a single phase half controlled converter with R load.
7.24	EEE312.L4	Lab expt. 4	To observe the output voltage waveforms and to find the average and rms output voltages of a three-phase half controlled bridge converter with R-load.
7.25	EEE312.L5	Lab expt. 5	To observe the output voltage waveforms and to find the average and rms output voltages of a single phase AC voltage controller with R and RL loads.
7.26	EEE312.L6	Lab expt. 6	To observe the output voltage waveforms and to find the average and rms output voltages of a single phase fully controlled bridge converter with R and RL loads.
7.27	EEE312.L7	Lab expt. 7	To observe the output voltage waveforms and to find the average voltage of a voltage commutated chopper.

7.28	EEE312.L8	Lab expt. 8	To observe the output voltage waveforms and to find the output voltage of a single phase series inverter with R and RL loads.
7.29	EEE312.L9	Lab expt. 9	To observe the output voltage waveforms and to find the output voltage of a single phase parallel inverter with R and RL loads.
7.30	EEE312.L10	Lab expt. 10	To observe the output voltage waveforms and to find the output voltage of a Single phase cycloconverter with R and RL loads.
8	Course Evaluation		
8.1	Course work: 30 marks		
8.11	Attendance	None	
8.12	Homework	10 assignments, no weight	
8.13	Quizzes	7 best quizzes (based on assignments); 20 marks	
8.14	labs	Evaluation of work done on each lab turn in the lab notebook and feedback from oral quiz about the work done that day. Zero, if the student is absent. 0.75N best marks out of N such evaluations: 10 marks	
8.15	Presentations	None	
8.16	Any other	None	
8.2	MTE	20 marks	
8.3	End-term examination: 50 marks		
9	References		
9.1	Text book	Rashid M.D., “ Power Electronics”, Prentice Hall, 1993.	
9.2	Other references	<ol style="list-style-type: none">1. Bose B.K., “Power Electronics and AC drives”, Prentice Hall, 19862. Sen P.C., “Power Electronics”, TataMc.Graw Hill, 1987.3. Singh M.D., Kanchandani K.B., “Power Electronics”, Tata McGraw-Hill, 2007.4. MATLAB user manuals.5. Simulink user manuals.	

Mapping of Outcomes vs. Topics

Outcome no. → Syllabus topic↓	1	2	3	4	5	6	7	8	9	10	11
EEE312.A1	X										
EEE312.A2		X	X								
EEE312.A3	X										
EEE312.B1		X	X								
EEE312.B2				X	X						
EEE312.B3				X	X						
EEE312.C1			X								
EEE312.C2						X	X				
EEE312.C3						X	X				
EEE312.D1		X	X								
EEE312.D2		X	X								
EEE312.D3				X							
EEE312.E1		X	X								
EEE312.E2								X			
EEE312.E3			X				X				
EEE312.E4										X	X