

Course code	Course Name	L-T-P -Credits	Year of Introduction
EE305	Power Electronics	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives			
<ul style="list-style-type: none"> To get an overview of different types of power semiconductor devices and their switching characteristics To study the operation and characteristics of various types of power electronic converters 			
Syllabus :			
Structure and characteristics of various power semiconductor devices – turn-on methods – controlled rectifiers – inverters – AC voltage controllers – cycloconverters – DC choppers and switching regulators			
Expected outcome.			
The students who successfully complete this course will be able to:			
<ol style="list-style-type: none"> Choose appropriate power semiconductor device in converter circuits and develop their triggering circuits. Analyze various types of power electronic converters and apply different switching techniques. Select appropriate power converter for specific applications. Interpret and use datasheets of power semiconductor devices for design. 			
Text Book:			
Muhammad H. Rashid, <i>Power Electronics Circuits, Devices and Applications</i> , Pearson Education			
References:			
<ol style="list-style-type: none"> Mohan N., T. M. Undeland and W. P. Robbins., <i>Power Electronics, Converters, Applications & Design</i>, Wiley-India Krein P. T., <i>Elements of Power Electronics</i>, Oxford University Press, 1998. P.S. Bimbhra, <i>Power Electronics</i>, Khanna Publishers, New Delhi L. Umanand, <i>Power Electronics – Essentials & Applications</i>, Wiley-India Singh M. D. and K. B. Khanchandani, <i>Power Electronics</i>, Tata McGraw Hill, New Delhi, 2008. 			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	SCR-Structure, static characteristics & switching (turn-on & turn-off) characteristics - di/dt & dv/dt protection – turn-on methods of SCR - two transistor analogy - series and parallel connection of SCRs Structure and principle of operation of power diode, TRIAC, GTO, Power MOSFET & IGBT – Comparison	6	15%
II	Gate triggering circuits – R, RC, UJT triggering circuits – natural and forced commutation (concept only). Requirements of isolation and synchronisation in gate drive circuits- Opto and pulse transformer based isolation. Controlled rectifiers – half-wave controlled rectifier with R load – 1-phase fully controlled bridge rectifier with R, RL and RLE loads (continuous & discontinuous conduction) – output voltage	8	15%

	equation – 1-phase half controlled bridge rectifier with R, RL and RLE loads – displacement power factor – distortion factor.		
FIRST INTERNAL EXAMINATION			
III	3-phase half-wave controlled rectifier with R load – 3-phase fully controlled & half-controlled converter with RLE load (continuous conduction, ripple free) – output voltage equation-waveforms for various triggering angles (no analysis) – 1-phase & 3-phase dual converter with & without circulating current – four-quadrant operation	7	15%
IV	Inverters – voltage source inverters– 1-phase half-bridge & full bridge inverter with R & RL loads – THD in output voltage – 3-phase bridge inverter with R load – 120° & 180° conduction mode – current source inverters.	7	15%
SECOND INTERNAL EXAMINATION			
V	Voltage control in inverters – Pulse Width Modulation – single pulse width, multiple pulse width & sine PWM – modulation index & frequency modulation ratio. AC voltage controllers (ACVC) – 1-phase full-wave ACVC with R, & RL loads – waveforms – RMS output voltage, input power factor with R load – sequence control (two stage) with R load	7	20%
VI	DC-DC converters – step down and step up choppers – single-quadrant, two-quadrant & four quadrant chopper – pulse width modulation & current limit control in dc-dc converters. Switching regulators – buck, boost & buck-boost - continuous conduction mode only – waveforms – design of filter inductance & capacitance	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100

Exam Duration: 3Hours.

Part A: 8 compulsory questions.

One question from each module of Module I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part C: 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part D: 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.