

Course code	Course Name	L-T-P -Credits	Year of Introduction
EE305	Power Electronics	3-0-0-3	2016
<b>Prerequisite: Nil</b>			
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>To get an overview of different types of power semiconductor devices and their switching characteristics</li> <li>To study the operation and characteristics of various types of power electronic converters</li> </ul>			
<b>Syllabus :</b>			
Structure and characteristics of various power semiconductor devices – turn-on methods – controlled rectifiers – inverters – AC voltage controllers – cycloconverters – DC choppers and switching regulators			
<b>Expected outcome.</b>			
The students who successfully complete this course will be able to:			
<ol style="list-style-type: none"> <li>Choose appropriate power semiconductor device in converter circuits and develop their triggering circuits.</li> <li>Analyze various types of power electronic converters and apply different switching techniques.</li> <li>Select appropriate power converter for specific applications.</li> <li>Interpret and use datasheets of power semiconductor devices for design.</li> </ol>			
<b>Text Book:</b>			
Muhammad H. Rashid, <i>Power Electronics Circuits, Devices and Applications</i> , Pearson Education			
<b>References:</b>			
<ol style="list-style-type: none"> <li>Mohan N., T. M. Undeland and W. P. Robbins., <i>Power Electronics, Converters, Applications &amp; Design</i>, Wiley-India</li> <li>Krein P. T., <i>Elements of Power Electronics</i>, Oxford University Press, 1998.</li> <li>P.S. Bimbhra, <i>Power Electronics</i>, Khanna Publishers, New Delhi</li> <li>L. Umanand, <i>Power Electronics – Essentials &amp; Applications</i>, Wiley-India</li> <li>Singh M. D. and K. B. Khanchandani, <i>Power Electronics</i>, Tata McGraw Hill, New Delhi, 2008.</li> </ol>			
<b>Course Plan</b>			
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	<b>Gate triggering circuits</b> – 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. <b>Controlled rectifiers</b> – 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.		
<b>FIRST INTERNAL EXAMINATION</b>			
<b>III</b>	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%
<b>IV</b>	<b>Inverters</b> – 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%
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	<b>Voltage control in inverters</b> – Pulse Width Modulation – single pulse width, multiple pulse width & sine PWM – modulation index & frequency modulation ratio. <b>AC voltage controllers (ACVC)</b> – 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%
<b>VI</b>	<b>DC-DC converters</b> – 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%
<b>END SEMESTER EXAM</b>			

### 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.