



K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CO-PO Mapping

<b>Course: POWER ELECTRONICS</b>			
<b>Type: Core</b>		<b>Course Code: 15EC73</b>	
<b>No of Hours</b>			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total/Week	Total teaching hours
5	0	5	50
<b>Marks</b>			
Internal Assessment	Examination	Total	Credits
20	80	100	4
<b>Aim/Objectives of the Course</b>			
<ol style="list-style-type: none"> <li>1. Understand the construction and working of various power devices.</li> <li>2. Study and analysis of thyristor circuits with different triggering conditions.</li> <li>3. Learn the applications of power devices in controlled rectifiers, converters and inverters.</li> <li>4. Study of power electronics circuits under various load conditions.</li> </ol>			
<b>Course Learning Outcomes</b>			
After completing the course, the students will be able to			
CO1	Understand the characteristics of various power semiconductor devices and its control characteristics		Understanding (K2)
CO2	Understand the working principle of SCRs, its characteristics, turn-on and turn-off methods and <b>designing</b> of gate triggering circuits.		Applying (K3)
CO3	Understand the working principle of thyristor circuits such as controlled rectifiers AC voltage controllers, its analysis, <b>design</b> and application.		Applying (K3)
CO4	Understand the working principle of choppers, analyze the basic types of DC-DC converters and <b>identify</b> its performance parameters.		Applying (K3)
CO5	Understand the working the principle of PWM inverters and to make use of the knowledge of thyristor in <b>design</b> of inverters.		Applying (K3)
<b>Syllabus Content</b>			
<b>Module 1</b>			<b>CO1</b>
<b>Introduction</b> - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits, Peripheral Effects. <b>Power Transistors:</b> Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics, di/dt and dv/dt limitations.			10 hrs
<b>LO: At the end of this session the student will be able to</b> <ol style="list-style-type: none"> <li>1. Identify and discuss the different types of power semiconductor devices</li> <li>2. Explain the control and steady state characteristics of power devices.</li> <li>3. Explain different power electronic circuits and identify the different types of</li> </ol>			PO1-3 PO2-2 PO3-1 PO6-1 P12-1  PSO1-3 PSO2-1

power devices used in them.	
4. Understand di/dt and dv/dt limitations and peripheral effect of power electronics.	

<p><b>Module 2</b></p> <p><b>Thyristor</b> - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-On Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced</p> <p><b>Commutation</b> – Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit, UJT Firing Circuit.</p> <p><b>LO:</b> At the end of this session the student will be able to</p> <ol style="list-style-type: none"> <li>1. Explain the working principle and operation of SCR.</li> <li>2. Explain the two-transistor model of SCR, methods of turn ON and turn OFF of SCR and its mechanism.</li> <li>3. Compare different types of commutation and identify different commutation circuits.</li> <li>4. Explain and design different types SCR firing circuits.</li> </ol>	<p><b>CO2</b></p> <p>10 hrs</p> <p>PO1-3 PO2-3 PO3-2 PO6-1 P12-1</p> <p>PSO1-3 PSO2-1</p>
<p><b>Module 3</b></p> <p><b>Controlled Rectifiers</b> - Introduction, Principle of Phase-Controlled Converter Operation, Single-Phase Full Converter with RL Load, Single-Phase Dual Converters, Single-Phase Semi Converter with RL load.</p> <p><b>AC Voltage Controllers</b> - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single-phase controllers with resistive and inductive loads.</p> <p><b>LO:</b> At the end of this session the student will be able to</p> <ol style="list-style-type: none"> <li>1. Explain the principle of operation of phase controlled rectifiers and AC voltage controllers.</li> <li>2. Explain, analyze, and design controlled rectifiers and AC voltage controllers for both R and RL loads.</li> <li>3. Explain the working of Dual converters and able to identify different quadrant operation of dual converters.</li> <li>4. Explain the ON-OFF AC voltage controller.</li> </ol>	<p><b>CO3</b></p> <p>10 hrs</p> <p>PO1-3 PO2-3 PO3-1 PO6-1 P12-1</p> <p>PSO1-3 PSO2-1</p>
<p><b>Module 4</b></p> <p><b>DC-DC Converters</b> - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators: Buck regulator, Boost regulator, Buck-Boost Regulators, Chopper circuit design.</p> <p><b>LO:</b> At the end of this session the student will be able to</p> <ol style="list-style-type: none"> <li>1. Identify the different types of DC-DC converters and explain the principle of chopper circuit.</li> <li>2. Explain the principle of operation of different types of DC-DC converters.</li> <li>3. Write a note on performance parameters of converters.</li> </ol>	<p><b>CO4</b></p> <p>10 hrs</p> <p>PO1-3 PO2-3 PO3-2 PO6-1 P12-1</p> <p>PSO1-3 PSO2-1</p>

4. Explain switch mode regulators such as buck, boost, and buck boost regulators.	
<p><b>Module 5</b></p> <p><b>Pulse Width Modulated Inverters-</b> Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter, Inverter circuit design.</p> <p><b>Static Switches:</b> Introduction, Single phase AC switches, DC Switches, Solid state relays, Microelectronic relays.</p> <p>LO: At the end of this session the student will be able to</p> <ol style="list-style-type: none"> <li>1. Identify the different types of DC-AC converters and explain the principle of inverter circuit.</li> <li>2. Write a note on performance parameters of inverters.</li> <li>3. Explain the principle of operation of different types of voltage source, current source and variable DC-link inverters.</li> <li>4. Explain static switches such as single phase AC switches, DC switches, solid state relays, and microelectronic relays.</li> </ol>	<p><b>CO1</b></p> <p>10 hrs</p> <p>PO1-3 PO2-3 PO3-2 PO6-1 P12-1</p> <p>PSO1-3 PSO2-1</p>
<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.</li> <li>2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897</li> </ol>	
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.</li> <li>2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.</li> <li>3. P.C. Sen, "Modern Power Electronics", S Chand &amp; Co New Delhi, 2005.</li> </ol>	
<p><b>Useful Websites</b></p> <ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/108105066/">https://nptel.ac.in/courses/108105066/</a></li> <li>• <a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/download-course-materials/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/download-course-materials/</a></li> <li>• <a href="https://www.udemy.com/course/fundamentals-of-power-electronics-1/">https://www.udemy.com/course/fundamentals-of-power-electronics-1/</a></li> </ul>	
<p><b>Useful Journals</b></p> <ul style="list-style-type: none"> <li>• IEEE transaction on Power Electronics</li> <li>• IEEE transaction on Industrial Electronics</li> <li>• IEEE transaction on Power Delivery</li> </ul>	
<p><b>Teaching and Learning Methods</b></p> <ol style="list-style-type: none"> <li>1. Lecture class: 50 hrs</li> <li>2. Practical classes: -</li> </ol>	

**Assessment****Type of test/examination:** Written examination**Continuous Internal Evaluation(CIE) :** 40 marks (Average of three tests will be considered)**Semester End Exam (SEE) :** 100 marks (students have to answer all main questions) which will be reduced to 60 Marks.**Test duration:** 1:30 hrs**Examination duration:** 3 hrs**CO to PO Mapping**

<b>PO1:</b> Science and engineering Knowledge	<b>PO7:</b> Environment and Society
<b>PO2:</b> Problem Analysis	<b>PO8:</b> Ethics
<b>PO3:</b> Design & Development	<b>PO9:</b> Individual & Team Work
<b>PO4:</b> Investigations of Complex Problems	<b>PO10:</b> Communication
<b>PO5:</b> Modern Tool Usage	<b>PO11:</b> Project Management& Finance
<b>PO6:</b> Engineer & Society	<b>PO12:</b> Life long Learning

**CO to PO Mapping**

At the end of the Program, the students should:

**PSO1:** Be able to acquire knowledge and apply concepts in the field of engineering and interdisciplinary subjects.**PSO2:** Be able to identify the existing problems, effectively utilize tools to provide solution, and disseminate the information.

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
15EC 73	K- level														
CO1	K3	3	2	1	-	-	1	-	-	-	-	-	1	3	1
CO2	K3	3	3	2	-	-	1	-	-	-	-	-	1	3	1
CO3	K3	3	3	1	-	-	1	-	-	-	-	-	1	3	1
CO4	K3	3	3	2	-	-	1	-	-	-	-	-	1	3	1
CO5	K3	3	3	2	-	-	1	-	-	-	-	-	1	3	1

*[Signature]*  
Faculty In Charge

*[Signature]*  
HOD  
12/10/19

*[Signature]*  
Principal