



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF:** - Technology and Engineering  
**DEPARTMENT OF:** - Electronics & Communication Engineering  
**SEMESTER:** - VII  
**CODE:** - 4TE07PEL1  
**NAME:** – Power Electronics (PEL)

**Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Schemes (Hours)				Credits	Evaluation Schemes							
		Th	Tu	Pr	To		Theory				Practical (Marks)		Total	
							Sessional Exam		University Exam		Internal	University		
							Marks	Hours	Marks	Hours	Pr	TW		Pr
4TE07PEL1	Power Electronics (PEL)	03	00	02	05	04	30	1.5	70	3.0	---	20	30	150

**Objectives:-**

- In this course, we will study about power electronics, power devices and different power converter circuits. We will also study applications of power electronic circuits.

**Prerequisites:-**

- Basic knowledge about electronic circuits and some mathematical formulae.

**Course Outlines:-**

Sr. No.	Course Contents	Hours
1	<b>Power Electronics System Overview:</b> History of power electronic development, Power electronic systems, Power semiconductor devices, Power electronic converters, Power electronic applications.	02
2	<b>Thyristor: Principles and Characteristics:</b> Principle of operation of SCR, Static Anode-Cathode characteristics of SCR, Two-transistor analogy of SCR, Thyristor construction, Gate characteristics of SCR, Turn-on methods of Thyristor, Dynamic turn-on switching characteristics, Turn-off characteristics, Turn-off methods, Thyristor ratings, Measurement of thyristor parameters, Comparison between transistors and thyristors.	06
3	<b>Gate Triggering Circuits:</b> Firing of Thyristors, Pulse transformers, Optical isolators, R and R-C firing circuits, R-C full-wave trigger circuit, UJT, PUT, Phase control using Pedestal-and-Ramp circuit.	04
4	<b>Series and Parallel Operation of Thyristor:</b> Series operations of thyristors, Need of equalizing network and its design, Triggering of series connected thyristors, Parallel operation of thyristors, Methods for ensuring proper current sharing, Triggering of thyristor in parallel, String efficiency and derating.	06
5	<b>Power Semiconductor Devices:</b>	06

	Phase controlled thyristors, Inverter-grade thyristors, DIAC, TRIAC, Power MOSFETs, IGBTs, Gate Turn-off Thyristors, Static induction devices, Power integrated circuits, Comparison of power devices.	
6	<b>Phase Controlled and Dual Converters:</b> Control techniques, 1- $\phi$ half-wave and full-wave controlled rectifier with R and R-L load, 1- $\phi$ half-controlled and fully-controlled bridge rectifier with R and R-L load, 3- $\phi$ half-wave controlled rectifier with R and R-L load, 3- $\phi$ half-controlled and fully-controlled bridge rectifier with R and R-L load, Effect of free-wheeling diode in 1- $\phi$ and 3- $\phi$ rectifiers, Examples, Principle of dual converter, Dual converter with and without circulating current operation, Comparison between non-circulating and circulating current modes.	<b>08</b>
7	<b>Choppers:</b> Introduction, Basic chopper classification, Basic chopper operation, Control strategies, Chopper configurations, Thyristor chopper circuits, Jones chopper, Morgan chopper, A.C. choppers, Multiphase choppers.	<b>06</b>
8	<b>Inverters:</b> Introduction, Classification of inverters, 1- $\phi$ and 3- $\phi$ series inverters, Self-commutated inverters, Parallel inverters, 1- $\phi$ half and full-bridge inverters, McMurray inverter, Modified McMurray inverter.	<b>06</b>
9	<b>Cycloconverters and A.C. Regulators:</b> Basic principle of cycloconverter operation, 1- $\phi$ to 1- $\phi$ cycloconverter, 3- $\phi$ half-wave cycloconverters, 1- $\phi$ and 3- $\phi$ A.C. regulators.	<b>04</b>

### Learning Outcomes:-

After successful completion of the course, students should:

- be able to understand different types of power devices, construction and its characteristics.
- be able to design different power converter circuits.

### Books Recommended:-

1. Power Electronics, **M. D. Singh & K. B. Khanchandani**, Tata McGraw Hill.
2. Power Electronics – Circuits, Devices & Applications, **Muhammad H. Rashid**, Pearson Education Inc.
3. Power Electronics, **P. C. Sen**, Tata McGraw Hill.
4. Power Electronics, **Dr. P. S. Bimbhra**, Khanna Publishers.

