

Subject Code: 1ET4030504	Subject Title: POWER ELECTRONICS
Pre-Requisite	--

RATIONALE:

The function of power electronics is to process and control the electric power by supplying voltage and current in a form that is optimally suited to the load. All the modern electrical machines are controlled by power electronics devices. With the advancement of power electronics devices, the conventional control and relays are now replaced by electronic control and relays. This course is designed to give theoretical and practical knowledge of power electronics to the students so that they will be able to use power electronics for controlling AC and DC power in various applications. And also get knowledge to use power electronics to control electrical machines in commercial and industrial sector.

COURSE OBJECTIVE:

The theory should be taught and practical should be undertaken in such a manner that students are able to

1. Understand construction of different power electronic devices.
2. To understand working of SCR Protection and Commutating Circuits.
3. Troubleshooting in chopper circuits.
4. Understand inverters and cyclo-converter circuits.
5. Use power semiconductor devices in different applications.

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment
4	-	2	5	60	40	20	30

DETAILS OF COURSE CONTENTS:

Sr No	Topics and Sub-topics	Total Hours	% Weightage
1	Power Semi Conductor Devices and Controlled Rectifier	14	20

	1.1 Classification of Thyristor family. 1.2 Working, of SCR, IGBT ,GTO, MCT, DIAC and TRIAC 1.3 Three phase half wave, full wave or bridge rectifier and Six phase half wave rectifier. 1.4 Effect of transformer reactance. 1.5 Single phase half wave and full wave controlled rectifiers using SCR, UJT & phase shift circuits. 1.6 Working of pulse transformer. 1.7 Principle of A.C. load control.		
2	SCR Protection and Commutating Circuits 2.1 Need of SCR protections: Over voltage and over current protection. 2.2 Snubber circuit, freewheeling diode, Thermistor, heat sink. 2.3 Turn off (commutation) method and types-Natural commutation, Forced commutation, Series resonance/ current commutation, Voltage commutation. 2.4 Auxiliary SCR for commutation. 2.5 External pulse commutation. 2.6 Specifications of SCR: Voltage, current, Power, temperature, dv/dt and di/dt	14	20
3	Choppers 3.1 Function and working of choppers 3.2 Types of chopper circuits: A type to E-type 3.3 Jone's chopper circuit 3.4 Morgan's chopper	08	15
4	Inverters and Cycloconverter 4.1 Working principle of inverter 4.2 Classification of inverter- • phase and 3-phase inverters, • Line commutated and forced commutated inverters • Series, Parallel and bridge inverter 4.3 Series and parallel inverter using SCR 4.4 PWM method and PWM inverter 4.5 Single pulse width, Multiple pulse width and Sinusoidal pulse width modulation 4.6 Operating principle of cyclo converter. 4.7 types of cyclo-converters: Single phase to single phase cyclo converter, Single phase to bridge cyclo converter.	12	20

5	Other Industrial Applications of Power Electronic Devices 5.1 Speed control of D.C. Motor using armature voltage control. 5.2 Speed control of D.C. Motor using SCR chopper circuit. 5.3 Speed control Using D.C. drive and PLL method. 5.4 Speed control of universal motor. 5.5 Different types of speed control methods for induction motor such as stator voltage control, frequency control, Power factor control method. 5.6 Heating control, resistance welding, static circuit breaker and time delay circuits.	08	15
---	--	----	----

COURSE OUTCOME:

The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes:

1. Understand construction of different power electronic devices.
2. To understand working of SCR Protection
3. To understand SCR Commutating Circuits.
4. Understand troubleshooting in chopper circuits.
5. Understand inverters and cyclo-converter circuits.
6. How to use power semiconductor devices in different applications.

LIST OF PRACTICAL:

SR NO	PRACTICALS/EXPERIMENTS
1	Write the three phases half wave rectifier & test the performance.
2	Write the three phase full wave bridge rectifier & test the performance.
3	Check the performance of six phase half wave rectifier.
4	Test the performance of TRIAC for AC load control
5	design and Trouble shoot Snubber Circuit
6	Use R-C Phase shift network for firing angle control of single phase controlled rectifier.
7	To study Speed Control of D.C. Motor using Chopper.
8	To study and perform SCR Commutating Circuits.
9	Performance of Parallel inverter.
10	Performance of Series inverter.
11	Study of Cycloconverter circuit using thyristors.

LIST OF REFERENCES:

1. Power Electronics Bimbhra, P.S. Khanna
2. Power Electronics Singh, M. D. K. Khanchandani, B.
3. www.youtube (lectures on Power electronics)
4. www.google.com
5. www.nptel.iitm.ac.in