GANPAT UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY (DIPLOMA PROGRAMMES)

Programme	Diploma Engineering		Branch/Spec.	Electrical Engineering	
Semester	v		Version	1.0.0.0	
Effective from Academic Year	2020-21		Effective for the batch Admitted in		July 2018
Subject code	1EE2502	Subject Name	POWER ELECTRONICS		

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	4	0	1	0	5	Theory	40	60	100
Hours	4	0	2	0	6	Practical	30	20	50

Course Learning Outcomes:

- Use power semiconductor devices in different applications.
- Maintain SCR Protection and Commutating Circuits**.**
- Troubleshoot chopper circuits.
- Maintain inverters and cyclo-converter circuits.
- Maintain power electronic circuits used in various domestic and industrial applications.

Theory syllabus

UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
Unit – I **Power Semi Conductor Devices and Controlled Rectifier**	1a. Classification of Thyristor family. 1b. Working, of SCR, IGBT , GTO, MCT, DIAC and TRIAC 1c. Three phase half wave, full wave or bridge rectifier and Six phase half wave rectifier. 1d. Effect of transformer reactance. 1e. Single phase half wave and full wave controlled rectifiers using SCR, UJT & phase shift circuits. 1f. Working of pulse transformer. 1g. Principle of A.C. load control.	1.1 Classify Thyristor family. 1.2 Working of various power electronics devices with sketches 1.3 Various polyphase uncontrolled rectifiers with sketches and waveforms 1.4 Effects of transformer reactance 1.5 Difference in working of the single phase half wave, full wave controlled rectifiers using SCR, UJT and Phase shift circuits 1.6 Working Principle of A.C. load control & of pulse transformer	16	16

Unit – II **SCR Protection and Commutating Circuits**	2a. Need of SCR protections : Over voltage and over current protection. 2b. Snubber circuit, freewheeling diode, Thermistor, heat sink. 2c. Turn off (commutation) method and types-Natural commutation, Forced commutation, Series resonance/ current commutation, Voltage commutation. 2d. Auxiliary SCR for commutation. 2e. External pulse commutation. 2f. Specifications of SCR: Voltage, current, Power, temperature, dv/dt and di/dt	2.1 Justify the need of SCR protections. 2.2 Describe working of snubber circuit, freewheeling diode, thermistor and heat sink for SCR. 2.3 State the need to turn off SCR. 2.4 Differentiate various types of commutation methods with sketches 2.5 Use SCR datasheets for the given parameters	16	16
Unit – III **Choppers**	3a. Function and working of choppers 3b. Types of chopper circuits: A type to E-type 3c. Control of chopper	3.1 Working principle of Chopper and its applications 3.2 Compare the salient features of different types of choppers 3.3 Distinguish different control techniques.	5	5
Unit - IV **Inverters**	4a. Working principle of inverter 4b. Classification of inverter 4c. Series and parallel inverter using SCR 4d. PWM method and PWM inverter 4e. Single pulse width, Multiple pulse width and Sinusoidal pulse width modulation	4.1 Basic working principle of inverter 4.2 Classify inverters 4.3 With sketches, explain the working of inverter circuit using transistors and SCR. 4.4 Distinguish the working of series and parallel inverters using SCR. 4.5 Describe pulse width modulation technique and its techniques	9	9
Unit - V **Cycloconverter**	5a. Operating principle of cyclo converter. 5b. types of cyclo-converters : Single phase to single phase	5.1 Working principle of cyclo-converter. 5.2 Compare the salient features of various types	6	6

	cyclo converter, Single phase to bridge cyclo converter.	of cyclo-converters		
Unit – VI **Other Industrial Applications of Power Electronic Devices**	6a. Speed control of D.C. Motor using armature voltage control. 6b. Speed control of D.C. Motor using SCR chopper circuit. 6c. Speed control of D.C. drive using PLL method. 6d. Speed control of universal motor. 6e. Different types of speed control methods for induction motor such as stator voltage control, frequency control 6f. Static circuit breaker and time delay circuits.	6.1 With sketches, explain the speed control of - a DC series motor using SCR chopper circuit & D.C. Motor using armature voltage control, D.C. drive using PLL method. 6.2 With sketches, describe the use of power electronics for speed control of universal motor. 6.3 With sketches, describe the use of power electronics for speed control methods of induction motor such as stator voltage control, frequency control 6.4 With sketches, describe the use of power electronics devices in static circuit breaker and time-delay circuit applications.	8	8

List of Practical	
1	Wire the three phase half wave rectifier & test the performance.
2	Wire the three phase full wave rectifier & test the performance.
3	Wire the Bridge rectifier & test the performance.
4	Check the performance of six phase half wave rectifier.
5	Analyze poly phase rectifier circuit performance through simulation.
6	Test the performance of IGBT.
7	Compare the ratings and packages of IGBT, GTO, MCT using data sheet.
8	Test the performance of TRIAC for AC load control.
9	Use R-C phase shift net work for firing angle Control of single phase controlled rectifier.
10	Troubleshoot chopper circuits with load.
11	Perform test the DC motor for speed control using appropriate chopper circuit
12	Simulate chopper circuit, observe and print the various wave forms.
13	Build Time delay relay circuit using UJT and SCR.
14	Test the Speed control of universal motor using SCR-UJT circuit.

15	Test the Speed control of 3 phase induction motor using solid state devices.		
List of Instruments/Equipments/ Trainer Board			
1	DIAC, TRAIC, SCR, IGBT, GTO and MCT - 5 Nos. each of current rating at least 20 amps or above		
2	Trainer Kits for testing the V-I characteristics of the following - 2 Nos. each: a) DIAC b) TRAIC c) SCR d) Power transistor e) Power MOSFET f) IGBT g) GTO h) MCT		
3	Trainer kit to check the performance for different types of loads of the following - 2 Nos. each: a) 3-phase uncontrolled half wave rectifier b) 3-phase uncontrolled full wave rectifier		
4	Electric DC Drive Trainer consisting of the following controlling schemes - set: a) Speed control of dc DC shunt motor using single phase fully controlled converter b) Speed control of DC shunt motor using three phase fully controlled converter c) Armature and field control of DC shunt motor d) Speed control of DC shunt motor using SCR dual converter e) Thyristor chopper for DC motor drive f) DC series motor controller using jones chopper		
5	Experimental set up to perform Speed control of a 3 phase induction motor using v/f method - 1 set		
6	Experimental set up to perform speed control of a DC shunt motor using open loop and PID control system through computer interfacing - 1 set		
List of Text Books			
1	Power Electronics	Rashid, Muhammad H.	PHI Learning, New Delhi latest edition
2	Power Electronics	Singh,M. D. K. Khanchandani, B.	Tata Mc. Graw Hill, New Delhi
3	Power Electronics	Bimbhra, P.S.	Khanna Publisher, New Delhi latest edition
List of Reference Books			
1	Industries and power Electronics	Rai, H.C.	Umesh Publications. New Delhi latest edition
2	Fundamentals of electric drives	Dubey, G. K.	Narosa Publishing house New Delhi latest edition
Link of Learning Resources			
1	www.nptel.iitm.ac.in		
2	www.alldatasheet.com		
3	Psim		
4	MATLAB/SIMULINK		