COURSE NAME : DIPLOMA IN ELECTRICAL POWER SYSTEM

COURSE CODE : EP/EE

SEMESTER : SIXTH

SUBJECT TITLE : POWER ELECTRONICS AND DRIVES

SUBJECT CODE : 9143

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
03	--	02	03	80	20	--	25@	--	125

Rationale:

The field of electrical engineering is generally segmented into three major areas – Electronics, Power and Control. Power Electronics involves a combination of these three areas. In broad terms, the function of power electronics is to process and control the electrical energy by supplying voltage and current in a form that is optimally suited to the load. Now a day's electrical machine are controlled by Power Electronics methods. Also the various conventional control & relays are replaced by electronic control & relays, employing solid state power semiconductor devices.

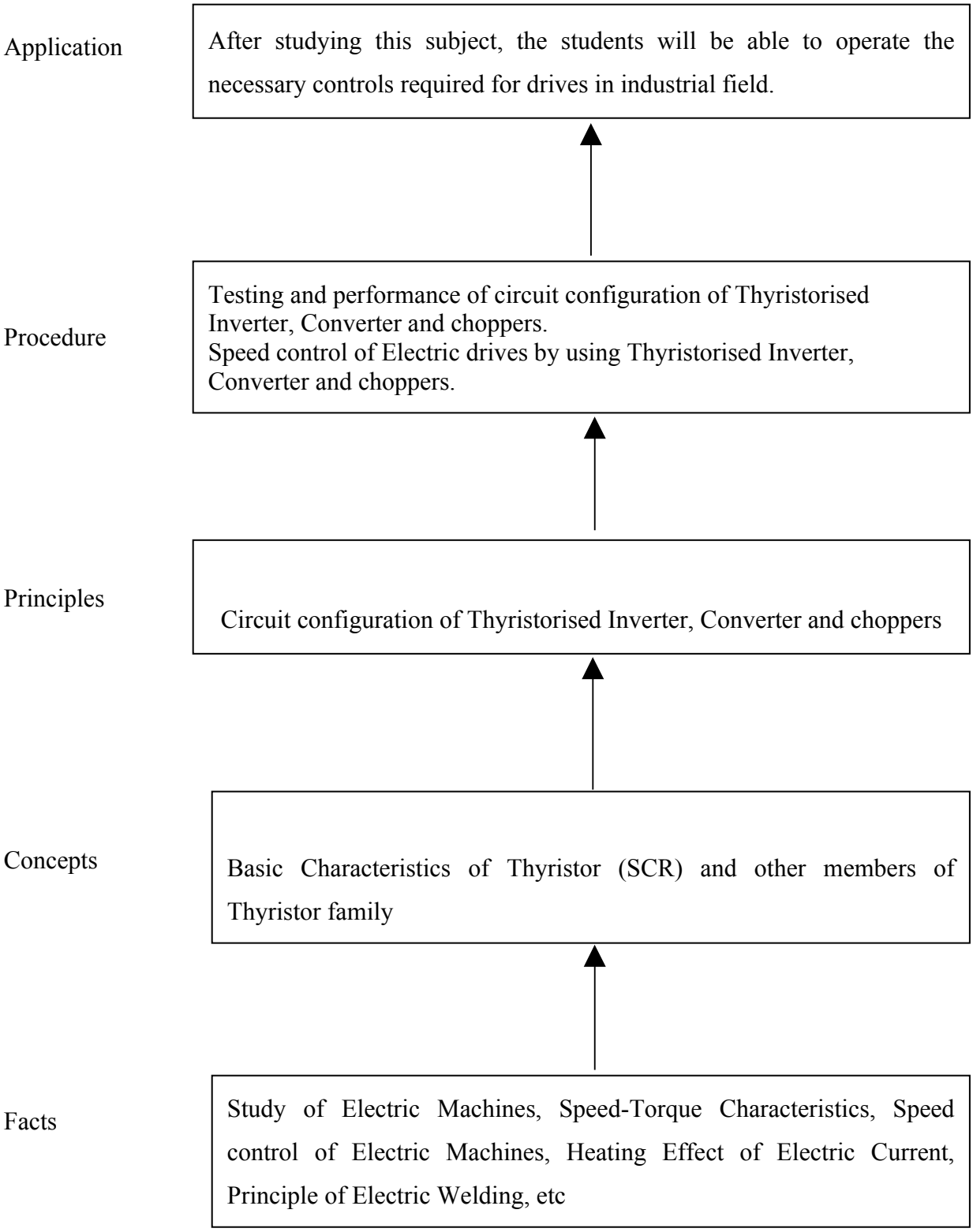
Hence, for electrical engineering Students it is desirable to study the course dealing with Power Electronics. This subject belongs to technology area.

Objectives:

The students will be able to:

1. Explain the construction and operation of power semiconductor devices and plot their characteristics.
2. Draw the circuit diagrams and explain the working of controlled rectifiers with appropriate waveforms.
3. Draw the circuit diagrams and explain the working of different types of Inverters with appropriate waveforms.
4. Explain the Voltage and Frequency Control Methods used in Inverters.
5. Draw the circuit diagrams and explain the working of different types of choppers with appropriate waveforms.
6. Apply the power electronic methods of controls in Electrical Engg. field.

Learning Structure:



Contents: Theory

Note: No Derivations and No Numerical for all Topics.

Chapter	Name of the Topics	Hours	Marks
01	**Power Semiconductor Devices:** 1.1 Thyristor (SCR) Construction, Operation and Symbol 1.3 V-I Characteristics 1. 4 Thyristor Turn Methods: Voltage Triggering, Gate Triggering, dv/dt Triggering and Light Triggering. 1.5 Gate Control: DC Gate Signal, AC Gate Signal and Pulse. 1.6 Thyristor Turn off Process 1.7 Thyristor Specifications and Ratings Voltage Ratings, Current Ratings, Power Ratings and Temperature Ratings. 1.8 Heat Sinks and Mountings 1.9 Thyristor Family: Symbols & V-I Characteristics	**06**	**12**
02	**Converters:** 2.1 – Introduction 2.2 – Single Phase Fully Controlled Half Wave Converter - With Resistive Load - With RL Load and Freewheeling Diode. 2.3 - Single Phase Fully Controlled Full Wave Converter - With Resistive Load - With RL Load. 2.4 - Single Phase Fully Controlled Bridge Converter - With Resistive Load - With RL Load 2.5 – Three Phase Fully Controlled Bridge Converter - With RL Load. 2.6 – Comparison of 3 ϕ and 1 ϕ Phase Converters. 2.7- Effect of Source Impedance on Converter Operation. 2.8 – Cycloconverters and Cycloinverters.: Single phase and three phase, principle of operation, Input output waveforms.	**08**	**16**
03	**Inverters:** 3.1 - Introduction 3.2 – Classification: 1ϕ & 3ϕ Inverters, Line Commutated & Forced Commutated Inverters, Series, Parallel, & Bridge Inverters. 3.3 – Series Inverter - Operation of Basic Series Inverter Circuit - Modified Series Inverter - Three Phase Series Inverter 3.4 – Parallel Inverter - Operation of Basic Parallel Inverter Circuit 3.5 – Single Phase Bridge Inverter - Half Bridge Inverter - Full Bridge Inverter 3.6 – Voltage and Frequency Control of 1ϕ Inverters: - Necessity of Control of Output Voltage	**08**	**16**

	- Methods for Output Voltage Control: External Control of DC Voltage, External Control of AC Voltage and Internal Control. - Pulse Width Modulation(PWM) Method: - Single Pulse Width Modulation - Multiple Pulse Width Modulation - Sinusoidal Pulse Width Modulation 3.7 – Waveform Control (Harmonic Reduction) - By Single Pulse Width Modulation - By Transformer Connections - By Using Filter(LC, Resonant, and OTT Filter)		
04	**Choppers:** 4.1 – Introduction 4.2 – Chopper Principle 4.3 – Control Techniques: - Constant Frequency System - Variable Frequency System 4.4 – Classification of Choppers: Class A, Class B, Class C, Class D and Class E 4.5 - Commutations Methods for Choppers: Auxiliary Commutation, Load Commutation 4.6 – Jones Chopper 4.7 – Step Up Chopper	**08**	**12**
05	**Power Electronic Applications:** 5.1 – DC Drives: 5.1.1 – Speed control of DC series motor with single phase and three phase half and full controlled converter, step up and step down chopper. 5.1.2 – Introduction to DC servo motor, Speed control of DC servomotor. 5.2 – AC Drives: 5.2.1 – Speed control of three phase Induction Motor with Variable frequency PWM VSI, Variable frequency square wave VSI, Variable frequency CSI, Variable frequency Variable Voltage, Cycloconverters. 5.2.2 – Open/Closed loop control of stepper motor. 5.2.3 – AC servomotor, speed control of AC servomotor. 5.3 – Other Applications: - Static Circuit Breakers (DC & AC). - Induction Heating Control. - Di-electric Heating Control. - Electric Welding Control. - Battery Charging Control. - Static Excitation System for Alternators. - Static VAR Compensation System.	**18**	**(24)** **10** **14**
	Total	**48**	**80**

Practical:
Skills to be developed:

Intellectual skills:

1. Select appropriate devices and instruments
2. Testing & troubleshooting

Motor Skills:

1. Accuracy of Measurement
2. Proper connections
3. Draw characteristics

List of Practicals:

(1) To identify the terminals and plot V-I Characteristics of Thyristor.
(2) To study Full Wave Rectifier Using SCR and UJT.
(3) To study Parallel Inverter Using SCR.
(4) To study Bridge Rectifier Using SCR and UJT.
(5) To study series Inverter Using SCR.
(6) To study Chopper Using SCR.
(7) To study Circuit Breaker Using SCR.
(8) To study Battery Charger Using SCR.
(9) TO Perform Speed control of DC series motor by static armature voltage control using single phase half/full controlled converter.
(10) TO Perform speed control of three phase Induction motor using PWM/CSI Inverter. Interpret the speed – torque characteristics. Use the circuit as Variable Voltage Variable Frequency (V. V. V. F.) drive.

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
1.	B. R. Gupta ,V. Singhal	Power Electronics	S. K. Kataria & Sons
2.	Muhammad H. Rashid	Power Electronics	Prentice-Hall of India Pvt. Ltd.
3.	M. D. Singh, K. B. Khanchandani	Power Electronics	Tata McGraw-Hill
4.	G. K. Dubey	Fundamentals of Electric Drives	Narosa Publishing House
5.	V. Subrahmanyam	Electric Drives – Concepts and Applications	Tata McGraw-Hill