

**Course Name : Industrial Electronics, Instrumentation And Instrumentation and Control**

**Course Code : IE/IU/IS/IC**

**Semester : Sixth for IE/IS/IC and Seventh for IU**

**Subject Title : Industrial Drives (Elective-II)**

**Subject Code : 9180**

**Teaching & Examination Scheme:**

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

**Rationale:**

In today's modern industry various A.C & D.C electrical drives are used. They are either fixed speed or variable speed type drives. These drives use the various methods to control the speed like thyristor power controller, voltage to frequency converter etc.

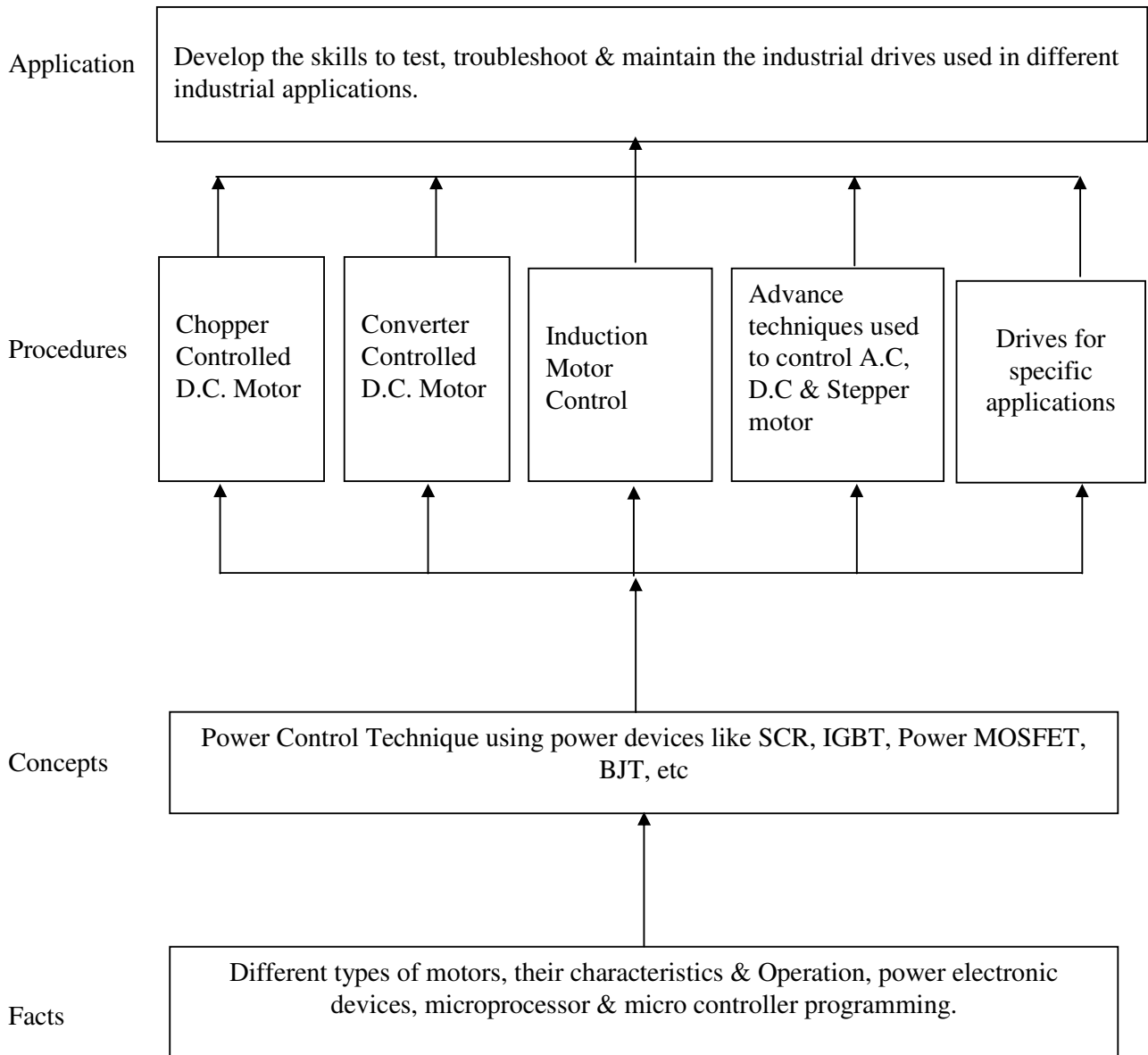
This is a technology subject; knowledge of this subject would enable the student to operate some controls. In addition, he would be able to carry out preventive and break down maintenance.

**Objectives:**

The student will be able to:

- 1) Describe construction/working principle of different types of drives.
- 2) Apply the different power control techniques to control speed of motors (A.C or D.C) using chopper, Converters, Inverters, Microprocessor & Micro Controller.
- 3) Interpret the waveforms at different test points in the power control circuits.
- 4) Differentiate between the types of drives.
- 5) Operate & control the drive for specific application.

## Learning Structure



## Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<b>Introduction :</b>	06	10
	1.1 Basic elements of drive, adjustable speed drive & its requirement. Four Quadrant operations of hoist, D.C. drive & A. C. drive & their comparison. 1.2 Load Torque Speed characteristics, stability of drive (No mathematical derivations). Factors considered for drive selection, starting & breaking of electric motors.		
02	<b>Chopper controlled D.C. motor</b>	06	10
	2.1 Basic Chopper circuit, D. C. chopper using power MOSFET. 2.2 Single, Two, Four quadrant chopper drive, Multiphase chopper drive.		
03	<b>Converter controlled D. C. motor.</b>	10	16
	3.1 Speed torque characteristics of d. c. motor, Types of single phase converter drive, single phase half wave converter, semi converter, Full converter and Dual converter drive. 3.2 Types of three phase converter drive, three phase half wave converter, Semi converter, Full converter & Dual converter drive.		
04	<b>Induction motor control</b>	10	16
	4.1 Star-Delta connection, Advantages of converter fed induction motor, Speed torque Characteristics of induction motor. 4.2 Different methods of speed control of Induction Motor, Stator voltage control, Rotor voltage control, Frequency control, Stator voltage & frequency control, Stator current control, Voltage, current & frequency control, Frequency controlled inverter using power MOSFET, slip energy recovery system, Chopper controlled resistance in rotor circuit.		
05	<b>Advance Techniques of Motor Control</b>	10	16
	5.1 Advantages of microprocessor & microcontroller for d. c. drive, Microprocessor based D C Motor control, Microcontroller based stepper motor control. 5.2 Phase Locked Loop control of D. C. motor.		
06	<b>Drive for Specific Applications.</b> Block diagram, Sequence of stages & drives required at each stage for following applications.	06	12
	6.1 Textile Mills		
	6.2 Steel Rolling Mills		
	6.3 Cranes and hoists		
	6.4 Cement Mills		
	6.5 Paper Mills		
	6.6 Sugar Mills		
	6.7 Machine Tool Applications		
6.8 Coal Mining			
<b>Total</b>		<b>48</b>	<b>80</b>

## **Practical:**

Skills to be developed:

Intellectual Skills:

- |              |                   |
|--------------|-------------------|
| 1. Identify  | 2. Discrimination |
| 3. Selection | 4. Interpretation |

Motor Skills:

- |                 |                |
|-----------------|----------------|
| 1. Testing      | 2. Measurement |
| 3. Operational. |                |

### **A) Practical:**

1. Measure the output power of chopper for resistive load by varying the frequency and /or duty cycle of chopper.
2. Find the effect on speed and torque of given D.C. Series motor by varying armature voltage using step up / down chopper.
3. Find the effect on speed and torque of given D.C. separately excited motor by varying field voltage using step up / down chopper.
4. Find the variation in armature voltage and speed of given separately excited motor by advancing or retarding the firing pulses of SCR using single Phase semi converter.
5. Find the variation in armature voltage and speed of given separately excited motor by advancing or retarding the firing pulses of SCR using single Phase full-converter.
6. Find the variation in armature voltage and speed of given separately excited motor by advancing or retarding the firing pulses of SCR using three phase full-converter.
7. Find the effect of change of rotor resistance of Induction Motor on speed.
8. Measure the speed of given Induction Motor for various stator voltages using A.C. voltage controller.
9. Develop a programme using Microprocessor /Microcontroller to control the speed of given stepper motor.

(Each group in the batch will develop a separate program, for the given stepper motor. The program will be developed for different steps of rotations for the motor.)

### **B) Mini Project**

1. Speed Control of D.C. motor using IGBT.
2. Collect the information to compare between the motors and their drives for the given particular application.

**Comparison will be made with respect to**

- 1) Type of drive
- 2) Manufacturer
- 3) Technical specifications
- 4) Cost

**Learning Resources:**

**1) Books**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
01	Vedam Subrahmanyam	Thyristor control of Electric drives	TATA McGraw Hill
02	Vedam Subrahmanyam	Electric Drives	TATA McGraw Hill
03	S.K.Bhattacharya & S.Chaterjee	Industrial Electronics & Control	TATA McGraw Hill
04	P.C.Sen	Power Electronics	TATA McGraw Hill
05	B. L.Theraja A. L. Theraja	Electrical Technology Volume-II A.C. & D.C.Machines	S.Chand & Company

**2) Technical Literature from manufacturers of motors and the associated drives.**