

COURSE NAME : ELECTRICAL ENGINEERING GROUP
COURSE CODE : EE/EP
SEMESTER : FIFTH
SUBJECT TITLE : INDUSTRIAL AUTOMATION
(ELECTIVE-I FOR EP AND ELECTIVE-II FOR EE)
SUBJECT CODE : 9091

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#	25@	150

Rationale:

This subject is classified as under Technology group intended to develop the technician to carry out the responsibilities in the industries related to industrial automation. The pass outs from the course needs to operate, test & maintain various industrial activities which are automated.

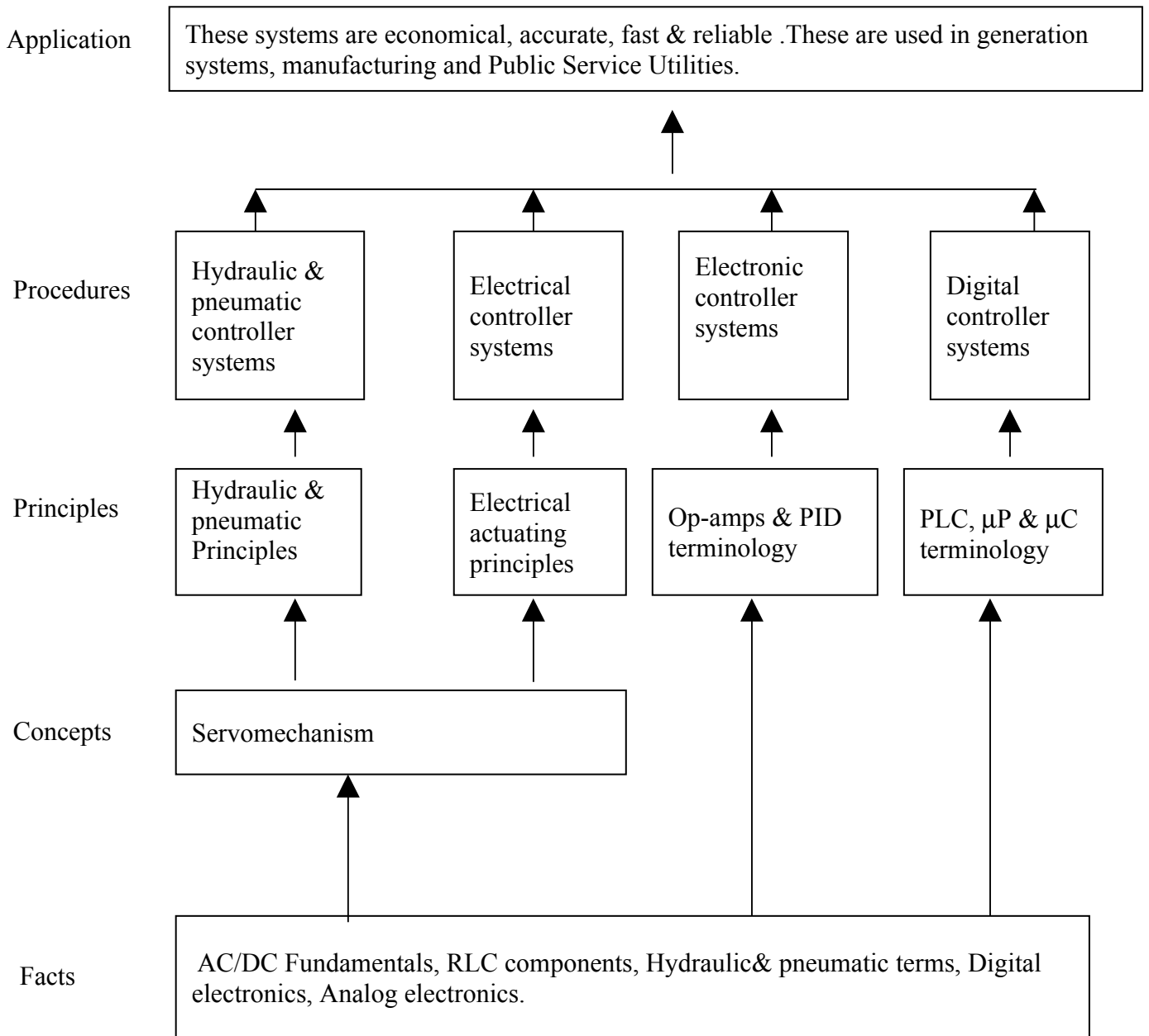
Student can analyze different types of control systems used in industries. The knowledge gained by students is used in the operation of various control systems like PLC, SCADA, DCS. His knowledge is used in supervising, controlling & maintaining the control systems.

Objective:

Student will be able to

1. Explain applications of control systems / Automation.
2. Read & design data for control systems.
3. Explain the hydraulic/ pneumatic systems.
4. Describe & program PLC using Ladder logic.
5. Describe working of control components.
6. Draw power & control circuit.

Learning structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	Automation 1.1 Need of automation 1.2 Advantages of automation 1.3 Requirements of automation	02	--
2	Control System 2.1 Concept of control system 2.2 Basic block diagram of control system 2.3 Transfer function 2.4 Different terms in control system 2.5 Types of control system 2.6 Applications of control system 2.7 Development of block diagram for simple applications like level, temperature, flow control	04	04
3	Control System Components 3.1 Contacts-types, current capacity & load utilization categories 3.2 Solenoids-dc, ac 3.3 I/P devices- switches-push buttons, foot switch, selector switch, pilot switch, proximity, photoelectric, temperature actuated, level control, pressure sensing, overload sensing 3.4 Relays- electromechanical, reed 3.5 O/P devices- contactors, valves, pilot lamps 3.6 Symbols in power & control circuits 3.7 Developing control circuit-basic & thumb rule 3.8 Power & control circuit for different applications like hoist, crane, conveyer belt, induction motors	08	12
4	Electrical Actuators 4.1 Potentiometers-working & use as error detector 4.2 Servomotors-ac & dc –working principle 4.3 Synchros - transmitter, control transformer, use of as error detector 4.4 Stepper motor-PM & variable reluctance- working principle 4.5 Tacho - generator 4.6 Applications of above components as AC/DC control system.	08	12
5	Controllers 5.1 Hydraulic-advantages & disadvantages, hydraulic servomotor, types of pumps used, control valves, components like accumulator, filter, seals 5.2 Pneumatic-resistance & capacitance of pressure system, pneumatic flapper-nozzle system, pneumatic relays, actuating valves, cylinders, comparison between pneumatic & hydraulic systems 5.3 Electrical & electronic controller-brief overview of op-amps, inverting, non-inverting, lead-lag networks 5.4 Digital controllers-brief overview of microprocessor & micro-controller to be worked as controller	08	12

6	Control actions 6.1 On-Off, P, I, P+I, P+D,P+I+D, actions 6.2 P+I+D action using hydraulic, pneumatic electronic controller 6.3 Tuning of P+I+D controller	06	12
7	Programmable Logic Controller 7.1 Introduction 7.2 Advantages & disadvantages 7.3 PLC Vs PC 7.4 Block diagram of PLC 7.5 Basic blocks like CPU, I/O modules, bus system, power supplies & remote I/Os 7.6 Different PLC's available in market	08	12
8	Programming of PLC 8.1 development of Ladder logic 8.2 some simple programs such as I/O connections, starting of IM, stepper motor control (treatment to topic no.8.2 should be given at the time of practical / pp hours.)	02	12
9	Introduction to special control systems 9.1 Distributed Control System(DCS)-brief introduction to hardware & software used 9.2 SCADA- brief introduction to hardware & software used	02	04
Total		48	80

Practical:

Intellectual Skills: a. Logical development
b. Programming skills

Motor Skills : a. Interpretation skills
b. Connecting properly

List of Practicals:

- 1) a) To plot the characteristics of potentiometer
b) Use of potentiometer as error detector
- 2) To plot V-I characteristics of DC & AC servomotors. compare them with DC & AC motor characteristics
- 3) a) To plot the characteristics of synchro transmitter
b) Use of synchro transmitter- control transformer pair as error detector.
- 4) Measure step angle for a stepper motor in forward & reverse direction.
- 5) Draw a power circuit & control circuit using control symbols for a 3-phase IM using DOL starter.
- 6) Observe various components /parts/symbols/connections of a PLC demonstration kit in your laboratory.

- 7) Draw a ladder logic diagram for two different examples.
- 8) By using above ladder logic diagram observe the status of I/Os using PLC.
- 9) Perform stepper motor/ temperature control using PLC.
- 10) Identify the parts of hydraulic/ pneumatic servomotor from cut-section/model.

B) Mini Project: (one in a group of eight students)

- 11) Collect the data of various PLC brands market & list.
- 12) Collect the data from internet about hardware & software of new control systems like SCADA, DCS.
- 13) Use the various control components in your laboratory to built a AC/DC position control system.
- 14) Built P, I, PI, PD & PID controller using op-amps & R-C circuits. Plot V-I characteristics

Learning Resources:

Books:

Sr.	Author	Title	Publisher & Address
1	Nagrath Gopal	Control System Engg.	Wiley Eastern
2	K.Ogata	Modern Control Engg.	Prentice Hall
3.	Jacob	Industrial Control Engg	Prentice Hall
4.	Andrew Parr	Hydraulics & Pneumatics	Jaico Publication
5.	Webb & Reis	Programmable Logic Controller: Principle applications	Wiley Eastern
6.	S.K. Bhattachrya Brijinder Singh	Control of Electrical Machines	New Age International Publishers