GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Instrumentation and Control Engineering

Subject Code : DI04017051

Subject Name : Industrial Power Control

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Professional Elective - I

Prerequisite:	Basic knowledge of electrical circuits, control systems, and industrial instrumentation.
Rationale:	In modern industrial environments, power control systems are essential for efficient operation, automation, and energy management. Diploma engineers must understand the principles and applications of industrial power control systems including motor control, power electronics, and programmable devices. This course equips students to design, install, and troubleshoot industrial power control systems, fostering skills aligned with Industry 4.0 and NEP's emphasis on practical, multidisciplinary learning.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Identify various industrial power control devices and their applications.	R
2	Explain the working principles of Power converters & inverters	U
3	Industrial Application of Power Electronics Devices	A
4	Integrate power control systems with PLCs and automation networks.	A
5	Troubleshoot faults in industrial power control systems.	A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content

Unit	Topics and Sub-topics	No. Of Hrs.	% Weightage
Unit – I Identify various industrial power control devices and commutation methods	1.1 Fundamentals of Industrial Power Control: 1.2Types of loads, control needs, 1.3Overview of power electronics devices (SCR, TRIAC, IGBT, MOSFET) 1.4 Safety and protection. 1.5 Compare the (features) characteristics of SCR, TRIAC, MOSFET and IGBT. 1.6 Commutation techniques of SCR. 1.7.Snubber circuit, freewheeling of SCR.	10	20
Unit-II Explain the working principles of Power converters & inverters	2.1 Explain working of Half and Full wave control bridge converter with R-L Load. 2.2 Explain the working principle of single phase Bridge Cyclo-converter. 2.3 Explain the working principle of single phase Mid-point Cyclo-converter. 2.4 Explain the Principle and working of Series Inverter circuit. 2.5 Explain the Principle and working of Parallel Inverter circuit. 2.6 Explain the Principle and working of bridge type Inverter circuit 2.7 Explain Basic D.C. chopper circuit. 2.8 Explain the working principle of step up Chopper circuits. 2.9Explain the working principle of step down Chopper circuits.	10	20

Unit – III Industrial Application of Power Electronics Devices	3.1 Describe Speed control of D.C. Motor using armature voltage Control with circuit. 3.2 Describe stator voltage speed Control for induction motor with circuit. 3.3 Describe stepper motor drive circuit. 3.4 Explain application like D.C. static switch, alarm circuit. 3.5 Explain circuit diagram for Temperature control using mercury thermostat. 3.6Explain conductive Liquid level control circuit. 3.7 Explain Ambient Light control power switch. 3.8 Single phase AC power control using DIAC-TRIAC. 3.9 UJT Triggered SCR power control.	10	20
Unit – IV Integrate power control systems with PLCs and automation networks.	4.1 PLC Integration and Automation 4.2 PLC basics & Interfacing Requirement 4.3 Interfacing with power control devices 4.4 ladder logic for motor control, 4.5 Safety interlocks.	8	20
Unit – V Troubleshoot faults in industrial power control systems.	5.1Troubleshooting and Energy Efficiency 5.2Fault diagnosis, 5.3preventive maintenance, 5.4Harmonics, power factor correction, 5.5Energy audits.	7	20
	Total	**45**	**100**

SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. *Some of the **PrOs** marked'*' are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

S.No.	PracticalOutcomes (PrOs)	Approx. Hrs. required
1	Test V/I Characteristics of SCR.	02
2	Test V/I Characteristics of DIAC.	02

S.No.	PracticalOutcomes (PrOs)	Approx. Hrs. required
3	Test V/I Characteristics of TRIAC.	02
4	Test Characteristics of Opto-Isolator.	04
5	Test Characteristics of power MOSFET.	02
6	Test outputs of Class A Load Commutation using MULTISIM.	04
7	Test outputs of Class B Resonant Pulse Commutation using MULTISIM.	04
8	Test outputs of Class C Complementary Commutation using MULTISIM.	04
9	Test Half control bridge converter.	02
10	Test Full control bridge converter.	02
11	Test parallel inverter using two SCRs	02
12	Test basic operation of series Inverter.	02
13	Test speed control of A.C. Motor using DIAC-TRIAC.	04
14	Test alarm circuit using MULTISIM.	02
15	Test D.C Static switch using MULTISIM.	04
16	Test D.C motor speed control using chopper.	02
	Total	44

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills / outcomes to match the COs. The above table is only a suggestive list.*

ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added / deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..*

Sr.No.	Sample Performance Indicators for the PrOs	Weightage in%
1	Prepare experimental setup	30
2	Operate the equipment setup or circuit	10
3	Follow safe practices measures	20
4	Record observations correctly	20
5	Interpret the result and conclude	20
	Total	**100**

MAJOR EQUIPMENT / INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment / instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators / management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Wires, tools and various connectors	1to 5 & 9,10,11,12
2	Computer and modem.	6,7,8 & 14,15

AFFECTIVE DOMAIN OUTCOMES

The following sample Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this competency.

a) Work as a leader/a team member for assigned student activity.
b) Follow safety practices and procedure in Lab.
c) Realize the importance of engineering for societal development.
d) Develop gradually the engineering mindset in day-to-day observation

SUGGESTEDSTUDENTACTIVITIES

Suggested Student Activities:

- Seminar on energy-efficient motor control systems.

- Comparative chart of different motor starters.
- Case study on power control in a local industry.
- Poster presentation on PLC-based automation in power control.

SUGGESTEDSPECIALINSTRUCTIONALSTRATEGIES (if any)

- Encourage students to document wiring and troubleshooting steps.
- Use simulation tools for virtual testing before hardware implementation.
- Invite industry experts for guest lectures on energy audits and automation.
- Assign mini-projects on motor control panels.

SUGGESTED MICRO-PROJECTS

YES

SUGGESTEDLEARNINGRESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Industrial Motor Control	Herman	Cengage Learning, Latest Edition
2	Power Electronics	M.H. Rashid	Pearson, Latest Edition
3	Programmable Logic Controllers	Frank D. Petruzella	McGraw-Hill, Latest Edition
4	Electrical Power Systems	C.L. Wadhwa	New Age International
5	Energy Management and Audit	Bureau of Energy Efficiency	Government of India

SUGGESTEDLEARNINGWEBSITES

i. www.nptel.iitm.ac.in.
ii. www.isa.org
iii. iii. www.ieee.org
iv. www.pacontrol.com
v. www.ourinstrumentation.com
vi. www.automation.com/pdf_articles/fieldbus.pdf

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