



Course Syllabus  
Gyanmanjari Diploma Engineering College  
Semester-5 (Diploma)

**Subject:** Industrial Electronics - DETEC15216

**Type of course:** Minor Stream

**Prerequisite:** Basic knowledge of Electronic Devices, Electrical Circuits, and Semiconductors.

**Rationale:** Industrial Electronics plays a vital role in modern industries by enabling efficient control and conversion of electrical energy. This course provides students with knowledge of power semiconductor devices, converters, inverters, PLC, and distributed control systems. It helps students understand real-time industrial applications such as motor drives, power supplies, automation systems, and control processes, making them industry-ready.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		Theory Marks		Practical Marks		CA	
			ESE	MSE	V	P	ALA		
3	0	2	4	60	30	10	20	30	150

*Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.*

**Course Content:**

Unit No.	Course Content	Hrs	% Weightage
1	<b>Power Devices and Trigger Circuits</b> IGBT (Insulated Gate Bipolar Transistor), Power MOSFET, GTO (Gate Turn Off Thyristor), comparison of power devices, trigger circuits, requirements for gate triggering circuits, gate triggering methods, pulse transformer in trigger circuits, isolation of gate and base drives, features of firing circuits, R-firing circuit, RC firing circuit, and waveforms, synchronized UJT triggering (ramp triggering)	11	25%



2	<p><b>Converters and Choppers</b>                  Controlled rectifiers, types of power electronic converters, single phase half controlled bridge converter with resistive load, half controlled bridge converter with R-L load, importance and effect of freewheeling diode, single phase fully controlled bridge converter with resistive load, fully controlled bridge converter with R-L load, commutation, forced commutation, classification of forced commutation, chopper, principle of DC chopper, Jones chopper, principle of working of single-phase AC chopper, MOSFET based chopper, comparison of half and fully controlled converters, comparison of semiconductor devices, natural vs forced commutation, types of choppers</p>	11	25%
3	<p><b>Inverters and Applications</b>                  Inverters, applications of inverters, series inverters with resistive load, single-phase inverter with R-L load, methods of obtaining sine wave output from an inverter, output voltage control in inverters, McMurray inverter, parallel inverter, switched mode power supplies (SMPS), block diagram of SMPS, advantages, disadvantages and applications of SMPS, uninterruptible power supplies (UPS), online UPS, offline UPS, comparison of UPS, battery banks</p>	09	20%
4	<p><b>Programmable Logic Controller</b>                  Evolution, introduction to PLC, advantages of PLC over relay logic, relays, block diagram of PLC, PLC programming languages, arithmetic functions, comparison functions, basics of input and output modules, digital input module, digital output module, logic functions, symbols used in ladder logic diagram, timers, ladder programming, ladder logic diagram for star-delta starter, conveyor control, lift control, PLC interfacing with GSM</p>	09	20%
5	<p><b>Distributed Control System</b>                  Introduction, evolution of distributed control systems, hybrid system architecture, centralized system architecture, distributed control system architecture, comparison of architectures, local control unit, operator displays, features of DCS, advantages of DCS, applications of DCS</p>	05	10%

**Continuous Assessment:**

Sr. No	Active Learning Activities	Marks
1	<p><b>Industrial Case Study Analysis:</b> Students will analyze a real industrial system, such as an elevator control system, a conveyor system, or a power supply unit. They will identify the roles of converters, inverters, PLCs, and DCSs in the system and explain their</p>	10



	operation using block diagrams. A brief report should be submitted on the GMIU web portal.(Student in a group of 2)	
2	<b>Circuit Debugging &amp; Fault Finding Activity:</b> Students will be given faulty power electronic circuits (simulation-based), such as chopper or rectifier circuits. They must identify faults, suggest corrective measures, and justify the solution.. Submit observations and conclusions on the GMIU web portal.(Students in a group of 2)	10
3	<b>Innovation Task / Idea Pitch:</b> Students will propose a creative application of industrial electronics (e.g., smart energy system, automated process, or power control solution). They will prepare a short concept note or pitch explaining the problem statement, solution approach, and expected outcome. Submit the idea document on the GMIU web portal (students in a group of 2).	10
	<b>Total</b>	<b>30</b>

### Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	30%	15%	10%	20%	05%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

### Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the working and characteristics of power semiconductor devices.
CO2	Analyze the operation of converters, choppers, and commutation techniques.
CO3	Explain the working and applications of inverters, SMPS, and UPS systems.
CO4	Develop basic PLC programs for industrial automation.
CO5	Understand architecture and applications of Distributed Control Systems.



**List of Practical:**

Sr. No	Description	Unit	Hrs
1	To study and plot the V-I characteristics of the IGBT and analyze its switching behavior.	1	2
2	To study the characteristics of a Power MOSFET and compare it with BJT.	1	2
3	To implement and analyze R and RC firing circuits for SCR.	1	2
4	To study the UJT triggering circuit and observe the output waveforms.	1	2
5	To simulate a single-phase half-controlled bridge converter with a resistive load and analyze output waveforms.	2	2
6	To study a single-phase fully controlled bridge converter with an R-L load.	2	2
7	To analyze the effect of the freewheeling diode in controlled rectifier circuits.	2	2
8	To study the operation of the DC chopper and verify duty cycle control.	2	2
9	To simulate a MOSFET-based chopper and analyze performance.	2	2
10	To study a single-phase inverter and observe the output waveform for different loads.	3	2
11	To study the operation of SMPS and UPS systems.	3	2
12	To develop basic ladder logic programs using PLC.	4	2
13	To implement PLC-based control for the motor (star-delta starter/conveyor system).	4	4
14	To study the architecture and operation of the Distributed Control System (DCS).	5	2
<b>Total</b>			<b>30</b>

**Instructional Method:**

The course delivery method will depend on the requirements of the content and the needs of students. The teacher, in addition to conventional teaching methods by blackboard, may also use any tools such as demonstration, role play, quizzes, brainstorming, MOOCs, etc.



From the content, 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, and Virtual Laboratory

The internal evaluation will be done based on the Active Learning Assignment

Practical/Viva examination will be conducted at the end of the semester for the evaluation of the performance of students in the laboratory.

### Reference Books:

- [1] Government of Tamil Nadu, Directorate of Technical Education, Industrial Electronics, Chennai, India: State Project Coordination Unit, 2015.
- [2] P. S. Bimbhra, Power Electronics, 5th ed., New Delhi, India: Khanna Publishers, 2012.
- [3] M. H. Rashid, Power Electronics: Circuits, Devices, and Applications, 4th ed., Upper Saddle River, NJ, USA: Pearson Education, 2014.
- [4] N. Mohan, T. M. Undeland, and W. P. Robbins, Power Electronics: Converters, Applications, and Design, 3rd ed., Hoboken, NJ, USA: John Wiley & Sons, 2003.
- [5] G. K. Mithal and J. P. Mittal, Industrial Electronics, New Delhi, India: Khanna Publishers, 2005.

