

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**  
**HYDERABAD CAMPUS**  
**SECOND SEMESTER 2023-2024**  
**Course Handout**

Date: 09.01.2024

In addition to part -I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

**Course No.** : **EEE/INSTR F342**  
**Course Title** : **Power Electronics**  
**Instructor-in-charge** : Prof. Sudha Radhika

**1. Scope and Objective of the Course:**

To obtain a thorough knowledge on:

- a. Need for Power electronic circuit topologies,
- b. Active and passive devices used in power electronic circuits,
- c. Analysis of the available topologies, their merits, and de-merits
- d. Development of control circuits for power electronic circuits and
- e. Various applications of power electronic circuits.

- 2. Course Description:** Theory, performance, design, testing and applications of Power electronic devices (Power Diodes, SCRs/ Thyristors, Power MOSFETs, Power BJTs and IGBTs) for AC to DC, DC to DC, DC to AC and AC to AC converter circuits used in various power and energy related applications.

**3. Text Books:**

**T1.** Ned Mohan, Tore M. Undeland, and William. P. Robbins, Power Electronics: Converters, Applications, and Design, John Wiley & Sons Inc. reprint 2008, third edition.

**T2.** Muhammad H. Rashid, Power Electronics: Circuits, Devices, and Applications, Prentice-Hall, Inc., Pearson education, 2004, third edition.

**4. Reference Books:**

**R1.** Daniel Hart, Power Electronics, Circuits, Devices and applications. Tata McGraw Hill, India.

**R2.** Joseph Vithayathil, Power Electronics, Circuits, Devices and applications. Tata McGraw Hill, India

**R3.** Issa Batarseh , Power Electronics, Circuits, Devices and applications. John Wiley and Sons.

**R4.** C.W.Lander, Power Electronics, John Wiley and Sons.

**Note:** The student may use course plan from Text Book or Reference Book.

**5. Course Plan with reference to Text book 2 (T2: Author: Muhammad H. Rashid):**  
**Course will have some self-study components which will be announced periodically**  
**in CMS**

<b>Lecture</b>	<b>Learning objective</b>	<b>Topics to be covered</b>	<b>Chapter Nos.</b>
1-2	Introduction to power electronics.	Power electronics versus linear electronics, Scope and applications of power electronic circuits, Classification of power processors and converters.	1.1,1.5,1.6
3-7	Power semiconductor devices as switching devices	Structure, Characteristics, protection and selection of Diodes, Thyristors, MOSFETs, BJT's and IGBTs	1.3, 2.3 to 2.12 7.2 to 7.5, 7.7 to 7.11.1, 4.2, 4.3, 4.6
8-16	AC to DC converters	Operation of diode and thyristor- single-phase and three-phase converters with R, R-L , R-L-C and R-L-E loads- with and without source inductance effects; Dual converters	3.1 to 3.7; 3.10 and 3.12, 10.1 to 10.14
17-23	DC to DC Converters	Operation and design of buck, boost, buck-boost, CUK, and other isolated converters like flyback, forward, push-pull, half-bridge and full-bridge converters.	5.1 to 5.12
24-30	DC to AC voltage converter	Voltage source Single and three phase inverters, 120° and 180° conduction modes, PWM techniques	6.1 to 6.5, 6.6 to 6.9
31-32	Other DC to AC Converters	Current Source inverter, operation and its control	6.10 and 6.13
33-37	AC to AC Converter	AC Voltage Controllers- single-phase and three-phase, Cyclo-converters and their control	11.1 to 11.5 11.9; 11.10;
38-42	Applications of Power Electronics	Applications of PE- in Energy storage and Renewable	13.1 to 13.4, 14.1, 14.2,15.1 to 15.4, 16.1, 16.2.1

## 6. Evaluation Scheme:

EC No	Evaluation Component	Duration (min.)	Weightage (%)	Date & time	Nature of component
<b>Theory component</b>					
1	Mid Semester Test	90	30	11/03 - 9.30 - 11.00AM	<b>CB</b>
2	*Surprise Quiz	30	10	Tutorial / Class hour as announced in Timetable	<b>CB</b>
3	Comprehensive Exam	180	40	06/05 FN	<b>CB</b>
<b>Laboratory component</b>					
4	Daily evaluation	--	10	Regular Laboratory periods	<b>OB</b>
5	Term paper/mini projects	--	10		

\* **Surprise Quiz** can be conducted during the tutorials or regular classes.

7. **Chamber Consultation Hour:** To be announced in the class.

8. **Notices:** All the notices will be displayed in CMS only. Besides this, students are advised to visit regularly CMS (institute's web based course management system) for latest updates.

9. **Make-up policy:** Make-up shall be given only to the genuine cases with valid medical certificate with prior intimation, at least one day before the exam. **No makeup is allowed for Quiz.**

10. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge: **Prof. Sudha Radhika**  
**EEE F342**

# POWER ELECTRONICS LAB

(EEE/INSTR F342)

## List of Experiments: -

**Experiment 1:** Introduction to Power Electronics Lab simulation and Hardware setup.

**Experiment 2:** Single Phase Uncontrolled (Diode) Rectifier.

**Experiment 3:** Three Phase Uncontrolled (Diode) Rectifier

**Experiment 4:** Single phase and Three phase uncontrolled rectifier with Smoothing Capacitor

**Experiment 5:** To study the operation of single phase fully controlled converter

**Experiment 6:** To study the operation of single phase half controlled converter

**Experiment 7:** To study the operation of Three phase fully controlled converter

**Experiment 8:** To study the operation of Buck, Boost, and Buck-Boost DC – DC Converter

**Experiment 9:** AC to AC Control using TRIAC

**Experiment 10:** PWM and Non – PWM Inverter