# BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI HYDERABAD CAMPUS

**SECOND SEMESTER 2021-2022**

**Course Handout**

Date: 15.01.2022

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*** : Dr. STP Srinivas

Instructors: Dr. STP Srinivas (L), Dr. Ankur Bhattacharjee (T), Dr. Sudha Radhika (P)

## Scope and Objective of the Course:

To obtain a thorough knowledge on:

* 1. Need for Power electronic circuit topologies,
  2. Active and passive devices used in power electronic circuits,
  3. Analysis of the available topologies, their merits, and de-merits
  4. Development of control circuits for power electronic circuits and
  5. Various applications of power electronic circuits.

1. **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.

## Text Books:

**T1**. Muhammad H.Rashid, Power Electronics:Circuits,Devices, and Applications, Prentice-Hall, Inc., Pearson education, 2004, third edition.

**T2.** Ned Mohan, Tore M. Undeland, and William. P. Robbins, Power Electronics: Converters, Applications, and Design, John Wiley & Sons Inc. reprint 2008, third edition.

## 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.** IssaBatarseh , 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.

## Course Plan with reference to Text book1(T1: Author: Muhammad H. Rashid): Course will have some self-study components which will be announced periodically in Google Classroom/CMS

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture** | **Learning objective** | **Topics to be covered** | **Chapter in the Text Book** |
| 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 device as switching devices | Structure, Characteristics, protection and selection of Diodes, Thyristors, MOSFETs, BJTs 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 |
| 17-26 | DC to DC Converters | Isolated converters like flyback, forward, push-pull, half-bridge and full-bridge converters. Review of DC Transients, Operation and design of buck, boost, buck-boost, CUK  converters. | 5.1 to 5.12 |
| 26-33 | 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 |
| 34-36 | Other DC to AC Converters | Current Source inverter, operation and its control | 6.10 and 6.13 |
| 36-39 | 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; |
| 40-42 | Applications of Power Electronics | Applications of PE- in drives and Renewable energy | 13.1 13.2, 14.1,  14.2,15.1, 16.1,  16.2.1 |

1. **Evaluation Scheme:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EC**  **No** | **Evaluation Component** | **Duration (min.)** | **Weightage (%)** | **Date & time** | **Nature of component** |
| ***Theory component*** | | | | | |
| 1 | Mid Semester Test | 90 | 75 M (25%) | 16/03 3.30pm to5.00pm | **CB** |
| 2 | 3 Quizzes | 40 | 45 M (15%) | Quiz – 1  (07/02/2022), 6-  7 PM  Quiz – 2  (18/02/2022), 2  – 3PM  Quiz – 3 date and time will be announced later | **OB** |
| 3 | Comprehensive Exam | 120 | 120 M (40%) | 23/05 FN | **OB** |
| ***Laboratory component*** | | | | | |
| 4 | Daily evaluation | -- | 30 M (10%) | Regular Laboratory periods | **Will be announced in class** |
| 5 | Lab Compre Exam | -- | 30 M (10%) |

1. **Chamber Consultation Hour:** To be announced in the class.
2. **Notices:** All the notices will be displayed in Google Classroom/CMS or Electrical and Electronics Engineering notice board only. Besides this, students are advised to visit regularly **Google Classroom /CMS** (institute’s web based course management system) for latest updates**.**
3. **Make-up policy:** Make-up shall be given only to the genuine cases with prior intimation. **No makeup is allowed for Quiz components.**
4. **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: **Dr. STP SRINIVAS**

## EEE/INSTR F342

***List of Experiments: -***

# POWER ELECTRONICS LAB (EEE/INSTR F342)

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

**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**: PWM and Non – PWM Inverter

**Experiment 10**: AC to AC Control using TRIAC