

## **Power Electronics Lab:**

Power Electronics Lab in Electrical Engineering Department, IIT(BHU) has been established to contribute in the development of various area of power electronic, which has grown tremendously as technology and academic discipline in last few decades. The power electronics has now become a wide field in power engineering and an inevitable and imperative part of many basic devices for serving the need of the modern society. The lab addresses comprehensive study and research and development activities for various domain under the umbrella of Power Electronics.

The power electronics lab encompasses the undergraduate and post graduate teaching lab and lab for the M. Tech. and Ph. D. research work. The activities and facilities in the power electronics lab involve the following:

1. **Undergraduate and Postgraduate course lab:** The lab facilitates the set-up of equipment and other associated devices for experiments in the syllabus for second, third and fourth year of B. Tech. students, second, third, fourth and fifth year of IDD students and first year of master's students. The following experimental set-ups are there for UG and PG courses.

- 1) Study of UJT firing circuit and single Phase half wave converter.
- 2) Study of full controlled rectifier using centre tapped transformer.
- 3) Single phase semi converter.
- 4) Single phase full converter
- 5) Single phase AC voltage controller.
- 6) Self-commuted chopper circuit
- 7) Thyristor Controlled Rectifier (TCR)
- 8) Thyristor Switched Capacitor and (TSC)
- 9) Thyristor Switched Inductor (TSI)
- 10) Voltage commuted/current commuted chopper
- 11) Single phase controller rectifier feeding R-L-C load
- 12) Three phase semi-converter
- 13) Cyclo converter
- 14) Single phase semi and full converter with source inductance
- 15) PWM Inverter
- 16) Buck Converter
- 17) Boost converter
- 18) Buck boost converter
- 19) Resonant converter
- 20) Switch Mode Power Supply (SMPS)
- 21) Boost /Buck converter for PV array
- 22) Uninterrupted Power Supply (UPS)
- 23) Fly back converter
- 24) Forward converter

2. **Thrust Research Areas:** In the power electronics lab, the following are the prominent ongoing research areas.

- 1) Modelling, simulation, and control of Power Electronics System

- 2) Energy Storage System and Optimal Bidirectional Battery Chargers
- 3) Power Electronics for the Hybrid Renewable AC/DC micro-grid
- 4) Modelling and control for Point-of-load's
- 5) EV/PHEV interface with renewable energy and grid
- 6) Multilevel inverter with power quality improvement
- 7) Hybrid AC/DC converter
- 8) Wireless power transfer
- 9) Photovoltaic solar power integration into the grid
- 10) Power quality improvement in grid connected PV system
- 11) Dual Active Bridge converters
- 12) Electric Vehicle
- 13) Leakage current minimization in PV system
- 14) High gain AC-DC inverters

### **3. Equipment and devices:**

DC power supply- Make: Aplab, Model-L1606, 0-16V/ 0-6A, Model-L6430, 0-64 V/ 0-30 A, Model- L12825, 0-128V/ 0-25A, Model- L12825-S, 0-110V/ 0-30A, Model-LD3205, 0-32V/ 0-5A

Arbitrary Function Generator- Make-Aplab, Model-DDS 20, 20 MHz, Make Tektronix, Model- AFG1022

Solar PV emulator- Make: Chroma, Model-620100H-600S, Output Power-10 KW, Output Voltage- 0-600V, Output Current- 0-17A.

Simulation Tools- MATLAB, PSCAD PSIM 10.0 tool

Soldering station- Make: Weller, Model: WR2002, 250W Two Channels Power Unit with 80Watt, WP80, 80Watt DSX 80

PCB Making Machine- Make: Bergen, Model: Protomat S62

Frequency Response Analyzer- Make: Ridley Engineering, USA Model: AP310

Prototyping tool- DXP prototype software is available for prototyping

Oscilloscope- Make- Tektronix:1. Model- MDO 3054 (Mixed Domain Oscilloscope with 500 MHz bandwidth option); 2. Model- TPS 2024B (Isolated four channel digital storage oscilloscope with 200 MHz bandwidth option)

Basic metering and debugging Equipment- Power supplies and measuring instruments like Multimeters, clamp meter, LCR meters etc.

Grid Simulator- 9 kW Four Quadrant three phase programmable AC grid Simulator

Real Time Simulator- OPAL-RT Model No-OP4510 with Intel Xeon E3 4 Core CPU, 3.2 GHz, Xilinx Kintex7 325T,326000 logic cells, -840 DSP Slice

Some Photographs



Experimental set-ups for UG lab



Solar PV Emulator



Three Phase AC Grid Simulator



Semikron Inverter Set-up



A hardware prototype of a research work



Load Test Kit



Grid Tied PV training system



OPAL-RT Real Time Simulators



A view of Laboratory