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Power Electronic Devices — Complete Syllabus (Elective — Specialisation, Option 3)

BTEUP Diploma in Electronics Engineering • 6th Semester • Session 2026-27

Subject 6.3.3 — Elective (Specialisation), Option 3 (Practicum) • Total 100 Marks • 3 Credits • L 2 – P 3 • Choose this OR Mobile and Wireless Communication OR VLSI Using VHDL

Note: No marks-distribution table and no reference-books list are given for this subject in the PDF, so unit weightages and books are not shown. Unit 3's topic text repeats the inverter introduction that Unit 4 then covers in full (as printed in the PDF).

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
6.3.3	Elective (Specialisation): Power Electronic Devices	Practicum	2 - 3	3	Practical 60	Practical 40	100
Power Electronic Devices Total				3	60	40	100

What This Subject Aims To Do

To introduce the fundamental concepts, principles and applications of power electronics and power semiconductor devices — MOSFETs, IGBTs and thyristors — and the operation, analysis and applications of power converters (DC-DC converters/choppers and inverters), with practical exposure through hands-on experiments and simulations, and integration in renewable energy applications such as solar and wind, with power quality considerations.

Unit-Wise Complete Topic List

Note: no marks-distribution table is given for this subject in the official syllabus, so unit weightages are not shown.

Unit 1 — Introduction to Power Electronics and Power Semiconductor Devices (6 Periods)

Topics: Introduction to Power Electronics: Definition, Basic concepts and Applications, Power Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-N-channel Enhancement Power MOSFET, Insulated Gate Bipolar Transistor (IGBT)- Symbol, Principle of Working, Voltage-Current (V-I) Characteristics, and its applications.

In simple words: Power electronics: what it is, and its two key switches — the power MOSFET and the IGBT — their symbols, working and V-I characteristics.

Unit 2 — Thyristor Family Devices (6 Periods)

Topics: SCR, DIAC, TRIAC, UJT – Symbol, working principle, Characteristics and applications.

In simple words: The thyristor family: SCR, DIAC, TRIAC and UJT — their symbols, working, characteristics and applications.

Unit 3 — Choppers & Converters (5 Periods)

Topics: Introduction to DC-DC converters (Choppers), Working principle and classification of choppers : Step-up (Boost) Converter, Step-down (Buck) Converter, Buck-Boost Converter, Cuk Converter, Types of Choppers, Applications of Choppers. Single Phase Full Controlled Bridge Converter with R Load and RL load. Introduction to Inverters, Types of inverters, Basic Operation, Control Strategies, Applications.

In simple words: DC-DC converters (choppers): boost, buck, buck-boost and Cuk types, plus controlled bridge converters — and a first introduction to inverters.

Unit 4 — Inverters (5 Periods)

Topics: Introduction to Inverters, Types of inverters, Basic Operation, Control Strategies, Applications. Inverter with Resistive Load, Single Phase Inverter with RL load –Methods to obtain Sine Wave output from an Inverter.

In simple words: Inverters in full: their types, operation and control, with resistive and inductive loads, and how to get a sine-wave output.

Unit 5 — Applications of Power Electronics in Renewable Energy Systems (6 Periods)

Topics: Solar Power Electronics: Solar cells, solar panels, and the working principle of photovoltaic systems, Power converters in solar systems: DC-DC converters, MPPT (Maximum Power Point Tracking), and solar inverters, Grid integration of solar power, Wind Power Electronics: Wind energy conversion systems and their components, Power electronics for controlling wind turbines and grid integration, Energy Storage Systems: Role of energy storage in renewable energy systems: Batteries, supercapacitors, and hybrid systems. Power quality issues in renewable energy and their mitigation using power electronics.

In simple words: Power electronics in renewable energy: solar PV with MPPT and solar inverters, wind energy conversion, energy storage, and power quality issues.

Practical Work

- Explore the working principle and applications of an N-channel enhancement MOSFET.
- Demonstrate the working principle and real-world applications of an IGBT.
- Visualize the Voltage-Current (V-I) characteristics of IGBT.
- Explore real-world applications of MOSFETs and IGBTs.
- To study the characteristics and applications of an SCR and observe its switching behaviour.
- To study the characteristics of the DIAC and observe its switching behaviour.
- To study the characteristics and switching behaviour of a TRIAC and observe its use in controlling AC loads.
- To study the characteristics of the UJT and use it in triggering applications like relaxation oscillators.
- Design and Simulation of a Boost Converter.
- Implement a simple application using a DC-DC converter, such as a power supply for a microcontroller.
- Design and Simulation of a Basic Inverter.
- Design and simulate a pure sine wave inverter.
- Study the characteristics of a solar panel and design an MPPT controller.
- Design and implement a basic solar inverter.
- Analyze a small wind energy conversion system with a focus on power electronics.

Reference Books

Reference books are not listed for this subject in the official syllabus.

Source: BTEUP 3rd Year curriculum (folder2627), approved in C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-English summaries, not syllabus text.

Please confirm with your own polytechnic for any local changes.

