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Fundamentals of Power Electronics — Complete Syllabus

BTEUP Diploma in Electrical Engineering • 4th Semester • Session 2026-27

Subject 4.3 (Practicum) • Total 100 Marks • 4 Credits • L 2 - P 4

Please note — cover year vs approval: BTEUP's own file for this curriculum prints “YEAR 2025-2026” on its cover, while carrying the approval line “UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026” on every page. It is filed in BTEUP's 2026-27 folder (folder2627), so it is treated here as the 2026-27 syllabus on the strength of that approval. The scheme it carries is identical, subject for subject and mark for mark, to the 2025-26 scheme.

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
4.3	Fundamentals of Power Electronics	Practicum	2 - 4	4	60	40 (3 hrs)	100
Fundamentals of Power Electronics Total				4	60	40	100

What This Subject Aims To Do

To help students maintain the proper functioning of power electronic devices.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
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I	Power Electronic Devices	08	30%
II	Turn-on and Turn-off Methods of Thyristors	08	26%
III	Phase Controlled Rectifiers	06	22%
IV	Inverters, Choppers, Dual Converters, Cyclo-converters	06	22%

Unit - I: Power Electronic Devices (08 Periods, 30%)

Topics: Definition – Scope and Applications; Power Electronic Switch Specifications: Power Diode, Power transistor, IGBT, GTO, DIAC, TRIAC; SCR – rating and their importance, Symbol, Circuit, Working, Characteristics, Protection and Applications - Battery charger using SCR, Emergency light system, Temperature controller using SCR; Working Principle of UJT.

Unit - II: Turn-on and Turn-off Methods of Thyristors (08 Periods, 26%)

Topics: SCR Turn-On methods: Voltage triggering, Thermal triggering, Illumination triggering, dv/dt triggering, Gate triggering; SCR triggering using UJT, PUT: Relaxation Oscillator and Synchronized UJT circuit; Pulse transformer and opto-coupler based triggering; Application: UPS and SMPS; SCR Turn-Off methods: Natural & Forced Commutations.

Unit - III: Phase Controlled Rectifiers (06 Periods, 22%)

Topics: Phase control: firing angle, conduction angle, extinction angle; Single phase half controlled, full controlled and midpoint-controlled rectifier with R, RL load: Circuit diagram, working, input-output waveforms, equations for DC output and effect of freewheeling diode; Different configurations of bridge-controlled rectifiers: Full-Wave & Half Wave.

Unit - IV: Inverters, Choppers, Dual Converters, Cyclo-converters (06 Periods, 22%)

Topics: Inverter: Introduction, working principles, voltage and current driven series and parallel inverters and applications; Choppers: Introduction, types of choppers and their working principles and applications; Dual converters: Introduction, working principles and applications; Cyclo-converters: Introduction, types, working principles and applications.

Practical Work

- Unit I — Identification & testing of SCR, TRIAC, DIAC, MOSFET and IGBT using a digital multimeter.
- Unit I — Obtain V-I characteristics of SCR.
- Unit I — Plot the V-I characteristics of IGBT and determine the break over voltage.
- Unit I — Plot the V-I characteristics of DIAC and determine the break over voltage.
- Unit I — Determine the latching current and holding current using V-I characteristics of SCR.
- Unit I — Plot the V-I characteristics of TRIAC and determine the break over voltage.
- Unit I — Illumination control / fan speed control through TRIAC.
- Unit II — Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.
- Unit II — To Study UJT Triggering Techniques for Half Wave Controlled rectifiers.
- Unit II — To Study UJT Triggering Techniques for Full Wave Controlled rectifiers.
- Unit II — Perform the operation of Class - A, B, C, turn off circuits.
- Unit II — Perform the operation of Class - D, E, F turn off circuits.
- Unit III — Use CRO to observe the output waveform of half wave-controlled rectifier with resistive load and determine the load voltage.
- Unit III — Draw the output waveform of Full wave-controlled rectifier with R load, RL load, freewheeling diode and determine the load voltage.
- Unit III — Determine the firing angle using DIAC and TRIAC phase-controlled circuit on output power under different loads such as lamp, motor or heater.
- Unit IV — Test the performance of given SMPS, UPS.
- Unit IV — Performance Measurement and Analysis of DC-DC Buck Regulator.
- Unit IV — Performance Measurement and Analysis of DC-DC Boost Regulator.

Reference Books (as listed in the syllabus)

- Ramamoorthy M., An Introduction to Thyristors and their applications, East-West Press Pvt. Ltd., New Delhi, ISBN: 8185336679
- Sugandhi, Rajendra Kumar & Sugandhi, Krishna Kumar, Thyristors: Theory and Applications, New Age International (P) Ltd. Pub., New Delhi, ISBN: 978-0-85226-852-0
- Bhattacharya, S.K., Fundamentals of Power Electronics, Vikas Publishing House Pvt. Ltd. Noida. ISBN: 978-8125918530
- Jain & Alok, Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd, Mumbai, ISBN: 978-8187972228
- Rashid, Muhammad, Power Electronics Circuits Devices and Applications, Pearson Education India, Noida, ISBN: 978-0133125900
- Singh, M. D. and Khanchandani, K.B., Power Electronics, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2008 ISBN: 9780070583894

- Zbar, Paul B., Industrial Electronics: A Text – Lab Manual, McGraw Hill Publishing Co. Ltd., New Delhi, ISBN: 978-0070728226
- Grafham D.R., SCR Manual, General Electric Co., ISBN: 978-0137967711
- Rahul Wadhawa, Industrial Electronics And Control, Asian Publishers, Muzaffarnagar. ISBN: 978-93-5502-131-1

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