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Electrical and Electronic Measurements — Complete Syllabus

BTEUP Diploma in Electrical Engineering • 3rd Semester • Session 2026-27
Subject 3.4 (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
3.4	Electrical and Electronic Measurements	Practicum	2 - 4	4	60	40 (3 hrs)	100
Electrical and Electronic Measurements Total				4	60	40	100

What This Subject Aims To Do

To help students use the relevant measuring instrument in different electrical applications — voltage, current, power, energy and circuit parameters.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
I	Fundamentals of Measurements	06	10%
II	Measurement of voltage and current	06	23%
III	Measurement of Electric Power	06	22%
IV	Measurement of Electric Energy	04	15%
V	Circuit Parameter Measurement through CRO and Other Meters	06	30%

Unit - I: Fundamentals of Measurements (06 Periods, 10%)

Topics: Measurement: Significance, units, fundamental quantities and standards; Classification of Instrument Systems, Classifications of Analog Instruments (Indicating, Recording and Integrating); Essential requirements of an indicating instruments: deflecting, controlling, damping torque; Static and dynamic characteristics, types of errors; Calibration: need and procedure.

Unit - II: Measurement of voltage and current (06 Periods, 23%)

Topics: Concept and working principles of moving iron (MI) and moving coil (MC) instruments; DC Ammeter: Basic, Multi range, Universal shunt; DC Voltmeter: Basic, Multi-range, concept of loading effect and sensitivity; AC voltmeter: Rectifier type (half wave and full wave); CT and PT: working principle and applications; Clamp-on meter.

Unit - III: Measurement of Electric Power (06 Periods, 22%)

Topics: Analog meters: Permanent magnet moving coil (PMMC) and Permanent magnet moving iron (PMMI) meter, their construction, working, salient features, merits and demerits; Dynamometer type wattmeter: Construction, working, merits and demerits; Range extension: Multiplying factor and extension of range using CT and PT; Errors and compensations; Active and reactive power measurement: One, two and three wattmeter method; Effect of Power factor on wattmeter reading in two wattmeter method; Maximum Demand indicator: construction and working principle; Digital wattmeter.

Unit - IV: Measurement of Electric Energy (04 Periods, 15%)

Topics: Single and three phase electronic energy meter: Constructional features and working principle; Errors and their compensations; Calibration of single-phase electronic energy meter using direct loading; Digital energy meter.

Unit - V: Circuit Parameter Measurement through CRO and Other Meters (06 Periods, 30%)

Topics: Measurement of resistance: (a) Low resistance: Kelvin's double bridge, (b) Medium Resistance: Voltmeter and ammeter method, and (c) High resistance: Megger and Ohm meter: Series and shunt; Measurement of inductance using Anderson bridge (no derivation and phasor diagram); Measurement of capacitance using Schering bridge (no derivation and phasor diagram); Measurement of voltage/ amplitude/ time period/ frequency/ phase angle delay line, through CRO; Other meters: Earth tester, Digital Multimeter; L-C-R meter, Frequency meter (ferromagnetic and Weston type), Phase sequence indicator, power factor meter (single phase and three phase dynamometer type), Synchro scope, Tri-vector meter.

Practical Work

- Unit I — Identify measuring instruments on the basis of symbols on dial, type, accuracy, class position and scale.
- Unit II — Measure AC and DC quantities in a working circuit.
- Unit II — Use Voltmeter, Ammeter and Wattmeter for different loads to conduct an experiment to measure voltage, current and power respectively in single phase a.c circuit.
- Unit II — Use Clamp-On Meter to conduct an experiment to measure current in a.c circuit.
- Unit III — Use single wattmeter for measurement of active power and power factor of single-phase circuit.
- Unit III — Use two wattmeters for measuring active power of three-phase balanced load.
- Unit III — Extend range of ammeter and voltmeter by using (i) shunt and multiplier (ii) CT and PT.
- Unit IV — Calibrate single phase energy meter by direct loading.
- Unit V — Use digital multi-meter for measurement of AC/DC current, AC/DC voltage.
- Unit V — Use Kelvin's double bridge for measurement of low resistance.
- Unit V — Use voltmeter and ammeter method for measurement of medium resistance.
- Unit V — Use Megger for insulation resistance measurements.
- Unit V — Use earth tester for measurement of earth resistance.
- Unit V — Use CRO for the Measurement of supply frequency in single-phase circuit.
- Unit V — Use Tri-vector meter for measuring kW, kVA and kVAR of a power line.

Reference Books (as listed in the syllabus)

- Theraja B. L., Theraja A. K., A Text Book of Electrical Technology Vol-I (Basic Electrical Engg.), S.Chand and Co. New Delhi, ISBN: 9788121924405
- Dr. T.D. Bisht, Ashish Sahu, Pooja Yadav, Electrical Instrumentation & Measurement, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-29-3
- Mittle V. N., Basic Electrical Engineering, McGraw-Hill New Delhi, ISBN: 978-0-07-0088572-5
- Edward Hughes, Electrical Technology, Pearson Education, New Delhi, ISBN-13: 978-0582405196
- Rajput R.K., Electrical and Electronic Measurement and Instrumentation, S.Chand and Co. New Delhi, ISBN: 9789385676017
- Sawhney A.K., Electrical and Electronics Measurements and Instrumentation., Dhanpai Rai and Sons, New Delhi, ISBN: 9780000279744
- Suryanarayna N.V., Electrical Measurements and Measuring Instruments, S.Chand and Co. New Delhi, ISBN: 8121920116

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