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Industrial Instrumentation and Condition Monitoring — Complete Syllabus (Program Elective-1, Option 2)

BTEUP Diploma in Electrical Engineering • 4th Semester • Session 2026-27
Subject 4.4.2 (Program Elective-1, Practicum) • Total 100 Marks • 3 Credits • L 1 – P 4 •
Choose this OR Industrial Automation and Control

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.

Note: In the PDF, the third practical of Unit – V is printed as a bare number "3." with no text — its content could not be read and is not included here.

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
4.4	Program Elective -1: Industrial Instrumentation and Condition Monitoring	Practicum	1 - 4	3	60	40 (3 hrs)	100
Industrial Instrumentation and Condition Monitoring Total				3	60	40	100

What This Subject Aims To Do

To help students use instrumentation equipment for condition monitoring and control.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
I	Fundamentals of instrumentation	02	15%
II	Transducers	02	20%
III	Measurement of Non-Electrical Quantities	05	25%
IV	Signal Conditioning	02	15%
V	Data Acquisition System and Condition Monitoring	03	25%

Unit - I: Fundamentals of instrumentation (02 Periods, 15%)

Topics: Basic purpose of instrumentation; Basic block diagram (transduction, signal conditioning, signal presentation) and their function; Construction, working and application of switching devices - Push button, limit switch, float switch, pressure switch, thermostat, electromagnetic relay.

Unit - II: Transducers (02 Periods, 20%)

Topics: Comparison between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive; Advantages of electric transducers; Required characteristics of transducers; Construction and working principle of resistive transducer - Potentiometer, variac and strain gauges; Gauge factor, Types of strain gauges; Construction and principle of Inductive transducers - L.V.D.T. and R.V.D.T, their applications; Construction, principle and applications of transducers - Piezo-Electric transducer, photoconductive cells, photo voltaic cells.

Unit - III: Measurement of Non-Electrical Quantities (05 Periods, 25%)

Topics: Temperature measurement - RTD, Thermistor and Thermocouple, radiation pyrometer; Pressure measurement - bourdon tube, bellow diaphragm and strain gauge, Combination of transducer - diaphragm and inductive transducer, Bourdon tube and LVDT, bellow and LVDT, diaphragm capacitance and bridge Circuit; Speed Measurement by contacting and non-Contact Type - DC tachometer, photo-electric tachometer, toothed rotor tachometer Generator - magnetic pickup and Stroboscope; Vibration measurement by accelerometer - LVDT accelerometer, Structure Piezo electric type; Flow measurement by electromagnetic and Turbine Flow meter; Liquid level measurement by resistive, inductive, capacitive gamma rays and Ultrasonic methods; Thickness measurement by resistive, inductive, capacitive, ultrasonic and nuclear methods.

Unit - IV: Signal Conditioning (02 Periods, 15%)

Topics: Basic Concept of signal conditioning System; Pin configuration of IC 741; Ideal OP-AMP and Practical of OP-AMP; Different Parameters of op-amp: Input offset voltage, Input offset current, Input bias current, Differential input resistance, CMRR, voltage gain, output voltage, slew rate, gain bandwidth, Output, short circuit current; Use of op-amp as inverting, non-inverting mode, adder, subtractor, and Working of Differential amplifier and instrumentation amplifier.

Unit - V: Data Acquisition System and Condition Monitoring (03 Periods, 25%)

Topics: DAS - Block diagram and description; Difference between Single Channel and Multi-Channel DAS; Data conversion - Construction and Working of Analog to digital conversion - successive approximation method, ramp type method; Digital to Analog conversion - Construction and Working of binary weighted resistance method; Telemetry system and its type - Electrical telemetering system; Digital display device - operation and its application of seven segment display, dot matrix display and concept of $3\frac{1}{2}$, $4\frac{1}{2}$ digits, LED and LCD applications; Definition of condition monitoring, Insulation deterioration Mechanism - factors affecting occurrence and rate of deterioration, types of stresses responsible for deterioration; Different tests on transformer, their purpose, and the necessary condition of machine; Tests on Circuit breaker, purpose and required condition of machine; Tests on CT, purpose, item to be tested and required condition of machine.

Practical Work

- Unit I — Identify different switches used in instrumentation system.

- Unit II — Measure linear displacement by L.V.D.T.
- Unit II — Measure the strain with the help of strain gauge.
- Unit III — Measure temperature by PT-100, thermistor, thermocouple along with simple resistance bridge.
- Unit III — Use Thermocouple to control the temperature of a furnace/machine.
- Unit III — Measure pressure using pressure sensor kit.
- Unit III — Measure angular speed using stroboscope and tachometer.
- Unit III — Measure the flow using flow meter.
- Unit IV — Use op-amp as inverter, non-inverting mode, adder, differentiator and integrator.
- Unit V — Convert digital data into analog data by using analog to digital converters and analog data into digital data by digital to analog converter.
- Unit V — Prepare a Report on various tools and equipment used for condition monitoring of electrical machines.

Reference Books (as listed in the syllabus)

- Sawhney, A.K. Electric and Electronic Measurement and instrumentation, Dhanpat Rai and Co. Author, Nineteenth revised edition 2011 reprint, 2014, ISBN: 10: 8177001000
- Rangan, C.S. G.R. Sharma and V.S. V. Mani, Instrumentation devices and system, Pen ram International Publishing India Pvt. Ltd. Fifth edition, ISBN: 10: 0074633503
- Mehta, V.K. Electronics and instrumentation, Third edition - S. Chand and company Pvt Ltd Reprint, 2010, ISBN: 81-219-2729-3
- Singh, S.K. Industrial instrumentation and control, Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141
- J.G. Joshi, Electronic Measurement and Instrumentation, Khanna Publishing House, New Delhi, ISBN: 978-93-86173-621

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