GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL (09) / POWER ELECTRONICS (24)
ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS
SUBJECT CODE: 2130903
B.E. 3rd Semester

Type of Course: Engineering Science (ELECTRICAL)

Prerequisite: N.A.

Rationale: N.A.

Teaching and Examination Scheme:

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<th>Teaching Scheme</th>
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Content:

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<tr>
<th>Sr. No.</th>
<th>Topics</th>
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<tr>
<td>1</td>
<td>Module 1: Philosophy Of Measurement- Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments &amp; measurement system, Errors in measurement &amp; its analysis, Standards.</td>
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<td>3</td>
<td>Module 3: Measurement of Parameters - Different methods of measuring low, medium and high resistances, measurement of inductance &amp; capacitance with the help of AC Bridges, QMeter.</td>
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<td>Module 5 Transducers: Definition - different types of transducers – criteria for selection –general characteristics–dynamic characteristics – transducers for measurement of displacement (RVDT &amp;LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications Instrumentation amplifiers – differential amplifiers –</td>
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<th>Teaching Hrs.</th>
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Data transmission and telemetry – methods of data transmission, General telemetry systems – Digital methods of frequency, phase, time and period measurements.

| 6 | Module 6 Display methods, recorders: Display methods and devices – different types of recorders – galvanometric recorders – pen driving system– magnetic recorders – digital recorders, digital storage oscilloscope (Block Diagram, theory and applications only) | 02 | 10 |

Reference Books:

2. Golding & Widis, Electrical Measurement and Measurement instrument, Wheelar Books
5. D. Patranabis, Sensors & Transducers, PHI.

Course Outcomes:

After learning the course the students should be able to
- Understand the working principal and construction of the measuring instruments and recorders.
- Measure various electrical and physical quantities and parameters using meters and transducers.
- Calibrate the measuring devices such as meters and transducers.

List of Practical including Open Ended Problems:

1. a) Calibration of single phase energy meter by direct loading b) Calibration of single phase static energy meter.
2. Calibration of single phase energy meter by phantom loading with and without phase shifting transformer.
3. Calibration of 3 phase energy meter a) phantom loading b) using phase shifting transformer.
4. Measurement of self and mutual inductance a) air cored coil b) iron cored coil.
5. a) Determination of B- H curve b) Determination of hysteresis loop using six point method.
6. Calibration of ammeter, voltmeter and wattmeter using vernier potentiometer

INSTRUMENTATION LAB
2. Extension of range of wattmeter using CT & PT
3. Measurement of displacement using LVDT
5. Thermocouple based ON – OFF controller
6. Measurement of physical quantities – strain, torque and angle
7. Measurement of temperature by RTD method
8. Measurement of low resistance by Kelvin’s double bridge;
9. Measurement of voltage, current and resistance using dc potentiometer;
10. Measurement of inductance by Maxwell’s bridge, Hay’s bridge, Anderson’s bridge;
11. Measurement of capacitance by Owen’s bridge, De Sauty bridge, Schering bridge;
12. Measurement of flow rate by anemometer;
  * The course coordinator has to define at least 3 open ended problems related to the courses.

**Major Equipments:**
The necessary Kits, Breadboard, equipments, accessories and instruments to be provided to conduct the above practicals in a group of max. 4 students.

**List of Open Source Software/learning website:**
- Open Source Software:
  - LTSpice for circuit simulation,
  - KiCAD for CAD application
- Web-based tools for design:
  - http://www.fairchildsemi.com/support/design-tools/power-supply-webdesigner/
- Circuit Lab:
  - https://www.circuitlab.com/editor/
- Open source Math Tools:
  - http://maxima.sourceforge.net/
  - http://www.sagemath.org/
  - http://www.scilab.org/
  - http://www.gnu.org/software/octave/
- Learning website
  - http://nptel.iitm.ac.in/courses.php

**Active learning Assignments (AL):** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.