

|           |                                   |          |   |   |   |   |        |                         |
|-----------|-----------------------------------|----------|---|---|---|---|--------|-------------------------|
| 25UEEL305 | ELECTRICAL<br>MEASUREMENTS<br>LAB | Category | L | T | P | R | Credit | Year of<br>Introduction |
|           |                                   | PCL      | 0 | 0 | 3 | 0 | 2      | 2025                    |

**Preamble:** This course aims to train students in the use of measuring instruments and transducers for physical parameter measurement, while developing their skills in planning, preparing, and implementing basic instrumentation systems through team-based activities.

**Prerequisite:** MAI205 Measurements and Instrumentation

**Course Outcomes:** After the completion of the course, the student will be able to:

| CO  | Course Outcomes                                                                                                             | Knowledge Level |
|-----|-----------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply voltage-current phasor relationships in RLC circuits and execute the verification of DC network theorems.             | K3<br>Apply     |
| CO2 | Determine power in single-phase and three-phase circuits using various methods.                                             | K3<br>Apply     |
| CO3 | Determine calibration characteristics, electrical parameters of meters, and magnetic characteristics of electrical devices. | K3<br>Apply     |
| CO4 | Implement the analysis of transducer characteristics and develop simulation models using modern simulation tools.           | K3<br>Apply     |

#### Mapping of course outcomes with program outcomes and program specific outcomes

|     | PO1  | PO2 | PO3 | PO4  | PO5  | PO6 | PO7  | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|------|-----|-----|------|------|-----|------|-----|-----|------|------|------|------|
| CO1 | 3    | 2   | 1   | 2    | 1    | 1   | 1    | -   | -   | -    | -    | 3    | 2    |
| CO2 | 3    | 2   | -   | 2    | 1    | 1   | 1    | -   | -   | -    | -    | 3    | 2    |
| CO3 | 3    | 2   | -   | 3    | 2    | 2   | 2    | -   | -   | -    | -    | 3    | 2    |
| CO4 | 2    | 2   | 3   | 2    | 3    | 2   | -    | -   | -   | -    | -    | 2    | 3    |
| AVG | 2.75 | 2   | 2   | 2.25 | 1.75 | 1.5 | 1.33 | -   | -   | -    | -    | 2.75 | 2.25 |

#### Mapping of course outcomes with Knowledge and Attitude Profile (WK)

|     | WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | *   | *   | *   | *   | *   | *   | *   | *   | *   |
| CO2 | *   | *   | *   | *   | *   | *   | *   | *   | *   |
| CO3 | *   | *   | *   | *   | *   | *   | *   | *   | *   |
| CO4 | *   | *   | *   | *   | *   | *   | *   | *   | -   |

Wks Mapped with the course

| WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| *   | *   | *   | *   | *   | *   | *   | *   | *   |

**Mark distribution:**

| Total Marks | CIE Marks | ESE marks | ESE Duration |
|-------------|-----------|-----------|--------------|
| 100         | 50        | 50        | 3 Hours      |

**Course Assessment Method**

(CIE: 50 marks, ESE: 50 marks)

**Continuous Internal Evaluation Marks (CIE):**

|            |                                                                                                                     |                      |       |
|------------|---------------------------------------------------------------------------------------------------------------------|----------------------|-------|
| Attendance | Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record<br>(Continuous Assessment) | Internal Examination | Total |
| 5          | 25                                                                                                                  | 20                   | 50    |

**End Semester Examination Marks (ESE):**

|                                                        |                                                                                       |                                                            |              |        |       |
|--------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------|--------------|--------|-------|
| Procedure/<br>Preparatory<br>work/Design/<br>Algorithm | Conduct of<br>experiment/<br>Execution<br>of work/<br>troubleshooting/<br>Programming | Result with<br>valid<br>inference/<br>Quality of<br>Output | Viva<br>voce | Record | Total |
| 10                                                     | 15                                                                                    | 10                                                         | 10           | 5      | 50    |

| Expt. No. | Experiments (Any 12 experiments mandatory)                                                                                                             |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         | Verification of Superposition theorem. *                                                                                                               |
| 2         | Verification of a) Thevenin's theorem and maximum power transfer theorem.*<br>b) Calculation of Norton's equivalent circuits(calculation only)         |
| 3         | Determination of impedance, admittance and power factor in RLC series/parallel circuit and to study the effect of reactive components on power factor. |
| 4         | 3-phase power measurement using one-wattmeter and two-wattmeter methods, and determination of reactive/apparent power drawn.*                          |
|           |                                                                                                                                                        |
| 5         | Resistance measurements using Wheatstone's bridge and extension of range of voltmeters.                                                                |
| 6         | Extension of instrument range using instrument transformers (CT and PT).                                                                               |
| 7         | Calibration of 1-phase Energy meter at various power factors and phantom loading (minimum 3 conditions) *.                                             |
| 8         | Calibration of 3-phase Energy meter using standard wattmeter                                                                                           |
| 9         | Determination of B-H curve $\mu$ -H curve and $\mu$ -B curve of a magnetic specimen.                                                                   |
| 10        | Measurement of self inductance, Mutual inductance and Coupling coefficient of a 1-phase transformer.                                                   |
| 11        | Determination of characteristics of Thermal sensors: Thermistor, Thermocouple and RTD*.                                                                |
| 12        | Calibration of meters (Ammeter/Voltmeter) using Potentiometers.                                                                                        |
| 13        | Determination of characteristics of LVDT                                                                                                               |

|                            |                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------|
| 14                         | Simulation of circuits using software platforms like PSpice/LT spice / MATLAB / Multisim etc.* |
| <b>Advanced Experiment</b> |                                                                                                |
|                            | Determination of insulation resistance and earth resistance.                                   |

### **Continuous Assessment (25 Marks)**

#### **1. Conduct of Experiments (10 Marks)**

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

#### **2. Lab Reports and Record Keeping (5 Marks)**

- Quality of Reports: Clarity, completeness and accuracy of lab reports.
- Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

#### **3. Viva Voce (10 Marks)**

- Ability to explain the experiment, results and underlying principles based on their theoretical knowledge
- Final Marks Averaging: The final marks for, conduct of experiments, viva, and records are the average of all the experiments performed in the lab.

### **Evaluation Pattern for End Semester Examination (50 Marks)**

#### **1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

#### **2. Conduct of Experiment/Execution of Work/Programming (15 Marks)**

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

### **3. Result with Valid Inference/Quality of Output (10 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

### **4. Viva Voce (10 Marks)**

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

### **5. Record (5 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted

### **Text Books:**

1. Sawhney, A. K. (2012). *A course in electrical and electronic measurements and instrumentation*. Dhanpat Rai Publishers.
2. Gupta, J. B. (2014). *A course in electrical and electronic measurement and instrumentation*. S. K. Kataria & Sons.
3. Kalsi, H. S. (2019). *Electronic instrumentation*. Tata McGraw-Hill.