SEMESTER S3

CIRCUITS AND MEASUREMENTS LAB

Course Code	**PCEEL307**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:0:3	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Nil	**Course Type**	Lab

Course Objectives:

1. To train the students to familiarize and practice various measuring instruments and different transducers for measurement of physical parameters.
2. Students will also be introduced to a team working environment where they develop the necessary skills for planning, preparing and implementing basic instrumentation systems

Expt. No.	Experiments
1	Verification of Superposition theorem. *
2	Verification of (a) Thevenin's theorem and Maximum Power Transfer theorem.* (b) Calculation of Norton's equivalent circuit (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	Measurement of two port network parameters.
5	Step response of RLC circuit (suggested to use DSO).
6	3-phase power measurement using one-wattmeter and two-wattmeter methods, and determination of reactive/apparent power drawn.*
7	Resistance measurement using Wheatstone's bridge and extension of range of voltmeters.
8	Resistance measurement using Wheatstone's bridge and extension of range of voltmeters.
9	Extension of instrument range using instrument transformers (CT and PT).
10	Calibration of 1-phase Energy meter at various power factors and phantom loading (minimum 3 conditions) *.
11	Calibration of 3-phase Energy meter using standard wattmeter
12	Determination of B-H curve, μ-H curve and μ-B curve of a magnetic specimen.

13	Measurement of self inductance, Mutual inductance and Coupling coefficient of a 1-phase transformer.
14	Measurement of Capacitance/ Inductance/ frequency using AC bridges.
15	Determination of characteristics of Thermal sensors: Thermistor, Thermocouple and RTD*.
16	Determination of P-V characteristics of solar PV array and determination of fill factor (study of partial shading may be included).
17	Determination of insulation resistance and earth resistance.
18	Calibration of meters (Ammeter/Voltmeter) using Potentiometers.
19	Determination of characteristics of transducers: LVDT, Strain gauge, and Load-cell
20	Simulation of circuits using software platforms like PSpice/LT spice / MATLAB / Multisim etc.*
21	Implementation of IoT-based data acquisition system
22	Demo Experiments: (a) Measurement of energy using TOD meter / Digital meters/ Bidirectional meter (b) Measurement of electrical variables and frequency using CRO and DSO (c) Harmonic analysers (d) Instrumentation systems for Gas / Fire/ Smoke Detection Systems. (e) Virtual instrumentation experiments using LABVIEW

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 (Continuous Assessment)	Internal Examination	Total
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

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

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Analyse voltage current phasor relations of RLC circuits	**K3**
CO2	Verify DC network theorems by setting up various electric circuits	**K3**
CO3	Measure power in single and three phase circuits by various methods	**K3**
CO4	Determine the calibration characteristics of various meters used in electrical systems	**K3**
CO5	Determine magnetic characteristics of different electrical devices	**K3**
CO6	Analyse the characteristics of various types of transducer systems	**K3**
CO7	Determine electrical parameters using various bridges	**K3**
CO8	Develop simulation models of electric circuits using modern simulation tools.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3		2	-	-	-	-	-	2			3
CO2	3	3	2	-	-	-	-	-	2	-	-	3
CO3	3	3	-	-	-	-	-	-	2	-	-	3
CO4	3	3	-	-	-	-	-	-	2	-	-	3
CO5	3	3	-	-	-	-	-	-	2	-	-	3
CO6	3	3	2	-	3	-	-	-	2	-	-	3
CO7	3	3	-	-	-	-	-	-	2	-	-	3
CO8	3	3	2	-	3	-	-	-	3	-	-	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A course in Electrical and Electronic Measurements & Instrumentation,	A. K. Sawhney:	Dhanpat Rai Publishers	
2	A course in Electrical & Electronic Measurement & Instrumentation	J. B. Gupta:	S. K. Kataria & Sons Publishers	
3	Electronic Instrumentation	Kalsi H. S.:	Tata McGraw Hill, New Delhi.	3

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 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.

3. Lab Reports and Record Keeping (6 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.

4. Viva Voce (5 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

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