Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: **ELECTRICAL CIRCUITS LAB**		Course Code	: **15EE22P**
Semester	: **II**	Course Group	: **Core**
Teaching Scheme in Hrs (L:T:P)	: **0:2:4**	Credits	: **3 Credits**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**

Pre-requisites	**:**Brief knowledge of circuit elements and magnetism
Course Objectives	**:**Prepare the student to understand the working of Electric Circuits

Course Outcomes:

On successful completion of the course the student will be able to -

1: Understand the measurement of Resistance, voltage and current.

2. Test and Verify the Ohm's, KVL, and KCL laws.

3: Understand measurement of Resistance and temperature coefficient of resistance.

4: Test and Verify cells in series, parallel and series-parallel.

5: Test and Verify Superposition, Reciprocity and Thevenin's theorems.

6: Understand measurement of Power and power factor in single phase ac circuit.

Course Contents:

Staff-in-charge must teach one hour tutorial for each Lab. The Contents to be taught in the one hour tutorial are

Tutorial 1:

1. Mention circuit elements as per I.S.
2. Use an analog multimeter to record different readings.
3. Connect analog voltmeter and analog ammeter in circuit and record the readings.
4. Identify different measuring instruments.

Tutorial 2:

1. Identify standard symbols of load and protective devices.
2. Identify AC/DC supply terminals and tabulate measured voltage between terminals.
3. Explain Ohm's law.

Tutorial 3:

1. Explain KCL.

Tutorial 4:

1. Explain KVL.

Tutorial 5:

1. Explain resistance.
2. Explain specific resistance.

Tutorial 6:

1. Study different types of rheostats, like wire wound, water rheostat.

Tutorial 7:

1. Explain secondary cells
2. Explain voltage variation when cells are connected in series.

Tutorial 8:

1. Explain current variation when cells are connected in parallel.

Tutorial 9:

1. Explain voltage and current variation when cells are connected series and parallel combination.

Tutorial 10:

1. Explain the conditions of fully charged battery.

Tutorial 11:

1. Connect wattmeter and calculate wattmeter constant.
2. Differentiate UPF and LPF wattmeter's and mention their uses.
3. Explain power and power factor and how power factor varies on different types of loads (resistive load or inductive load).

Tutorial 12:

1. Explain super position theorem.

Tutorial 13:

1. Explain reciprocity theorem.

Tutorial 14:

1. Explain Thevenin's theorem

PERFORMING EXPERIMENTS: 52hrs

1. Use a multimeter to measure -The voltage across the terminals, the current flowing in the circuit and the resistance of the load.
2. Verify Ohm's law experimentally.
3. Verify Kirchhoff's current law experimentally.
4. Verify Kirchhoff's voltage law experimentally.
5. Measure the resistance of a given material by using ammeter and voltmeter method and calculate the specific resistance of Copper.
6. Measure the temperature coefficient of resistance of a resistive material using calorimeter.
7. Measure voltage and current when secondary cells are in series.
8. Measure voltage and current when secondary cells are in parallel.
9. Measure voltage and current when secondary cells are in series- parallel.
10. Test and report the condition of car battery of 12 V rating .
11. Measure power in a single phase AC circuit using ammeter, voltmeter, Wattmeter and calculate p.f.
12. Verify experimentally super position theorem.
13. Verify experimentally reciprocity theorem.
14. Verify experimentally Thevenin's theorem

References:

1. Electrical Lab Manual by CCTEK, S. J. (GOVT.) POLYTECHNIC,BANGALORE.
2. Experiments in Electrical Engg by Soni, Gupta and Bhatnagar

e-Resources

1. http://www.facstaff.bucknell.edu
2. http://www.electronics-tutorials
3. http://electrical4u.com/
4. https://www.safaribooksonline.com/
5. http://www.allaboutcircuits.com/

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering	30
2	Understanding	30
3	Application/ Analysis	40
Total		**100**

Mapping Course Outcomes with Program Outcomes: (Course Outcome linkage to Cognitive Level)

Course Outcome		Experiment linked	PO Mapped	Cognitive Level	Lab Sessions
CO1	Understand the measurement of Resistance, voltage and current.	1	2, 3, 8, 9, 10	R/U/A	3
CO2	Test and Verify the Ohm's, KVL, and KCL laws.	2,3,4	2, 3, 8, 9, 10	U/A	9
CO3	Understand measurement of Resistance and temperature coefficient of resistance.	5,6	2, 3, 8, 9, 10	R/U/A	6
CO4	Test and Verify cells in series, parallel , series-parallel and report condition car battery	7,8,9,10	2, 3, 8, 9, 10	U/A	12
CO5	Test and Verify Superposition, Reciprocity and Thevenin's theorems.	12,13,14	2, 3, 8, 9, 10	U/A	15
CO6	Understand measurement of Power and power factor in single phase ac circuit.	11	2, 3, 8, 9, 10	R/U/A	3

R-Remember, U-Understanding; A-Application/ Analysis;

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Electrical Circuits Lab	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Delivery:

The laboratory Course will be delivered through Tutorial, laboratory interaction, group discussion, practical exercises, instructions, assignments and viva voice.

Tutorial - 1Hr:

Staff-in-charge will;

1. Explain the concept and working of experiment to be conducted.
2. Impart/ discuss required selection of components/ devices/ meters /equipment / suitable accessories for the experiment to be conducted.
3. Ask students to draw the circuit diagram, tabular column and truth table if any.
4. Give clear instructions about safety precautions to be followed while conducting the experiment.

Conduction/ Execution- 2 Hr:

Student will rig up the circuit diagram and conduct experiment individually under the supervision of the staff-in-charge.

Course Assessment and Evaluation:

Method	What		To Whom	Frequency	Max Marks Practical	Evidence Collected	Course Outcomes
Direct Assessment	CIE (Continous Internal Evaluation)	I A Tests	Students	Practical: Two IA tests (Average of IA test marks will be computed)	10	Blue Books	1 to 6
		Record Writing		Record Writing (Average of Marks allotted for each expt.)	10	Lab Record	1 to 6
				Assignments or Mini Program Project	5	Blue Books	1 to 6
				TOTAL	25		
	SEE (Semester End Examination)	End Exam	Students	End Of the Course	50	Answer Scripts	ALL COs
Indirect Assessment	Student Feedback on course		Students	Middle Of The Course		Feed Back Forms	ALL COs
	End Of Course Survey			End Of The Course		Questionn-aire	ALL COs

*CIE – Continuous Internal Evaluation *SEE – Semester End Examination

Note:

1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

Suggested Student Activity (any one to be submitted with 3 pages report):

1. Visit nearby Battery charging shop or show room and prepare a report of the visit.
2. Identify the faulty battery and service the same using standard tools.
3. Identify the faults in the Rheostats in the Laboratory and service the same.
4. Prepare a report of the conditions of batteries available in the Polytechnic.
5. Mini project on measurement methods of Resistance, Inductance and Capacitance.
6. For given voltage, current, Ah ratings of individual cell, and required voltage and current rating of battery, prepare a report of calculations for number of cells and their method of connections.

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)

Dimension	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks **One activity on any one CO (course outcome) may be given to a group of FIVE students** **Grand Average/Total**						14/4 =3.5 ≈4				

Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-
Task given- Industrial visit and report writing

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Conversions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
Total marks						14/4=3.5 ≈4				

QUESTION BANK

1. Conduct an experiment to Verify Ohm's law by applying to a simple circuit.
2. Conduct an experiment to Verify Kirchhoff's current law.
3. Conduct an experiment to Verify Kirchhoff's voltage law
4. Conduct an experiment to Measure the resistance of a given material by using ammeter and voltmeter method and calculate the specific resistance of Copper or Nichrome or Eureka.
5. Conduct an experiment to measure the temperature coefficient of resistance like Copper or Nichrome or Eureka etc
6. Conduct an experiment to Connect secondary cells in series and measure emf and current.
7. Conduct an experiment to Connect secondary cells in parallel and measure total emf and current
8. Conduct an experiment to Connect secondary cells in Series - Parallel and measure emf and current.
9. Conduct an experiment to Test and report the condition of car battery of 12 V and 24 V rating
10. Conduct an experiment to measure current, power and p.ffor a given single phase load.
11. Conduct an experiment to Verify super position theorem.
12. Conduct an experiment to Verify reciprocity theorem.
13. Conduct an experiment to Verify Thevinin's theorem.

Scheme of Valuation:

Sl. no.	Performance	Max.Marks
1	Writing circuit diagram and Procedure(for One)	10
2	Conduction of Experiment	25
3	Calculation and Result	5
5	Viva voce	10
	TOTAL	**50**

List of materials for Electrical Circuits lab

	RPS 0-30V/60V,5/10A	10
1	Wire wound rheostats range-assorted	30
3	Portable DC Moving coil ammeter –multirange (0-1-2-5-10A)	30
4	Portable DC Moving coil Voltmeters –multirange (0-2-10-15-30-75-150-300V)	20
5	Portable Moving iron ammeter –multirange (0-1-2-5-10A)	20
6	Portable Moving iron Voltmeters –multirange (0-5-10-15-30-75-150-300-600V)	20
7	Multimeters analog and digital	06
8	Dynamometer type UPF Wattmeter75/300/600V,5/10A	04
9	Knife switches SPST,DPST,DPDT,TPST,TPDT etc.	20
10	Galvanometers centre zero type	10
11	Electric heater 1kw 230v	02
12	Thermometer industrial range	02
13	Standard screw gauge	02
14	Cells 1.5 v	20
15	Batteries 6v,12v,24v	05 each
16	Decade resistance boxes	03
17	Decade condenser boxes	03
18	Decade inductor boxes	03
19	Rheostats assorted	20
20	Soldering iron 25W-10,60w-05	15
21	0-15 V at 2/1A continuously variable power supply with current limit.	10
22	230v,40Watts choke	5
23	230v, 100 W bulbs	10
24	230v,fan capacitor.	5
25	0-30V at 2/1A continuously variable power supply with current limit	10