Basic Electrical and Electronics Engineering Lab

(BEE01T1003P)

Lab Manual

Version: 2.0 (16 August 2021)

School of Electrical, Electronics and Communication Engineering

BEEE Lab Organization Details

In-Charge	Name	Cabin No.	Contact No.
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University Vision

"To be known for world-class education, cutting-edge research, innovation, and application of knowledge to benefit society."

University Mission

M1: To provide high-quality education, knowledge and skills necessary for our students to be successful in the technologically evolving world.

M2: To provide a supportive learning environment that facilitates discovery of new knowledge and continuous innovation

M3: To instil a culture of interdisciplinary enquiry and education that facilitates generation of cutting-edge solutions to real-world problems.

M4:To foster an environment that inculcates skills in life-long learning and team based problem solving.

School Vision

"*To be known globally as a premier School of Electrical, Electronics and Communication Engineering for value based education and interdisciplinary research for innovation.*"

School Mission

SM1: Create a strong foundation on fundamentals of school through OBL process.

SM2: Establish state-of -the-art facilities for design and simulation.

SM3: Provide opportunities to students to work on real world problems and develop sustainable ethical solutions.

SM4: Involve the students in group activities, including those of professional bodies to develop leadership and communication skills.

Programme Outcome (PO)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12:Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE OBJECTIVES

1. Verifying and analyzing the practical network circuits.
2. Use of basic laboratory equipments and procedure to measure electrical quantities using laboratory test equipment such as multimeters, power supplies etc.
3. Analyzing and solving different electrical and electronic circuits by applying different laws and theorems.
4. Evaluate the performance of electrical and electronic circuits.

COURSE OUTCOMES

On completion of this course, the students will be able to

CO 1: Handle of basic electrical and electronics equipment's.

CO 2:

CO 3: Understand

CO 4: Design of basic electronic circuits and electronic systems.

CO 5: Analyze the fundamental concepts involving electrical and electronics engineering.

CO-PO Mapping

Basic Electrical and Electronics Engineering Lab (BEEE1003)		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	PSO 1	PSO 2	PSO 3
COs		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Handle of basic electrical and electronics equipment's.	3	3	2						3			3	3		
2	Do staircase wiring on bread board	3	3	3												
3	Understand domestic wiring procedures practically	3	3	3						3			3	3		
4	Design of basic electronic circuits and electronic systems	3	3	2	3					3			2	3		
5	Analyze the fundamental concepts involving electrical and electronics engineering.	3	3	3	1					3			1	3		

Mode of Evaluation

Components	Laboratory	
	Internal Examination	End Term Examination
Marks	50	50
Total Marks	100	

Details Evaluation Scheme:

Component of evaluation	Evaluation	Rubric for CO	Marks
Experiment understanding	**Internal**	Design process	10
Performance		Discussion of results	20
Record		Quality of sketch, drawing and graphs	10
Internal viva		Theory, tools, &team works	10 (2+4+4)
Lab experiment	**End term**	Design process	20
Lab Report		Quality of sketch, drawing and graphs	20
Viva by external expert		Theory, tools, &team works	10(2+4+4)
Total			100

BEEE Lab Assessment Process

- Faculty members must carry the attendance register.
- Before coming to class faculty members must have ensured the students get the lab manual.
- Clearly define the lab problem to the students and the expected outcome of the experiment.
- Clearly explain the objective and theory behind the lab experiments.
- All faculty members in a lab class shall actively participate in the lab experiment giving guidance to students.
- Faculty members must check the results obtained by each student and sign on it.
- Faculty members must correct the error in results and instruct student to do necessary modification in experiment to get the correct results.
- Faculty must take a note of any mal functioning of equipment or component if found during the tour of lab.
- Faculty must check and correct the student's lab records.
- Faculty members evaluate the student's performance in the lab class as a part of continuous evaluation.
- Faculty must give the assignment or lab problem to students for lab based solutions and shall assess the course outcomes based on performance of students.
- Faculty must ensure that each student endorse the following and upload in Moodle;
    - ✓ Preparation of data table and plot the graphs
    - ✓ students must explain data in table or graphs
    - ✓ Students must write the observation on data pattern or behavior of graphs.
    - ✓ Students must write the scientific justification of data variation or graphs behavior.
    - ✓ Students must write the error in results if any obtained during experiment.
- One course file is to be maintained for each course and all faculties must put the necessary documents of practice in the course file time to time.
- Faculty must declare the title of next experiment and must the students to go through lab manual before coming to lab.
- Faculty members must do the counseling to students who were absent in last class and instruct them to complete missed out experiment in extra time, otherwise the student will lose the marks.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB [BEE01T1003P]

EXPERIMENT LIST

Ser	Objective
1	To familiarize with Electrical and Electronics Lab Equipment and basic Electronics Components
2	To verify (i) Kirchhoff's Current law (ii) Kirchhoff's Voltage law
3	To verify the Norton's Theorem
4	To verify the Thevenin's Theorem
5	Observe the given waveform (Sinusoidal/Square/Triangular) and calculate its Frequency, Peak Value, Average Value, RMS Value and Form factor
6	To plot the V-I Characteristics of P-N Junction Diode and calculate the forward and reverse resistance of the Diode
7	To plot the V-I Characteristics and Verification of Regulation action of ZENER Diode
8	To verify the working of Half/Full Wave Rectifier Circuit and calculate its efficiency
9	To plot the input and output characteristics of a Bipolar Junction Transistor (BJT) in Common Emitter (CE) connection
10	Project – Students should be encouraged to make a working model/Project to demonstrate any Transducer/Sensor action or any related field

Mapping with Cos:

SN.	Experiments	Readings	Activities	COs
1	Bread board Connection and Resistance color coding.	Text Books/Lab Manual	Bread board/Demo work	1, 2, 3
2	To verify: (i) Kirchhoff's current law (ii) Kirchhoff's voltage law	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 4
3	Measure the phase shift for an RC and RL circuit.	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 4
4	Verification of Truth table for logic Gates- AND, OR, NOT, NAND, NOR and XOR and Half adder Circuit.	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3
5	To plot the V-I characteristics of P-N Junction Diode and calculate the forward and reverse resistance of the diode.	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 5
6	Verification of Regulation action of ZENER Diode.	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 5
7	To verify the working of Half Wave Rectifier Circuit and calculate it's efficiency.	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 5
8	To verify the working of Full Wave (Bridge) Rectifier Circuit and calculate it's efficiency.	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 5
9	To connect R-C Filter Circuit and verify the filtering action. (Use a full wave rectified output).	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 5
10	To plot the input and output characteristics of Bipolar Junction Transistor (BJT) in Common Emitter connection.	Text Books/Lab Manual	Bread board/ Demo work	1, 2, 3, 5
11	Students should be encouraged to make a working model/Project to demonstrate any transducer/sensor action or any related field			

Details of the Experiments

EXPERIMENT 1(A)

OBJECTIVE: To familiarize with Measuring and testing equipments like Multimeter, CRO, Function Generator, Power Supply etc and also familiarize with bread board, resistors and capacitors etc.

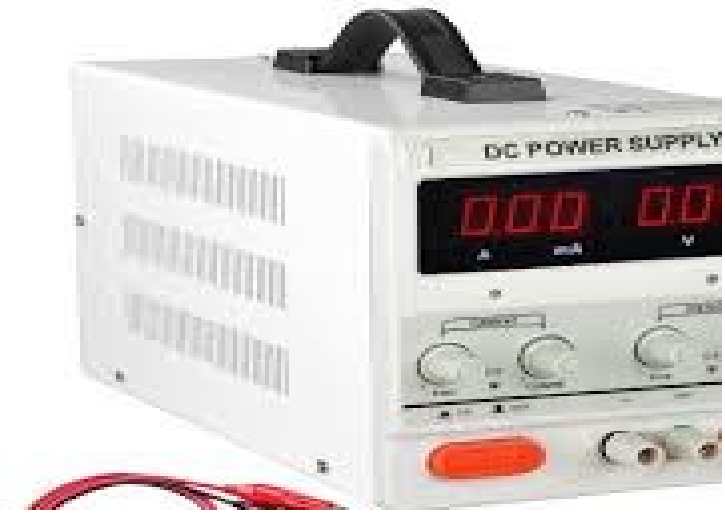
Calculate the Resistance value according to Color band and verify the same by measuring through Multimeter.

THEORY:

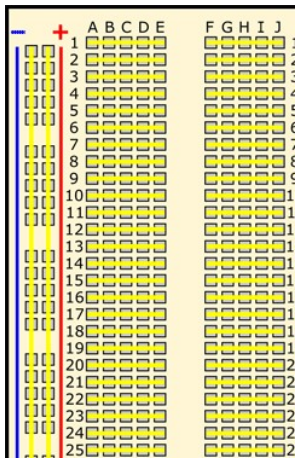
Cathode Ray Oscilloscope

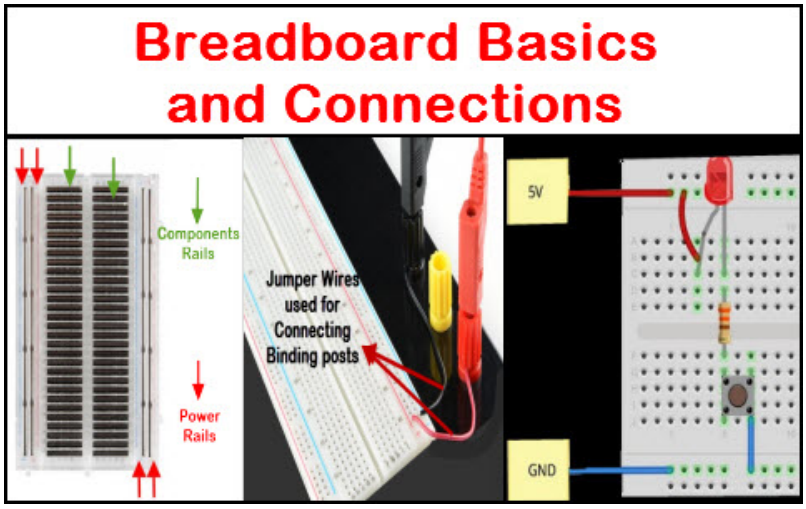
Multimeter

Power Supply



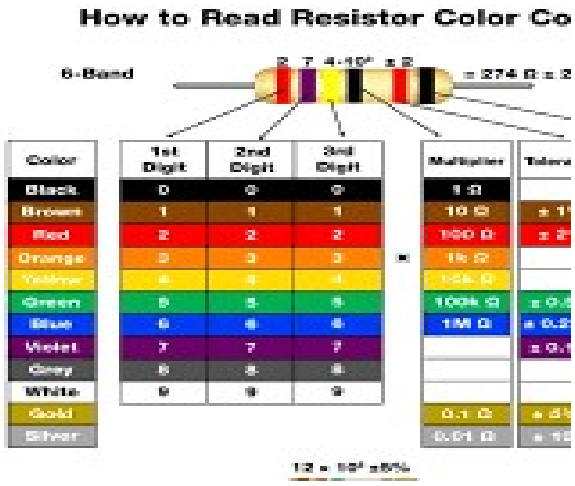
Bread Board





EXPERIMENT 1(B)

Testing of Resistance Value:



OBSERVATION TABLE:

S. No.	Resistor	Color Band	Calculated Value of "R" (Ohm)	Measured Value of "R" (Ohm)	Remark
1.	R1	1. 2. 3. 4.	1		
2.	R2	1. 2. 3. 4.	3		
3.	R3	1. 2. 3.	4		

		4.			
4.	R4	1. 2. 3. 4.			

CALCULATIONS:

QUESTIONS:

1. What do you understand by tolerance value in case of resistors?

EXPERIMENT 2(A)

AIM: To verify the Kirchhoff's current law (KCL).

OBJECTIVE: The objective of this Lab activity is to verify Kirchhoff's Current Law (KCL) using mesh and nodal analysis of the given circuit.

THEORY: According to Kirchhoff's current law, in any network of wires carrying currents, the algebraic sum of all currents meeting at a junction (or node) is zero or the sum of incoming currents towards any junction (or node) is equal to the sum of outgoing currents away from that junction.

APPARATUS REQUIRED:

S. No.	Equipment	Specification	Quantity	Remark
1.	Regulated power DC Supply	0-24V	1	
2.	PMMC Ammeter	0-1A	3	
3.	Resistances/Rheostats		4	
4.	Connecting Wires			

CIRCUIT DIAGRAM:

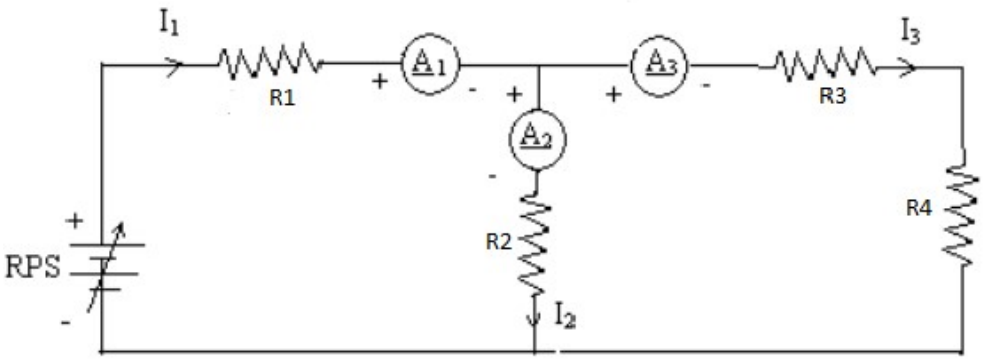


Figure 1 Circuit Diagram

PROCEDURE: Four Resistance R_1, R_2, $R_3$and R_4; and ammeters A_1, $A_2$and $A_3$are connected to DC battery or regulated DC power supply as shown in figure. The Four Resistances are connected as per circuit diagram, supply is switched on and the reading of the ammeter A_1, $A_2$and $A_3$are noted. The process may be repeated by varying either of resistancesR_1, R_2, $R_3$and R_4.

OBSERVATIONS:

S. No.	Reading of Ammeter A_1 (I_1)	Reading of Ammeter A_2 (I_2)	Reading of Ammeter A_3 (I_3)	I_2+I_3
1.				
2.				
3.				
4.				
5.				

WORKING PRINCIPLE: The algebraic sum of currents in a network of conductors meeting at a point is zero. Recalling that current is a signed (positive or negative) quantity reflecting direction towards or away from a node; this principle can be stated as:

$$\sum_{k=1}^{N} I_k = 0$$

N is the total number of branches with currents flowing towards or away from the node.The law is based on the conservation of charge whereby the charge (measured in coulombs) is the product of the current (in amperes) and the time (in seconds).

KEY PARAMETERS: Let $R_1 = 220\Omega, R_2 = 1k\Omega, R_3 = 330\Omega, R_4 = 330\Omega$ and also calculate the

$$\text{error} = \frac{Actual - Measured}{Actual} \times 100 .$$

EXPERIMETAL RESULTS:

1. Calculate the ideal voltages and currents for each element in the circuit and compare them to the measured values.
2. Compute the percentage error in the two measurements and provide a brief explanation for the error.

PRECAUTIONS:

- All connections should be tight.
- All steps should be followed carefully.
- Readings and calculation should be taken carefully.
- Don’t touch the live terminals.

QUESTIONS:

2. What is KCL?
3. What is ohm's law?
4. What is difference between emf and potential difference?
5. Why ammeters are connected in series to measure current?
6. If the length of a wire of resistance R is uniformly stretched to n times its original value, what will be its new resistance?

EXPERIMENT 2(B)

AIM: To verify the Kirchhoff's voltage law (KVL).

OBJECTIVE: The objective of this Lab activity is to verify Kirchhoff's voltage Law (KVL) using mesh and nodal analysis of the given circuit.

THEORY: According to Kirchhoff's voltage law, in any closed circuit or mesh, the algebraic sum of emf acting in the circuit or mesh is equal to the algebraic sum of the products of the currents and resistances of each part of the circuit or mesh.

APPARATUS REQUIRED:

S. No.	Equipment	Specification	Quantity	Remark
1.	Regulated power DC supply or Battery	0-24V	1	
2.	PMMC Voltmeter	0-24V	4	
3.	Resistances/Rheostats		4	
4.	Connecting Wires			

CIRCUIT DIAGRAM:

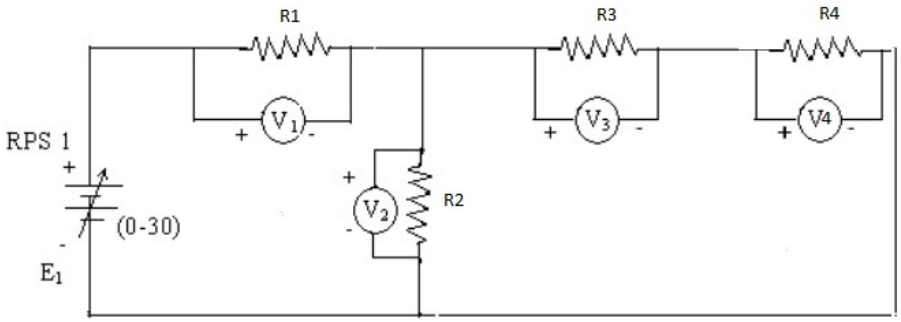


Figure 2 KVL Circuit Diagram

PROCEDURE: Resistances R_1, R_2, R_3 and R_4; and three voltmeters V_1, V_2 , V_3 and $V_4$are connected to DC battery or regulated power supply as shown in figure. Three rheostats are set their maximum values, supply is switched on and the reading of the voltmeters V_1, V_2, $V_3$and V_4 is noted. The process may be repeated by varying either of resistances R_1, R_2, R_3 and R_4.

OBSERVATIONS:

S. No.	Reading of Voltmeter V_1(Volts)	Reading of Voltmeter V_2(Volts)	Reading of Voltmeter V_3(Volts)	Reading of Voltmeter V_4(Volts)	$V=V_1+V_2$	$V_2=V_3+V_4$

WORKING PRINCIPLE: The sum of the emfs in any closed loop is equivalent to the sum of the potential drops in that loop, or: The algebraic sum of the products of the resistances of the conductors and the currents in them in a closed loop is equal to the total emf available in that loop.Similar to KCL, it can be stated as:

$$\sum_{k=1}^{N} V_k = 0$$

N is the total number of branches with currents flowing towards or away from the node.This law is based on the conservation of energy whereby voltage is defined as the energy per unit charge.

The total amount of energy gained per unit charge must be equal to the amount of energy lost per unit charge, as energy and charge are both conserved.

KEY PARAMETERS: Let $R_1 = 220\Omega, R_2 = 1k\Omega, R_3 = 330\Omega, R_4 = 330\Omega$ and also calculate the

$$\text{error} = \frac{Actual - Measured}{Actual} \times 100 .$$

EXPERIMENT RESULT:

1. Calculate the ideal voltages and currents for each element in the circuit and compare them to the measured values.
2. Compute the percentage error in the two measurements and provide a brief explanation for the error.

PRECAUTIONS:

- All connections should be tight.
- All steps should be followed carefully.
- Readings and calculation should be taken carefully.
- Don't touch the live terminals.

QUESTIONS:

1. What is KVL?
2. What is ohm's law?
3. Why voltmeters are connected in parallel to rheostats to measure voltage?
4. How does the resistance of a homogeneous material having constant length vary with the changing cross sectional area?
5. What is Fleming's left hand rule?
6. What is Fleming's right hand rule?
7. Define junction and node.
8. Define Mesh and loop.