ANNAMACHARYA UNIVERSITY

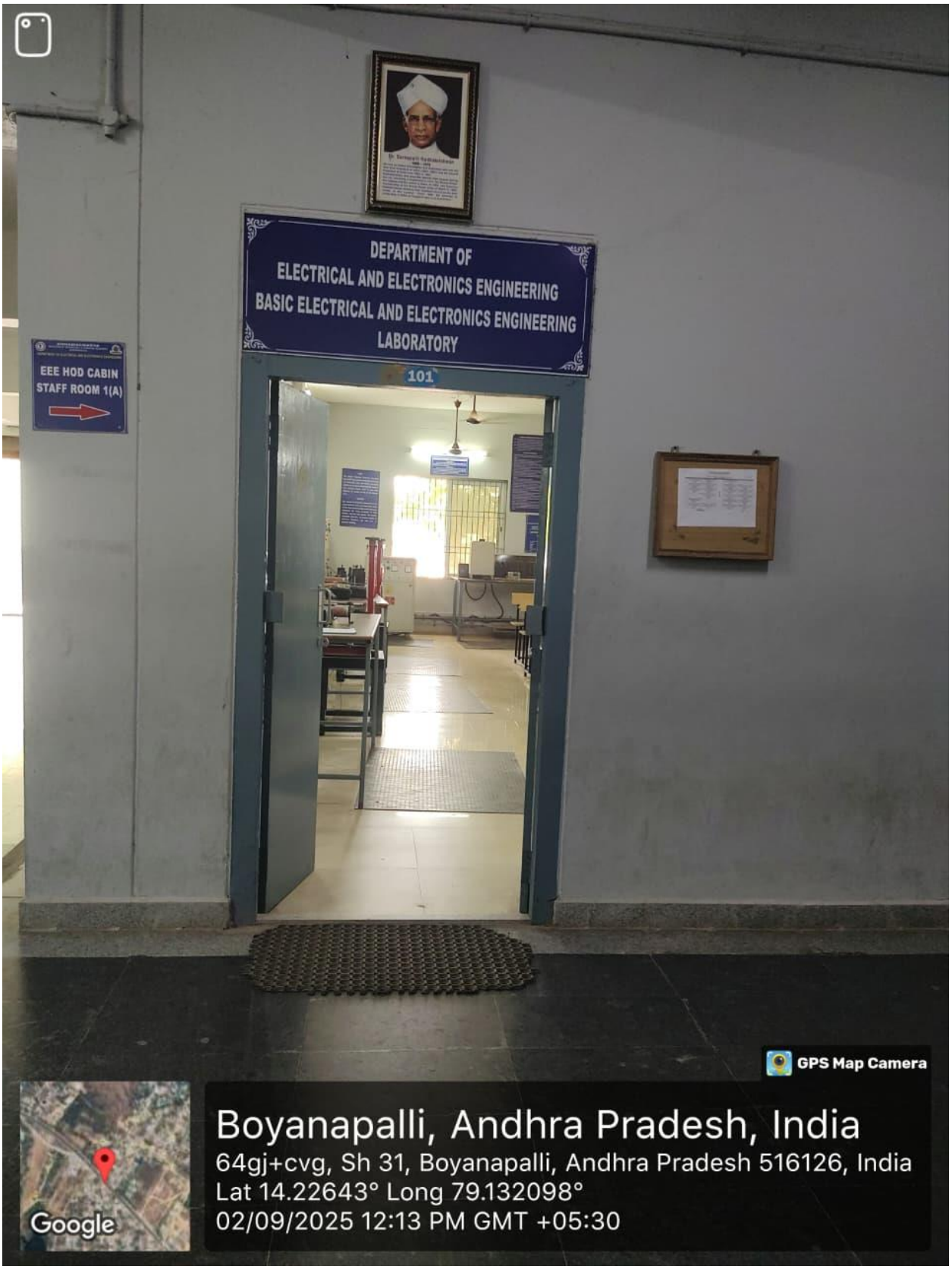
(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Department of Electrical and Electronics Engineering

Basic Electrical and Electronics Engineering Lab



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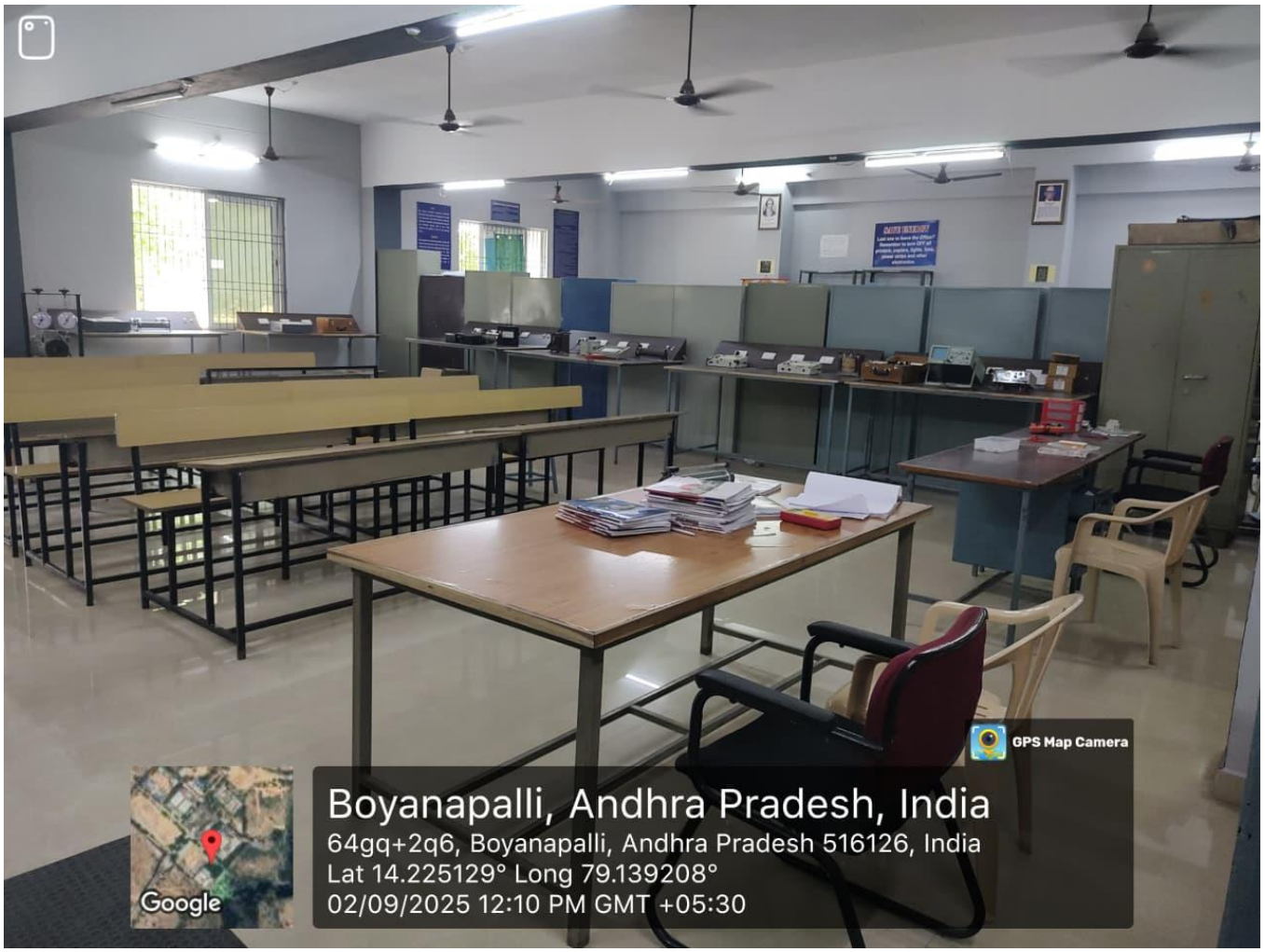

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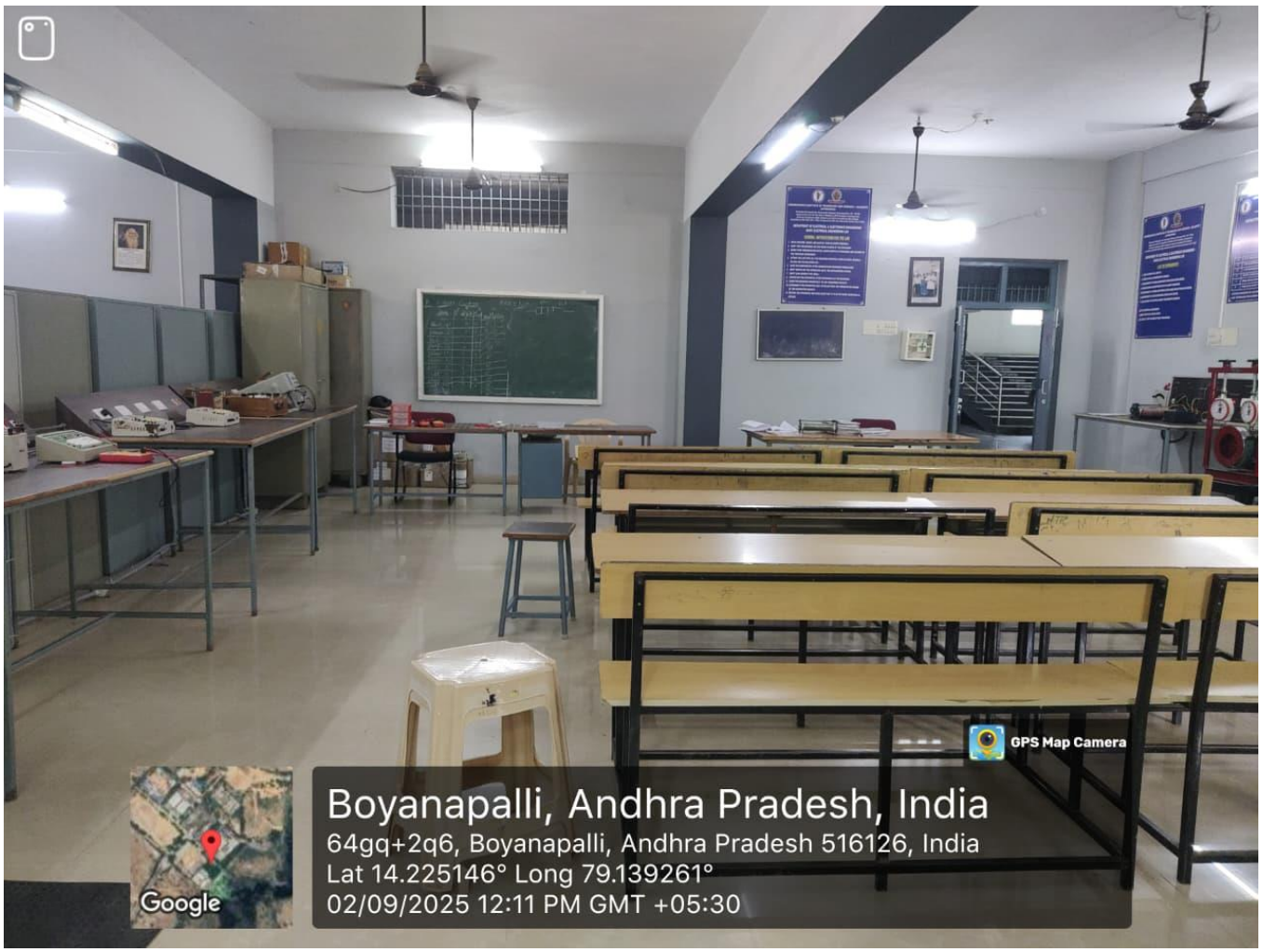

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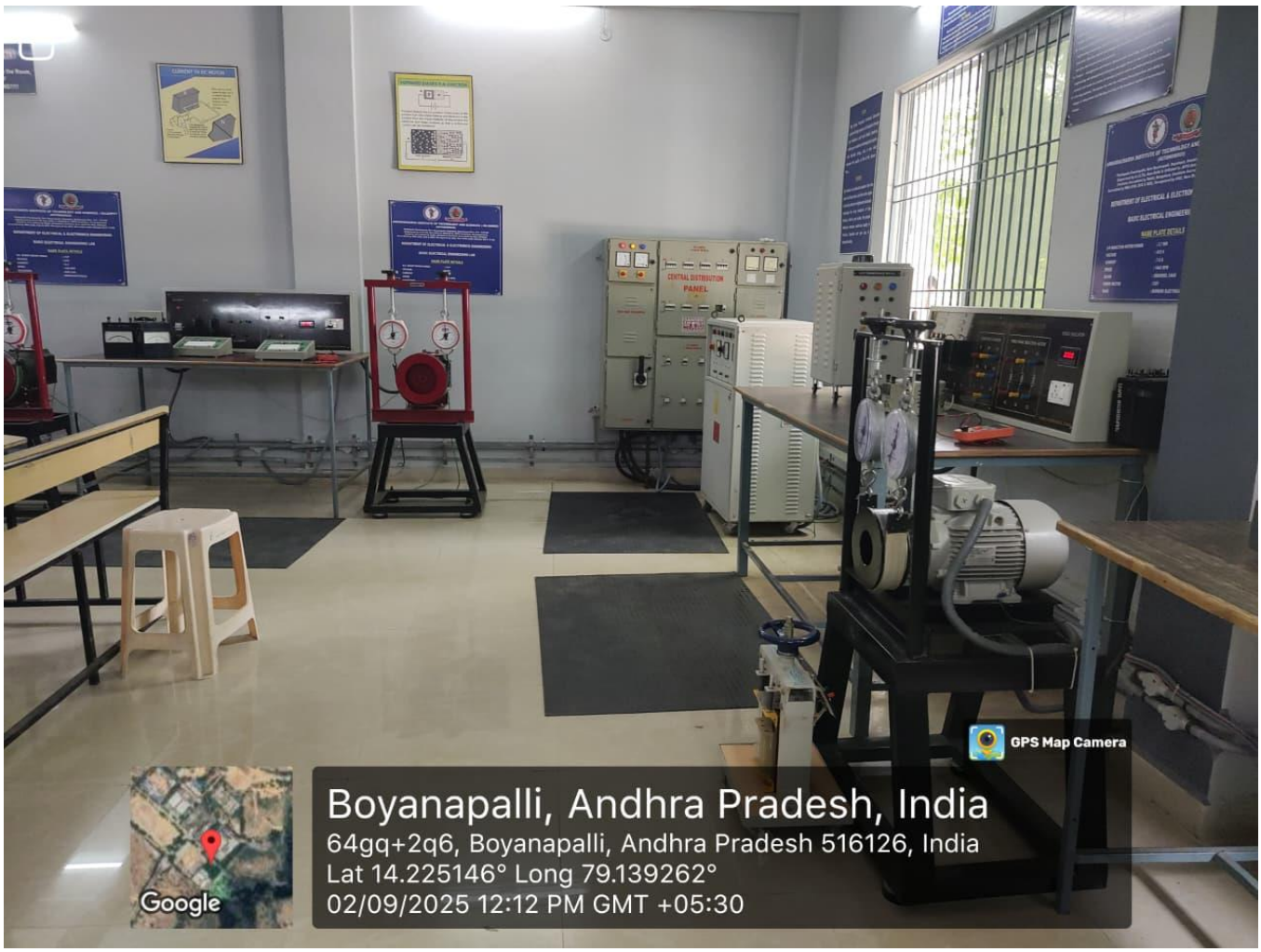

Basic Electrical and Electronics Engineering Lab

Description of Lab

Across all academic programs, this laboratory course is a fundamental, practical part of first-year engineering curriculum. The purpose of this program is to close the knowledge gap between classroom theory and practical applications in electrical and electronic systems.

The lab is based on the fundamental idea of "Learning by Doing." It gives concrete, quantifiable phenomena to abstract ideas like voltage, current, and semiconductor behavior. With no prior practical experience, the course is designed to guide a student from recognizing fundamental parts to evaluating the operation of working machines and circuits.

Key Experiments Include:

- Verification of Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) by setting up simple resistive circuits.
- Measurement of unknown resistance using the Ammeter-Voltmeter method.
- Controlling the speed of dc shunt motor by Flux control and Armature control method.
- Brake test on dc shunt motor.
- Performance tests such as open-circuit (OC) and short-circuit (SC) tests on single-phase transformers for efficiency calculations.
- Study and analysis of V-I characteristics of P-N junction diode in Forward and Reverse Bias operation.
- Study and analysis of V-I characteristics of Zener diode in Forward and Reverse Bias operation.
- Determination of ripple factor and voltage regulation of half wave rectifier with and without capacitor filter.
- Determination of ripple factor and voltage regulation of full wave rectifier with and without capacitor filter.
- Study of circuit performance using oscilloscopes and simulating various electrical phenomena.

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Basic Electrical and Electronics Engineering Lab

Total Lab Cost

Item No.	Name of the Equipment/Machine/Instrument	Total Cost (In Rupees)
1	3-Φ Rectifier	120000
2	D.C Shunt Motor	336960
3	3-Φ Induction Motor (Squirrel Cage Type)	77850
4	DC Distribution Panel (6 Outputs/Wall Mounted)	20250
5	Digital Speed Indicator with speed sensor & mounting arrangement	12600
6	Control Panel includes MCB, Staretr Fuse, Indicators etc.,)	90000
7	D.C. Voltmeter	1916
8	D.C. Voltmeter	3840
9	D.C. Voltmeter	4790
10	D.C. Voltmeter	4790
11	D.C. Voltmeter	6400
12	D.C. Voltmeter	958
13	D.C.Ammeters	2000
14	D.C.Ammeters	3000
15	D.C.Ammeters	2610
16	D.C.Ammeters	3000
17	D.C.Ammeters	2610
18	D.C.Ammeters	6000
19	AC Voltmeters	2170
20	AC Voltmeters	1085
21	AC Voltmeters	10850
22	AC Voltmeters	1085
23	AC Voltmeters	3510
24	AC Ammeters	5425
25	AC Ammeters	2340
26	AC Ammeters	4340
27	AC Ammeters	4340
28	AC Ammeters	1085
29	AC Ammeters	5800

Item No.	Name of the Equipment/Machine/Instrument	Total Cost (In Rupees)
30	Rheostats	1934
31	Rheostats	9900
32	Rheostats	1375
33	Rheostats	1170
34	Rheostats	1029
35	Rheostats	2340
36	Rheostats	1990
37	Rheostats	5670
38	Rheostats	15120
39	Rheostats	5712
40	1- Φ LPF Wattmeters	4100
41	1- Φ LPF Wattmeters	7645
42	1- Φ Wattmeters (Digital)	9600
43	1- Φ LPF Wattmeters	4545
44	1- Φ LPF Wattmeters	4100
45	1- Φ Wattmeters (Digital)	4800
46	1- Φ UPF Wattmeters	1840
47	1- Φ UPF Wattmeters	3680
48	1- Φ UPF Wattmeters	3250
49	1- Φ UPF Wattmeters	3930
50	1- Φ Step down transformer	5325
51	1- Φ Step down transformer	4420
52	1- Φ Step down transformer	8055
53	1-Φ Auto Transformer	17200
54	3- Φ UPF Wattmeters (Two element)	3980
55	Tachometer	1260
56	Digital Multimeters	7500
57	Digital Multimeters	7200
58	Bread Board with DC Power Supply	7800
59	Bread Board Trainer Kit	55000
60	Decade Resistance Box	1700
61	Wheatstone Bridge	22921.5
62	Megger	20738.5

Item No.	Name of the Equipment/Machine/Instrument	Total Cost (In Rupees)
63	Linear Variable Inductive Load	12552.25
64	3-Φ Auto Transformer	4750

Total Cost: 1015736.25 (Rupees Ten Lakhs Fifteen Thousand Seven Hundred and Thirty Six)

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Basic Electrical and Electronics Engineering Lab

List of Equipment with Cost and Quantity

Item No.	Name of the Equipment/Machine/Instrument	Rating	Unit Cost (in Rupees)	No.of Units
1	3-Φ Rectifier	(0-200)V, 100A	120000	1
2	D.C Shunt Motor	3 H.P, 220V/12A, 1500 r.p.m	112320	3
3	3-Φ Induction Motor (Squirrel Cage Type)	5 H.P, 415V/1410 r.p.m	77850	1
4	DC Distribution Panel (6 Outputs/Wall Mounted)	-	20250	1
5	Digital Speed Indicator with speed sensor & mounting arrangement	-	3150	4
6	Control Panel includes MCB, Starter Fuse, Indicators etc.,)	-	22500	4
7	D.C. Voltmeter	(5/10) V	958	2
8	D.C. Voltmeter	(30/60) V	1280	3
9	D.C. Voltmeter	(150/300) V	958	5
10	D.C. Voltmeter	(150/300) V	958	5
11	D.C. Voltmeter	(150/300) V	1280	5
12	D.C. Voltmeter	(300/600) V	958	1
13	D.C. Ammeters	(1/2) A	1000	2
14	D.C. Ammeters	(1/2) A	1000	3
15	D.C. Ammeters	(1/2) A	1305	2
16	D.C. Ammeters	(5/10) A	1000	3
17	D.C. Ammeters	(5/10) A	1305	2
18	D.C. Ammeters	(10/20) A	1000	6
19	AC Voltmeters	(15/30) V	1085	2
20	AC Voltmeters	(75/150) V	1085	1
21	AC Voltmeters	(150/300) V	1085	10
22	AC Voltmeters	(300/600) V	1085	1
Item No.	**Name of the Equipment/Machine/Instrument**	**Rating**	**Unit Cost (in Rupees)**	**No.of Units**

23	AC Voltmeters	(300/600) V	1170	3
24	AC Ammeters	(1/2) A	1085	5
25	AC Ammeters	(1/2) A	1170	2
26	AC Ammeters	(2.5/5) A	1085	4
27	AC Ammeters	(5/10) A	1085	4
28	AC Ammeters	(10/20) A	1085	1
29	AC Ammeters	(10/20) A	1450	4
30	Rheostats	25Ω/5A	967	2
31	Rheostats	25Ω/5A	4950	2
32	Rheostats	145Ω/2.8A	1375	1
33	Rheostats	145Ω/2.8A	1170	1
34	Rheostats	200Ω/1.7A	1029	1
35	Rheostats	200Ω/1.7A	1170	2
36	Rheostats	360Ω/1.2A	1990	1
37	Rheostats	360Ω/1.2A	945	6
38	Rheostats	360Ω/1.2A	3780	4
39	Rheostats	365Ω/1.2A	1428	4
40	1- Φ LPF Wattmeters	75/150/300V, 1/2 A	4100	1
41	1- Φ LPF Wattmeters	75/150/300V, 1/2 A	3822.5	2
42	1- Φ Wattmeters (Digital)	75/150/300V, 1/2 A	4800	2
43	1- Φ LPF Wattmeters	75/150/300V, 1/2 A	4545	1
44	1- Φ LPF Wattmeters	125/250/500V, 5/10A	4100	1
45	1- Φ Wattmeters (Digital)	75/150/300V,10/20 A	4800	1
46	1- Φ UPF Wattmeters	150/300/600V, 2.5/5 A	1840	1
47	1- Φ UPF Wattmeters	150/300/600V, 5/10 A	1840	2
48	1- Φ UPF Wattmeters	150/300/600V, 5/10 A	1625	2
Item No.	**Name of the Equipment/Machine/Instrument**	**Rating**	**Unit Cost (in Rupees)**	**No.of Units**
49	1- Φ UPF Wattmeters	150/300/600V, 5/10 A	1965	2
50	1- Φ Step down transformer	2kVA, 230/115V	5325	1

51	1- Φ Step down transformer	2kVA, 230/115V	4420	1
52	1- Φ Step down transformer	2kVA, 230/115V	8055	1
53	1-Φ Auto Transformer	2kVA, 230/(0-270)V	4300	4
54	3- Φ UPF Wattmeters (Two element)	250/500V, 5/10 A	3980	1
55	Tachometer	Digital	1260	1
56	Digital Multimeters	Model R603A	1250	6
57	Digital Multimeters	Model M890	1200	6
58	Bread Board with DC Power Supply	ModelBTS-301	2600	3
59	Bread Board Trainer Kit	BBS-GPT2	5500	10
60	Decade Resistance Box	1000 ohms	850	2
61	Wheatstone Bridge	-	11460.75	2
62	Megger	Analog	10369.25	2
63	Linear Variable Inductive Load	1-Phase	12552.25	1
64	3-Φ Auto Transformer	(0-415V), 15A	4750	1

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Basic Electrical and Electronics Engineering Lab

Syllabus

Title of the Course	Basic Electrical and Electronics Engineering Lab (Revised)
Category	BSC (LAB)
Course Code	24AEEE11L
Year	I
Semester	I
Branch	Common to all branches

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	2	1

Course Objectives:

1. To identify the various electrical and electronic components and devices.
2. To impart knowledge and practical exposure on various elements of electrical circuits, operational aspects of various electrical machines and electronic circuits.
3. To analyze the performance of rectifier circuits in practical approach.
4. To observe the characteristics of semiconductor devices

List of Experiments

S.NO	Name of Experiments
1	Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCBs, Diodes, BJT)
2	Study and operation of • Multi-meters (Analog and Digital) • Function Generator • Regulated Power Supplies
3	Verification of KCL and KVL
4	Measurement of resistance by using Ammeter and Voltmeter method
5	Measurement of Earth Resistance using Megger
6	Speed control of DC Shunt Motor
7	Brake Test on DC Shunt Motor
8	OC and SC Test on Single Phase Transformer (Calculation of Efficiency)
9	Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias
10	Plot V – I characteristics of Zener Diode
11	Determination of Ripple Factor and Regulation of Half Wave Rectifier with and without capacitive filter
12	Determination of Ripple Factor and Regulation of Full Wave Rectifier with and without capacitive filter

13	Study of Cathode Ray Oscilloscope. (CRO)

Course Outcomes:

At the end of the course, the student will be able to Blooms Level of Learning

1.	Identify the various Electrical and Electronic Components and Devices.	L1
2.	Analyze various characteristics of electrical circuits, electrical machines and measuring instruments.	L4
3.	Analyze the characteristics of various semiconductor devices through practical investigations.	L4
4.	Comprehend the usage of Electronic devices as half wave and full wave rectifier	L2

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering tool usage	The engineer and the world	Ethics	Individual and collaborative team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
CO1	1	1	1	1	-	1	-	2	2	-	1	-	-
CO2	3	3	2	2	-	2	-	2	2	-	1	1	1
CO3	3	3	2	2	-	2	-	2	2	-	1	1	-
CO4	2	2	1	1	-	1	-	2	2	-	1	1	1

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Basic Electrical and Electronics Engineering Lab

List of Experiments Beyond Syllabus

S.No.	Name of the Experiment
1	Verification of Ohm's Law.
2	Resistance in series and parallel connection.
3	Input and output characteristics of transistor in Common Emitter Configuration.
4	Swinburne's test on d.c shunt machine.

Basic Electrical and Electronics Engineering Lab

Out of Box Experiments

1. The Lemon Battery and Energy Harvesting

Concept: Get beyond the controlled power source. Copper coins, zinc nails, and lemons can be used to make a basic battery. It generates relatively little voltage and current, which can be measured using a multimeter.
Out-of-the-Box Twist: Students are challenged to connect several lemon cells in parallel and series to generate a voltage high enough (for example, >3V) to turn on a low-power LED, which needs about 20mA and 2–3V. Through a very engaging approach, this teaches the practical issues of internal resistance and energy harvesting, as well as the fundamental ideas of series/parallel connections.

2. Build a Simple Continuity Tester / Cable Tester
Concept: Instead of just using a multimeter's continuity mode, have students build their own. This can be a very simple circuit using a battery, resistor, LED, and probes.
Out-of-the-Box Twist: Make it a "**Cable Tester**" for cables with several cores, such as phone or Ethernet cables. Teams can create a system with a breadboard, batteries, LEDs, and resistors in which a second box with LEDs reveals which wire is linked, and a first box sends a signal down each wire. Digital logic (on/off states) and useful troubleshooting techniques are taught here.

Basic Electrical and Electronics Engineering Lab

Scope of research

A Basic Electrical and Electronics Engineering (BEEE) lab conducts fundamental and largely instructive research. It's more about developing skills, gaining a tangible grasp of the fundamental ideas that underlie all contemporary electrical and electronic systems, and conducting experiments than it is about developing novel theories for publication.

1. Verification of Ohm's Law, Kirchhoff's Current and Voltage Laws (KCL, KVL):
Determining the basic connections between resistance, voltage, and current in basic circuits.
2. Comprehending voltage division, current division, and equivalent resistance/capacitance/inductance is essential for the analysis of series and parallel circuits.
3. The ability of Thevenin's, Norton's, Maximum Power Transfer, and Superposition theorems to simplify and analyze intricate circuits has been demonstrated experimentally.
4. When a switch is opened or closed, the transient response of RC, RL, and RLC circuits is observed and measured using oscilloscopes (e.g., charging/discharging of a capacitor).
5. Examining how impedance changes with frequency and how capacitors and inductors induce phase shifts between voltage and current in AC circuits.
6. Real, Apparent, and Reactive Power: Understanding power factor in AC circuits.
7. Power Factor Correction: Performing experiments to improve the power factor of a circuit (e.g., an inductive motor) by adding a capacitor.
8. Transformers: Determining turns ratio, studying magnetization characteristics, and calculating efficiency and regulation.
9. DC Motors and Generators: Studying their speed-torque characteristics and load performance.
10. AC Motors (Induction Motors): Studying speed control methods and performance under varying loads.
11. Effect of Filters: Investigating how capacitor filters smooth the rectified output.
12. Bipolar Junction Transistor (BJT) Characteristics: Input and Output Characteristics: Plotting curves (e.g., I_c vs. V_{ce} for different I_b) to determine parameters like current gain (β), and understanding the cutoff, active, and saturation regions of operation.