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

DC Machines and Transformers Lab



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



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



DC Machines And Transformers Lab

Description of Lab

The **DC Machines and Transformers Laboratory** is an essential facility in the Electrical and Electronics Engineering Department, designed to provide students with practical knowledge and hands-on experience on electrical machines. This lab primarily focuses on the study of **DC machines** and **single-phase & three-phase transformers**, their constructional features, performance, testing, and applications.

Objectives of the Lab

- To familiarize students with the construction, working principles, and characteristics of **DC motors, DC generators, and transformers**.
- To conduct **performance tests** to evaluate efficiency, regulation, and losses in machines.
- To bridge the gap between **theoretical concepts** and **practical applications** in electrical machines.
- To develop skills in handling laboratory equipment safely and accurately.

TOTAL COST OF THE LAB : **Rs.15,40,500/-**

LIST OF EQUIPMENT

S.No	Name of the equipment	Make	Date of purchase	Quantity	Cost/Unit (Rs)	Total Cost (Rs)
1	Rectifier Power Unit with DC Distribution panel	KIRLOSKAR	22/09/2015	1	2,50,000	2,50,000
2	DC Shunt Motor Coupled to DC Shunt Generator with digital speed indicator& speed sensors	KIRLOSKAR	22/09/2015	3	120000	3,60,000
3	Series Motor Coupled To Series Generator	Associate Engineer	14/12/2010 8/1/2010	1	65,137	65,137
4	MG Set(DC Shunt Motor & DC Compound Generator	Kirloskar	30/12/99	1	47,000	47,000
5	MG Set(DC Shunt Motor & DC Shunt Generator	Kirloskar	30/12/99	1	41,190	41,190
6	DC Series motor	Kirloskar	30/12/99	1	28,470	28,470
7	DC Shunt Motor coupled with spring balance load setup with digital speed indicator& speed sensor	Kirloskar	22/09/2015	3	70,000	2,10,000
			30/12/99	1	28,470	56,940
8	DC Compound Motor	Kirloskar	30/12/99	1	33,600	33,600
9	Rheostats-365Ω/1.2A	Stead Make	17/10/2015	17	1,800	30,600

	Rheostats-145Ω/2.8A	Stead Make	17/10/2015	3	2,400	7,200
	Rheostats-25Ω/5A	Stead Make	17/10/2015	3	2,200	6,600
10	Loading Rheostats	Power Labs	22/09/2015	5	16,000	80,000
11	Voltmeters-(0-30)V MC	Meco Make	17/10/2015	6	1,449	2,899
	Voltmeters-(0-300)V MC	Meco Make	17/10/2015	17	1,449	24,633
12	Ammeters-(0-2)A MC	Meco Make	17/10/2015	11	1,449	15,939
	Ammeters-(0-10)A MC	Meco Make	17/10/2015	14	1,449	17,394
	Ammeters-(0-20)A MC	Meco Make	17/10/2015	04	1,449	5,798
13	Digital Tachometers CONTACT TYPE CONTACT LESS	Systems	17/10/2015	06 05	2,000 30,000	12,000 15,000

14	3-Point starters	Ramson make	17/10/2015	11	3,500	38,500
15	Panel Boards for individual machines	Power Labs	22/09/2015	12	11,000	1,32,000
16	DC 2 Point Starter	Associate Engineer	22/12/2011	1	2,700	2,700
17	Insulation Mats	Itta Instruments	6/2/17	13	2300	29,900
	Total Cost					**15,40,500**

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

ANNAMACHARYA UNIVERSITY: RAJAMPET

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Title of the Course:	**DC MACHINES & TRANSFORMERS LAB**
Category:	**PC**
Couse Code:	**24AEEE31L**
Branch/es:	**EEE**
Year :	**II**
Semester:	**I**

Lecture Hours	Tutorial Hours	Practice Hours	Credits
--	--	3	1.5

Course Objectives:

To impart hands on experience in Testing of DC and AC Machines, measurement of performance parameters, study of machine characteristics. It also gives practical exposure to the usage of different DC and AC Machines with different conditions.

Course Outcomes:	**Blooms Level**
At the end of the course, the student will be able to	
1. Apply theoretical concepts to determine the performance characteristics of DC Machines.	L3
2. Demonstrate starting and speed control methods of DC Machines.	L2
3. Analyze the parallel operation of single phase transformers	L4
4. Analyze the performance analysis of transformers using various tests	L4
5. Determine the performance parameters of single-phase transformer.	L3

List of Experiments:

Any 10 of the following experiments are to be conducted:

1. Magnetization characteristics of DC Shunt Generator.Determination of Critical resistance and Critical Speed.
2. Speed control of DC shunt motor by Field Current and Armature Voltage Control.
3. Brake test on DC shunt motor- Determination of performance curves.
4. Swinburne's test - Predetermination of efficiencies as DC Generator and Motor.
5. Load test on DC compound generator-Determination of characteristics.
6. Load test on DC shunt generator-Determination of characteristics.
7. Load test on DC series generator-Determination of characteristics
8. Fields test on DC series machines-Determination of efficiency.
9. Brake test on DC compound motor-Determination of performance curves.
10. Retardation Test on DC Shunt Motor-Determination of Stray Losses.
11. OC & SC tests on single phase transformer.
12. Sumner's test on single phase transformers.
13. Scott connection of transformers.
14. Parallel operation of Single-phase Transformers.
15. Separation of core losses of a single-phase transformer.

Refernce Books:

1. Laboratory Manual for Electrical Machines by D. P.Kothari, BS Umre, Dreamtech Press, 2nd Edition,2020 .
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education,4th Edition, 2017.
3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.

Reference:

1. https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

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 teamwork	Communication	Project management and finance	Life-long learning	PSO1	PSO2
1	3	2	2	-	2	-	-	2	1	-	1	3	2
2	3	3	2	-	-	-	-	2	1	-	1	3	2
3	3	2	3	1	-	-	-	2	1	-	1	3	2
4	3	3	2	1	-	-	-	2	1	-	1	3	2
5	3	3	2	-	-	-	-	2	1	-	1	3	2

LIST OF EXPERIMENTS BEYOND THE SYLLABUS.

1. Ward–Leonard Speed Control
2. Simulation of Magnetization Characteristics of a DC Generator.

OUT OF BOX EXPERIMENTS

1.Smart Transformer Monitoring (IoT-based)
2.Energy Regeneration during Braking.

Scope of Research in DC Machines and Transformers Laboratory.

The **DC Machines and Transformers Laboratory** provides not only a platform for undergraduate learning but also a foundation for advanced **research, innovation, and interdisciplinary applications**. The experiments and equipment available in this lab can be extended for various **research-oriented activities** in the areas of **energy systems, drives, renewable integration, condition monitoring, and smart grid technologies**.

1. Research in DC Machines

- **Electric Vehicle Applications**
  - a. Development of advanced **DC motor drives** for traction.
  - b. Study of **regenerative braking** and energy recovery techniques.
  - c. Optimization of **speed–torque characteristics** for EV performance.
- **Modern Power Electronics Integration**
  - a. Chopper and converter-fed DC drives.
  - b. High-efficiency PWM control techniques.
  - c. Comparative analysis of linear vs. switched-mode supplies.
- **Condition Monitoring and Predictive Maintenance**
  - a. Vibration and thermal analysis for **fault diagnosis**.
  - b.ML-based performance prediction and health monitoring.
- **Energy Conservation & Sustainability**
  - a. Studies on **energy regeneration** during testing.
  - b. Integration of machines with **renewable sources** (solar, wind).

2. Research in Transformers

- **Smart Transformers & Grid Modernization**
  - a. IoT-based online monitoring of transformer health.
  - b. Development of **smart load sharing** techniques for parallel transformers.
  - c. Transformer role in **microgrids and smart grids**.
- **Harmonics and Power Quality Studies**
  - a. Analysis of transformer behavior under **non-linear loads** (rectifiers, inverters).
  - b. Derating due to harmonics and K-factor studies.
  - c. Mitigation techniques using filters and compensators.
- **Core Material & Efficiency Improvement**
  - a. Research on **advanced magnetic materials** (CRGO, nanocrystalline).
  - b. Loss reduction and **efficiency enhancement** studies.

c. Experimental validation of **thermal modeling** and cooling techniques.

.

3. Interdisciplinary Research Possibilities

- **Renewable Energy Systems** – Machine/transformer integration with **solar, wind, and hybrid microgrids**.
- **IoT & AI Applications** – Real-time data acquisition, machine learning-based fault prediction.
- **Green Energy Initiatives** – Laboratory energy recycling through **regenerative testing**.
- **Digital Twins & Simulation Studies** – MATLAB/Simulink and hardware co-simulation for predictive analysis.
- **Smart Campus Implementation** – Using lab machines as prototypes for **distributed generation, storage, and smart grid demonstrations**.