RAGHU ENGINEERING COLLEGE (Autonomous)

(Approved by AICTE, New Delhi & Permanently Affiliated to JNTUGV, Vizianagaram) NBA and NAAC 'A+' grade accredited Institute.

Dakamarri, Bheemili Mandal, Visakhapatnam – 531162,A.P. Phone: 08922-248001

www.raghuenggcollege.com

INSTITUTE VISION

"Envisioning to be a world class technical institution by synergizing quality education with ethical values"

INSTITUTE MISSION

- To encourage training and research in cutting-edge technologies.
- To develop and strengthen strategic links with the industry.
- To kindle the zeal among the students and promote their quest for academic excellence.
- To encourage extra-curricular activities along with good communication skills.

QUALITY POLICY

"RAGHU Engineering College underscores ethical values along with innovative teaching through an interactive, activity-based pedagogy; establishes the best of infrastructural facilities, inculcates engineering temper among the students through the use of the latest Information and Communication Technologies, and strives for an efficient, responsive and transparent administration in all areas"

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

"To produce Electrical and Electronics Engineers through quality education with exposure to state of art technology and innovation with ethical values"

MISSION

- M1 : Empowering students and professionals with state-of-art knowledge and Technological skills.
- M2 : To prepare students for higher studies and entrepreneurship.
- M3 : To impart essential skills of leadership, teamwork, communication and ethics among the students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- **PEO 1:**
  Domain Knowledge:
  Graduates will have knowledge in basic science, mathematical tools and fundamental engineering stream with contemporary problem solving, critical analysis in Electrical and Electronics Engineering and its allied areas.

- **PEO 2:**
  Communication Skills & Employability:
  Graduates will have careers in the diversified sectors of electrical power industry, software industries and also encouraged for higher education and research.

- **PEO 3:**
  Life Long Learning & Social Concern:
  Graduates will be able to communicate effectively, adopt lifelong learning act with integrity and have inter personal skills needed to engage in, lead and nurture diverse teams with commitment to their ethical and social responsibilities.

MAPPING OF MISSION STATEMENTS WITH PEOs

MS/PEO	PEO 1	PEO 2	PEO 3
M1	3	3	2
M2	2	2	3
M3	2	3	2

1-Slight, **2**- Moderate, **3**- Substantial

PROGRAMME OUTCOMES

Graduates of Electrical and Electronics Engineering Will:

PO 1	**Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**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.
PO 3	**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.
PO 4	**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.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6	**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.
PO 7	**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.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**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.
PO 11	**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.
PO 12	**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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: On successful completion of the B. Tech. (EEE) Program, the graduates will be able to apply technical knowledge and usage of modern hardware & software tools related to Electrical and Electronics Engineering for solving real world problems.

PSO 2: On successful completion of the B. Tech. (EEE) Program, the graduates will be able to analyse, comprehend, design & develop Electrical subsystems/systems for a variety of engineering applications and thus demonstrating professional ethics and concern for societal wellbeing.

MAPPING OF PEOS WITH POS AND PSOS:

PEO/POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO- 1	PSO- 2
PEO 1	3	3	3	3									3	3
PEO 2						3	3	3	3	3	3		2	2
PEO 3									3	3		3	2	2

1-Slight**, 2-** Moderate**, 3-** Substantial

2302103 - DC MACHINES AND TRANSFORMERS

(for EEE only)

Programme & Branch	B.Tech & EEE	Sem	Category	L	T	P	Credit
Prerequisites	23ES104: Basic Electrical and Electronics Engineering. 23ES204: Electrical and Electronics Engineering Workshop Lab 23ES2101: Electrical Circuits Analysis–I 23ES2201: Electrical Circuits Lab	**3**	**PC**	**3**	**0**	**0**	**3**

Course Objectives:

Students will get exposure:

1. To impart the basic knowledge on principle of operation and Classification of DC Machines and Single Phase and Three Phase Transformers.
2. To provide working knowledge on how to develop Phasor Diagrams and Equivalent Circuits for Transformers
3. To develop problem solving skills for calculation of Generated EMF, Torque, Speed, Losses, Efficiency of DC Machines and Induced EMF, Losses, Efficiency and Voltage Regulation and Load Sharing of Single-Phase Transformers.
4. To Analyze performance characteristics of DC Machines and Single Phase Two Winding Transformers.
5. To Identify applications of DC Generators, DC Motors, Single Phase Transformers and Three- Phase Transformers in Domestic, Commercial, Industrial, Electric Traction, Transmission and distribution of electric power Applications.

Preamble:

This course provides an introduction to basic concepts of rotating machines, DC Machines (Generators and Motors), transformers and their testing methods, emphasizing their interrelations and applications to engineering, it introduces students to cognitive learning and develops problem solving skills with both theoretical and engineering-oriented problems.

Course Contents:

Unit-1	DC Machines	Contact Hours: 9

DC Generator:

Construction and Principle of operation, EMF equation, Types, No-Load Characteristics, Critical Speed, Critical Resistance and Load Characteristics, Applications, Armature Reaction and Commutation.

DC Motor:

Back-Emf, Principle of operation, Torque Equation, Types, Characteristics of DC motors Applications.

Unit-2	Starting, Speed Control and Testing of DC Machines	Contact Hours:9

Necessity of a starter, starting by 3-point and 4-point starters, Speed control by armature voltage and field current control, Testing of DC machines, Losses and Efficiency Calculation of DC Machines, Swinburne's Test, Brake Test and Hopkinson's test.

Unit-3	Single-Phase Two Winding Transformers	Contact Hours:9

Construction, Principle of Operation, Emf equation, operation on no-load and on Load (Lagging, Leading and Unity power factor), Phasor Diagrams, Equivalent circuit, Losses, Effect of variation of frequency and supply voltage on losses, Real Power Efficiency, All Day Efficiency, Voltage Regulation.

Unit-4	Testing of Single-Phase Two Winding Transformers and Single-Phase Auto Transformers	Contact Hours: 9

Open-Circuit Test, Short-Circuit Test. Sumpner's Test, Necessity of Parallel operation of Single-Phase Transformers, Load shared (Equal and Unequal Voltage Ratios), Phasor diagrams, Equivalent Circuit.
Single Phase Auto Transformers:
Principle of Operation, Types (Step-Up and Step-Down), Power Transferred, Savings in copper Comparison with two winding transformers, Applications of Auto Transformers. Advantages of Single-Phase Auto Transformers over Single Two Winding Transformers,

Unit-5	Three Phase Transformers	Contact Hours: 9

Three Single Phase Transformer Bank, Three Phase Transformers (Core Type and Shell Type) and comparison. Three-Phase connections (Y/Y,Δ/Δ,Y/Δ,Δ/Y,Δ/Open-Δ), Scott Connection, Tap changing transformers (On Load and Off Load).

Total Hours: 45

Text Books:

1	Electrical Machinery by Dr. P S Bimbhra, Fully Revised edition, Khanna Publishers, New Delhi,2021
2	Performance and analysis of AC machines by M.G. Say, CBS, 2003.

Reference Books:

1	Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition, 2017.
2	Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2013.

Web References:

1	nptel.ac.in/courses/108/105/108105155

Course Outcomes: Upon completion of the course, students will be able to		**BT Mapped** (Highest Level)
CO 1	Understand basic principle of operation and can also categorize different Types of DC Machines, Single Phase Two Winding Transformers, Single Phase Auto Transformer and Three Phase Transformers.	L1
CO 2	Compare the performance characteristics of DC Machines and Single Phase Two Winding Transformers	L2
CO 3	Develop Phasor Diagrams and Equivalent Circuits for Single Phase Two Winding Transformers, Single Phase Auto Transformer.	L3
CO 4	Analyze the performance of DC Machines and Single Phase Two Winding Transformers under different tests.	L4
CO 5	Compute load sharing between two Single Phase Two Winding Transformers connected in parallel and also able to understand the working of Tap-changing of three phase transformers and conversion of three phases to two phase.	L3
CO 6	Realize the requirement of Transformers in Transmission and distribution of Electric Power and other applications of both DC Machines and Transformers.	L3

Mapping of COs with POs and PSOs

COs/POs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2
CO 1	2	2											1	1
CO 2	1	2											1	1
CO 3	1	2											1	1
CO 4	1	2											1	1
CO 5	1	2											1	1
CO 6	1	2				2							1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Assessment Pattern - Theory							
TEST	Remembering (K1)%	Understanding (K2)%	Applying (K3)%	Analyzing (K4)%	Evaluating (K5)%	Creating (K6)%	Total %
Mid-1	10	10	70	10			100
Mid-2	10	10	70	10			100
SEE	10	10	70	10			100
*± 3% may be varied							