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

2302106 - INDUCTION AND SYNCHRONOUS MACHINES

(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	**4**	**PC**	**3**	**0**	**0**	**3**

Course Objectives:

1. To impart the basic knowledge on principle of operation and Classification of induction and synchronous machines
2. To provide working knowledge on how to develop Phasor Diagrams and Equivalent Circuits for induction and synchronous machines.
3. To develop problem solving skills for calculation of Generated EMF, Torque, Speed, Losses, Efficiency of induction and synchronous machines
4. To Analyze performance characteristics of induction and synchronous machines.
5. To Identify applications of induction and synchronous machines in Domestic, Commercial, Industrial, Electric Traction.

Preamble:	This course covers topics on 3-Phase Induction Motor and Synchronous Machines which have wide application in power systems. The main aim of the course is to provide a detailed analysis of operation and performance of 3-Phase Induction Motor, and Synchronous Machines. In addition, it also covers voltage regulation and parallel operation of synchronous generators.

Course Contents:

Unit-1	3-Phase Induction Motors	Contact Hours: 9

Production of Rotating Magnetic Field, Basic Principle of Operation, Constructional Details, Types, Synchronous Speed, Slip, Rotor Emf and Rotor Frequency, Rotor current and Power factor at standstill and during running conditions, Emf Equation, Phasor Diagram, Equivalent circuit, Torque equation, expressions for maximum torque and starting torque, torque-slip characteristics.

Unit-2	Performance of 3-Phase induction motors	Contact Hours: 9

Losses, Power Stages, Power flow diagram, Rotor power input, Rotor copper loss and rotor output power and their inter-relationship, mechanical power developed, Efficiency. Double cage and Deep bar rotors, Induction Generator Operation. No load, Brake test and Blocked rotor tests, circle diagram for predetermination of performance- methods of starting, starting current and torque calculations, speed control of induction motor with V/f control method, Crawling and Cogging,

Unit-3	Single- Phase Motors	Contact Hours: 9

Double Revolving Field theory, Constructional Features, Torque Slip Characteristics, Equivalent circuit, starting methods: Resistance Split Phase, capacitor start, capacitor star and capacitor run, two value capacitor star and capacitor run induction motors, shaded pole, AC Series Motor.

Unit-4	Synchronous Generator	Contact Hours: 9
Principle of Operation, Constructional details, Types of Rotors, Distribution Factor , Pitch Factors, E.M.F Equation, Synchronous Reactance, Phasor Diagrams, Equivalent Circuit, Armature Reaction, Operating characteristics, Voltage Regulation by Synchronous Impedance method, MMF method and Potier triangle method, Two Reaction Theory, Determination of Direct and Quadrature axis reactance using Slip Test, Necessity of Parallel operation, conditions for Parallel operation, Procedure for parallel operation.		
Unit-5	**Synchronous Motor**	**Contact Hours: 9**
Principle of Operation, Methods of Starting. Phasor diagram, Equivalent Circuit, Effect of Excitation on current and power factor, Hunting and its suppression. Synchronous condenser and Applications.		
		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, 2002.
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/108/105/108105131
2	https://nptel.ac.in/courses/108106072

Course Outcomes: Upon completion of the course, students:		**BT Mapped** (Highest Level)
CO 1	will have basic knowledge on principle of operation and Classification of induction and synchronous machines.	L1
CO 2	Can develop Phasor Diagrams and Equivalent Circuits for induction and synchronous machines.	L1
CO 3	will have problem solving skills for calculation of Generated EMF, Torque, Speed, Losses, Efficiency of induction and synchronous machines.	L2
CO 4	can Analyze performance characteristics of induction and synchronous machines.	L3
CO 5	can identify applications of induction and synchronous machines in Domestic, Commercial, Industrial, Electric Traction.	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
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	9	12	79				100
Mid-2	9	12	79				100
SEE	10	10	80				100
*± 3% may be varied							