



**Kadi Sarva Vishwavidyalaya's
LDRP Institute of Technology & Research
Gandhinagar-382 015**



B.E Semester: 4 Mechanical Engineering

Subject Name: Electrical Machines & Electronics (ME-402)

A. Course Objective:

- To present a problem oriented introductory knowledge of Electrical Machines.
- To focus on the study of electro mechanical energy conversion & different parts of electrical machine.
- To address the underlying concepts & methods behind Electrical Engineering machines.
- To present knowledge of electronics devices and their characteristics.
- To focus on electronic devices and circuits.
- To present application oriented approach to the students in the field of electronic circuits.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
		Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
ME-402	Electrical Machines & Electronics	3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus

1. **DC generators:** Types, Working principle, Construction, Open circuit characteristic, External and Internal characteristic, Losses & Efficiency
2. **DC Motors:** Types, Principle of operation, Torque equation, Speed-Torque characteristics of shunt, series and compound motor, Need of Starter and Types, Methods of speed control, Losses and Efficiency.
3. **Transformers:** Construction of Three phase and single phase transformers, Working principle, Types of transformers based on construction, connections and service conditions, Transformer on no-load and load, Voltage Regulation, Open circuit and Short circuit test and their applications, Star-Star, Delta-Star, Star- Delta, Delta-Delta types of three phase transformer
4. **3-Phase induction motor:** Construction, Production of Rotating magnetic field, Principle of operation, Speed and Slip, Rotor current, Power Flow diagram, Relations between rotor input, copper losses and Output, Torque Equation, Torque-Slip Characteristics, Losses and Efficiency, Need of Starters and Types, Methods of Speed control.
5. **Single phase induction motor:** Difference between Rotating & Pulsating magnetic field, Working Principle of Single Phase Induction Motor, Construction & Types, Universal motors.
6. **A.C. Generators:** Construction & Types, E.M.F. equation, Voltage Regulation, Losses & Efficiency, Synchronizing procedure with system.



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7. **Diode, Transistor and OP-AMP Circuits:** Half wave rectifier circuits, Full wave rectifier, Full wave bridge rectifier, Three phase bridge rectifier, Common Emitter amplifier, Multistage amplifier, Symbol and pin diagram of IC 741 OPAMP, OPAMP circuits – Inverting, Non-inverting, Differential, Comparator
8. **Logic Gates and Boolean algebra:** Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex- NOR and their truth tables), Laws of Boolean algebra, De-Morgan's theorem.

D. Lesson Planning

SR No.	No. of Hours	Weight-age in % in Exam	Topic
1	03	16	DC generators: Types, Working principle, Construction, Open circuit characteristic, External and Internal characteristic, Losses & Efficiency
2	03		DC Motors: Types, Principle of operation, Torque equation, Speed-Torque characteristics of shunt, series and compound motor, Need of Starter and Types, Methods of speed control, Losses and Efficiency
3	04	24	Transformers: Construction of Three phase and single phase transformers, Working principle
4	04		Types of transformers based on construction, connections and service conditions, Transformer on no-load and load, Voltage Regulation, Open circuit and Short circuit test and their applications.
5	04		Star-Star, Delta-Star, Star- Delta, Delta-Delta types of three phase transformer.
6	03	20	3-Phase induction motor: Construction, Production of Rotating magnetic field, Principle of operation,
7	03		Speed and Slip, Rotor current , Power Flow diagram, Relations between rotor input, copper losses and Output, Torque Equation, Torque-Slip Characteristics,
8	03		Losses and Efficiency, Need of Starters and Types, Methods of Speed control
9	03	12	Single phase induction motor: Difference between Rotating & Pulsating magnetic field,
10	03		Working Principle of Single Phase Induction Motor, Construction & Types, Universal motors.
11	05	18	A.C. Generators: Construction & Types, E.M.F. equation, Voltage Regulation, Losses & Efficiency, Synchronizing procedure with system.
12	03		Diode, Transistor and OP-AMP Circuits: Half wave rectifier circuits, Full wave rectifier, Full wave bridge rectifier, Three phase bridge rectifier, Common Emitter amplifier, Multistage amplifier, Symbol and pin diagram of IC 741 OP-AMP, OP-AMP circuits – Inverting, Non-inverting, Differential, Comparator
15	04	10	Logic Gates and Boolean algebra: Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex- NOR and their truth tables), Laws of Boolean algebra, De-Morgan's theorem.
TOTAL	45	100	



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E. Instructional Method & Pedagogy

1. At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2. Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weight age should be given to all topics while teaching and conduction of all examinations.
3. Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4. One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5. Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6. Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7. Experiments shall be performed in the laboratory related to course contents.

Suggested list of Experiments

1. Internal and External Characteristics of D.C. Generator.
2. Armature Voltage control method of DC shunt motors.
3. Field Current control method of DC shunt motors.
4. Determination of efficiency and voltage regulation using Load Test on Single Phase Transformer.
5. Determination of efficiency and voltage regulation using Open Circuit & Short Circuit Test on single Phase Transformer.
6. Determination of efficiency by Direct Load test on Induction motor.
7. No-load and blocked rotor test on three phase induction motor.
8. Various parts of D.C. machines.
9. To study about 1-phase induction motor.
10. To perform CE amplifier.
11. To perform on Three phase bridge rectifier.
12. To study various components of sub-stations.

F. Students Learning Outcomes

On successful completion of the course

- The student can be acquired the basic knowledge of energy conversion principle and electrical machine thus being prepared to pursue any area of engineering spectrum in depth as desired.
- The students will be able to effectively employ electrical systems and lead the exploration of new applications and techniques for their use.

G. Recommended Study Materials

• Text &Reference Books:

1. Electrical Machines. By Nagarath & Kothari,TMH Publications
2. Electrical Technology Vol II. B. L. Theraja,S .Chand Publications
3. A Text book of Power Plant Engineering by R. K Rajput, Laxmi publications
4. Principles of power systems by V.K. Mehta, S.Chand publication, 4th edition
5. Principles of Electronics by V. K. Meht