

**B. E. Semester: IV**  
**Automobile Engineering**  
**Subject Name: ELECTRICAL MACHINES AND ELECTRONICS (AE402)**

**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.

**Teaching / Examination Scheme:**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY	IE	CIA	PR. / VIVO		
CODE	NAME	Hrs	Hrs	Hrs	Hrs	Hrs	Marks	Marks	Marks	Marks	Marks	
AE402	<b>Electrical Machines &amp; Electronics</b>	3	0	2	5	4	3	70	30	20	30	150

**Detailed Syllabus:**

**Topic No      Details**

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.
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.

**Lesson Planning:**

Sr.No.	No. of Hours	Weight-age in % in Exam	Topic
1	03	07	<b>DC generators:</b> Types, Working principle, Construction, Open circuit characteristic, External and Internal characteristic, Losses & Efficiency
2	03		<b>DC Motors:</b> 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	<b>Transformers:</b> 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	<b>3-Phase induction motor:</b> 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	<b>Single phase induction motor:</b> Difference between Rotating & Pulsating magnetic field, Working Principle of Single Phase Induction Motor, Construction & Types, Universal motors.
10	03		
11	05	18	<b>A.C. Generators:</b> Construction & Types, E.M.F. equation, Voltage Regulation, Losses & Efficiency, Synchronizing procedure with system.
12	03		<b>Diode, Transistor and OP-AMP Circuits:</b> 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, OP-AMP circuits – Inverting, Non-inverting, Differential, Comparator
13	04	10	<b>Logic Gates and Boolean algebra:</b> 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	

#### Instructional Method & Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carry five marks in overall evaluation.
- 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.
- 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.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- Experiments shall be performed in the laboratory related to course contents
- Suggested list of Experiments:
  - a) Internal and External Characteristics of D.C. Generator.
  - b) Armature Voltage control method of DC shunt motors.
  - c) Field Current control method of DC shunt motors.
  - d) Determination of efficiency and voltage regulation using Load Test on Single Phase Transformer.

- e) Determination of efficiency and voltage regulation using Open Circuit & Short Circuit Test on single Phase Transformer.
- f) Determination of efficiency by Direct Load test on Induction motor.
- g) No-load and blocked rotor test on three phase induction motor.
- h) Various parts of D.C. machines.
- i) To study about 1-phase induction motor.
- j) To perform CE amplifier.
- k) To perform on three phase bridge rectifier.
- l) To study various components of sub-stations.

**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.

**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

