

**1. Preamble**

This course makes the students to know the functions, working principles of various automotive electrical & electronics components.

**2. Pre-requisite**

1150EE101	Basic Electrical Engineering
1150EC101	Basic Electronics Engineering

**3. Links to other courses**

- Automotive Safety
- Electric and Hybrid Vehicles
- Engine Electronics Management Systems
- Microprocessor and Microcontroller

**4. Course Educational Objectives**

Students undergoing this course are expected

- To know the concepts and develop basic skills necessary to diagnose automotive electrical problems
- To know Starting, and charging, lighting systems, advanced automotive electrical systems, to include body electrical accessories and basic computer control.
- To explore practically about the components present in an Automotive electrical and electronics system.

**5. Course Outcomes**

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Enumerate the construction, characteristics and maintenance of battery, lighting system and different accessories in a typical automobile after careful inspection.	K2, S2
CO2	Explain the construction, characteristics and maintenance of starting and ignition system and diagnose the ignition system fault of any vehicle.	K2, S2
CO3	List out the principles and characteristics of charging system components and demonstrate their working with suitable tools.	K2, S2
CO4	Enumerate the principles, application, construction and specification of different sensors and actuators usable in typical automobile by suitable testing.	K2, S2
CO5	Describe the principles and architecture of electronics systems and its components present in an automobile related to instrumentation, control, security and warning systems.	K2, S2

**6. Correlation of COs with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO1	M	H	H	H	M	L			L				H	H
CO2	M	H	H	H	M	L			L				H	H
CO3	M	H	H	H	M	L			L				H	H
CO4	M	H	H	H	M	L			L				H	H
CO5	M	H	H	H	M	L			L				H	H

H- High; M-Medium; L-Low

## 7. Course content

### UNIT – I: ELECTRICAL SYSTEMS

**L-9 P-6**

Principle and Construction of Lead Acid and Lithium-Ion Battery, Characteristics of Battery, Rating Capacity and Efficiency of Batteries, Various Tests on Batteries, Maintenance and Charging. Lighting System and Photometry: Insulated and Earth Return System, Details of Head Light and Side Light, LED Lighting System, Head Light Dazzling and Preventive Methods – Horns, Wiper System and Trafficator.

### UNIT – II: STARTING AND IGNITION SYSTEM

**L-9 P-6**

Condition at Starting, Behavior of Starter During Starting, Series Motor and its Characteristics, Principle and Construction of Starter Motor, Bendix Type, Solenoid Operated and Axle Type Of Starter Motor, Overrunning Clutch, Over Running Clutch Working of Different Starter Drive Units, Care and Maintenances of Starter Motor, Starter Switches. Spark Plugs. Advance Mechanisms. Different Types of Ignition Systems- Electronic Ignition System and its Types

### UNIT – III: CHARGING SYSTEM

**L-9 P-6**

Generation of Direct Current, Shunt Generator Characteristics, Armature Reaction, Third Brush Regulation, Cutout. Voltage and Current Regulators, Compensated Voltage Regulator, Alternators Principle and Constructional Aspects and Bridge Rectifiers, New Developments.

### UNIT – IV: SENSORS AND ACTUATORS

**L-9 P-6**

Types of Sensors: Speed, Throttle Position, Exhaust Oxygen Level, Manifold Pressure, Crankshaft Position, Coolant Temperature, Exhaust Temperature, Rain, Headlight and Anti-Theft Sensors, Hot Wire Anemometer and Air Mass Flow Sensor For Engine Application. Solenoids, Stepper Motors, Relay.

### UNIT – V: ELECTRONICS SYSTEMS

**L-9 P-6**

Current Trends in Automotive Electronic Engine Management System, Types of EMS, Electromagnetic Interference Suppression, Electromagnetic Compatibility, Electronic Dashboard Instruments, Onboard Diagnostic System, Security , Warning System, Infotainment and Telematics.

**Total: 75 periods**

## 8. Practicals

### List of Experiments

#### 1. Electrical Lab

1. Testing of Batteries and Battery Maintenance
2. Testing of Starting Motors and Generators
3. Testing of Regulators and Cut – Outs

4. Diagnosis of Ignition System Faults
5. Study of Automobile Electrical Wiring

## **2. Electronics Lab**

1. Study of Rectifiers and Filters
2. Study of Logic Gates, Adder and Flip-Flops
3. Study of SCR and IC Timer
4. Interfacing A/D Converter and Simple Data Acquisition
5. Micro Controller Programming and Interfacing

**Total: 30 Periods**

**Total (45+30): 75 Periods**

## **9. Text Books**

1. Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press-1999.
2. William B. Ribbens "Understanding Automotive Electronics", 5<sup>th</sup> edition - Butterworth Heinemann Woburn, 1998.
3. Ganesan .V- "Internal Combustion Engines"- Tata McGraw-Hill Co- 2003.

## **10. References**

1. Bechhold "Understanding Automotive Electronics", SAE, 1998.
2. Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3<sup>rd</sup> edition, 1986.
3. Judge A.W "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.
4. Kholi.P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
5. Robert Bosch "Automotive Hand Book", SAE (5<sup>th</sup> Edition), 2000.
6. Ganesan.V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003.