

# AUTOMOTIVE TECHNOLOGY

## ENME 301

**Lecture** : 3  
**Tutorial** : 1  
**Practical** : 3/2

**Year: III**  
**Part : I**

### **Course Objectives:**

The objective of this course is to provide a comprehensive understanding of the principles of automobile systems, including the engine, drivetrain, suspension, steering, braking, electrical, and electronic systems. It further focuses on the analysis of vehicle stability, powertrain configurations, and emission control technologies. Additionally, the course explores recent advancements in automotive technology, particularly electric and hybrid vehicles, while offering practical experience in vehicle diagnostics, testing, and assembly.

### **1 Introduction (4 hours)**

- 1.1 History and evolution of automobiles
- 1.2 Classification of vehicles
- 1.3 Overview of modern automotive systems
- 1.4 Engine components, types, and configurations
- 1.5 Operation of 2-stroke and 4-stroke cycle engines
- 1.6 Comparison of air standard cycle, fuel air cycle and real cycle
- 1.7 Comparison of SI and CI engines

### **2 Fuel Supply Systems (6 hours)**

- 2.1 Engine fuels, basic requirements of engine fuels
- 2.2 Air-fuel mixture for different operating conditions
- 2.3 Carburetor vs fuel injection system
- 2.4 Electronic fuel injection system for SI engines: TBI, MPFI and GDI system
- 2.5 Conventional vs modern diesel fuel injection systems
- 2.6 Fuel filters, low pressure and high-pressure fuel pumps
- 2.7 Diesel fuel injection systems
- 2.8 Electronic diesel control system and common rail direct injection system

### **3 Ignition and Combustion (4 hours)**

- 3.1 Combustion in SI engine
- 3.2 Spark ignition timing and spark advance
- 3.3 Ignition systems: Magneto, battery, electronic
- 3.4 Phases of combustion in CI engine
- 3.5 Combustion chamber design

3.6 Engine knock and pre-ignition

**4 Engine Cooling and Lubrication (3 hours)**

- 4.1 Overview of air and liquid cooling systems
- 4.2 Consequences of engine overcooling and overheating
- 4.3 Overview of engine lubrication system and types
- 4.4 Engine oil and its grade

**5 Transmission Systems (5 hours)**

- 5.1 Clutch, types and operation
- 5.2 Gear box, types and operation
- 5.3 Manual transmission
- 5.4 Automatic transmission
- 5.5 Continuous variable transmission (CVT), dual clutch transmission (DCT)
- 5.6 Transfer case
- 5.7 Torque converters
- 5.8 Propeller shaft and universal joints
- 5.9 Final drive, differential and axles

**6 Suspension and Steering (4 hours)**

- 6.1 Purpose and functions of suspension system
- 6.2 Types of springs used in suspension
- 6.3 Types of suspension system
- 6.4 Shock absorbers and stabilizer bar
- 6.5 Basic principle of steering system
- 6.6 Manual and power steering systems
- 6.7 Steering geometry and its parameters

**7 Braking Systems (4 hours)**

- 7.1 Mechanical and hydraulic braking system
- 7.2 Disc vs drum brakes
- 7.3 ABS and EBD systems
- 7.4 Pneumatic braking system

**8 Wheels and Tires (2 hours)**

- 8.1 Wheels and its types
- 8.2 Tire construction, types and specifications factors affecting tire life
- 8.3 Tire characteristics and inflation
- 8.4 Wheel alignment and wheel balancing

**9 Vehicle Electrical Systems (4 hours)**

- 9.1 Automobile electrical system layout

- 9.2 Automotive batteries
- 9.3 Alternators and charging system
- 9.4 Starter motors and starting system
- 9.5 Lighting, instrumentation, and wiring harness

**10 Emissions and Emission Control Systems (2 hours)**

- 10.1 Exhaust system
- 10.2 Emission norms (EURO, BS-VI, EPA)
- 10.3 Evaporative emission control system, catalytic converters, EGR, and DPF

**11 Automotive Electronics (4 hours)**

- 11.1 Sensors, actuators and electronic control unit (ECU)
- 11.2 CAN and LIN bus systems
- 11.3 Engine management system (EMS)
- 11.4 ADAS introduction

**12 Trends in Automobiles (3 hours)**

- 12.1 EV architecture and motor types
- 12.2 Batteries, BMS, and charging
- 12.3 Series, parallel, and plug-in hybrids
- 12.4 Autonomous vehicles
- 12.5 AI and IoT in automobile technology
- 12.6 Sustainable mobility

**Tutorial (15 hours)**

- 1. Numerical problems on thermodynamic cycles (Otto, diesel, dual/mixed cycle) and comparison with real cycle
- 2. Injector calculations and air-fuel ratio and spray analysis
- 3. Ignition timing analysis using P-V diagrams
- 4. Gear ratio calculations and torque flow
- 5. Braking force calculation and skid analysis
- 6. Electrical circuit diagram reading and analysis
- 7. Sensor data interpretation and EMS mapping

**Practical (22.5 hours)**

- 1. Automobiles component identification (physical/digital models)
- 2. Engine disassembly and component study
- 3. Fuel injectors and injection pump testing
- 4. Ignition circuit and ignition timing analysis
- 5. Inspection of cooling and lubrication systems
- 6. Gearbox disassembly and function testing
- 7. Demonstrating suspension setup and steering geometry and alignment
- 8. Disc and drum brake dismantling and assembling

9. Wheel alignment and wheel balancing
10. Lighting, charging and starting circuits analysis and diagnostic tools
11. Exhaust gas analysis and emission testing
12. Trouble codes and ECU diagnostics

### Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

<b>Chapters</b>	<b>Hours</b>	<b>Marks distribution*</b>
1 and 2	10	10
3 and 4	7	10
5	5	10
6 and 7	8	10
8, 9, and 10	8	10
11 and 12	7	10
<b>Total</b>	<b>45</b>	<b>60</b>

\* There may be minor deviation in marks distribution.

### References

1. Singh, K. (2019). Automobile engineering (Vols. I & II). Standard Publishers Distributors.
2. Crouse, W. H., Anglin, D. L. (2001). Automotive mechanics. McGraw-Hill.
3. Crolla, D. (2009). Automotive engineering: Powertrain, chassis system and vehicle body. Elsevier Butterworth-Heinemann.
4. Heywood, J. B. (2018). Internal combustion engine fundamentals. McGraw-Hill Education.
5. Gill, P. S. (2012). Automobile engineering (Vol. III). S.K. Kataria & Sons.
6. Husain, I. (2021). Electric and hybrid vehicles: Design fundamentals. CRC Press.
7. Halderman, J.D. (2025). Advanced automotive electricity and electronics. Pearson.
8. Ribbens, W. B. (2017). Understanding automotive electronics. Elsevier