

DOMAIN TITLE: Automobile Engineering (AECU2170)

Sl. No.	Course Code	Course Title	Course Type	T-P-Pr	Credits
1	CUAE2170	Introduction to Automobile Engineering	Theory +Practice	2-1-0	3
2	CUAE2171	Subsystems of Automobile	Theory + Practice	3-2-0	5
3	CUAE2172	Electric Vehicles	Theory + Practice	2-1-0	3
4	CUAE2173	Maintenance of Automobile	Practice	0-3-0	3
5	CUAE2174	Project		0-0-6	6
6	CUAE2175	Internship		0-0-4	4
Total					24

Domain Track Objectives:

1. To familiarise the students with different systems and subsystems of automobile.
2. To teach basic skill in maintenance of different types of automobiles.
3. To know the operation and maintenance of electric vehicle.

Domain Track Learning Outcomes:

1. Students will gain knowledge about the construction and working of different systems and subsystems of automobile.
2. They will be able to disassemble and assemble major aggregates of the automobile
3. Students will be able to do vehicle trouble shooting.

Introduction to Automobile Engineering

Course Title	Course Code	Type of Course	T-P-Pr	Pre-Requisite
Introduction to Automobile Engineering	CUAE2170	Theory+Practice	2-1-0	Nil

Objective

- To understand the working of automobiles and its sub-systems
- To learn the modern technologies used in automobiles

Course Outcome

- Familiarise and explain working principles of automobile and its sub-systems

Course content

Module I **3 (hrs)**

Automobile Architecture: Definition and Classification of Automobiles, Major Units of the Automobile, Types of Automobile Layouts, Automobile Chassis Types and Components, Automobile Body Types and Components, Automobile Safety Parameters.

Module II **6 (hrs)**

Engine: Classification of Engine, Engine Nomenclature, Components of Engine, Valve Timing Diagram of SI & CI Engines, Variable Valve Timing, Working Principles of Modern Engine Combustion Technologies (CRDI, GDI, HCCI, Dual Fuel Engine, Stratified Charge Engine).

Practice

- Valve Timing Diagram of SI Engine.
- Valve Timing Diagram of CI Engine.

Module III **5 (hrs)**

Carburetion: Air-Fuel Ratio, Mixture Requirements for Different Load Conditions, Factors Affecting Carburetion, Principle of Carburetion, Limitations of Simple Carburettor, Additional Systems in Carburettor, Concept of Electronic Carburettor.

Practice

- Model Study of a Solex Carburettor

Module IV **5 (hrs)**

Fuel Injection: Classification of Injection Systems, Fuel Feed Pump, Injection Pump, Injection Pump Governor, Fuel Injector, Nozzle, Electronic Injection Systems, Multi-Point Fuel Injection (MPFI) System, Direct And Indirect Fuel Injection.

Practice

- Study of Fuel Injection System of a Diesel Engine.

Module V **5 (hrs)**

Transmission System: Layout of Power Flow from Engine to Wheels, Brief Construction and Working Principles of - Clutch, Transmissions, Propeller Shaft, Final Drive and Differential, Front and Rear Axles.

Practice

- Study of Transmission System of Automobile.
- Model Study of Differential of Automobile.

Module VI

5 (hrs)

Cooling and Lubrication System:

Direct Air Cooled and Indirect Liquid Cooled Cooling Systems, Types and Components of Liquid Cooled Cooling System, Engine Coolant and Antifreeze Solution, Desired Properties of Lubricants, Classification, Construction, Working Principles and Components of Various Types of Lubricating Systems.

Practice

- Model Study of Air Cooling System.
- Model Study of Liquid Cooling System.

Module VII

4 (hrs)

Super Charging & Turbo Charging: Naturally Aspirated and Forced Induction Engine, Effect of Forced Induction, Method of Supercharging, Types of Super Chargers, Basic Principle and Method of Turbo Charging, Types of Turbo Charging, Concept of Variable Geometry Turbocharging.

Practice

- Study of Working Model of Supercharger
- Study of Working Model of Turbocharger.

Text Books

1. Gupta R. B., Automobile Engineering, Satya Prakashan, New Delhi.
2. Giri N. K., Automobile Technology, Khanna Publishers.

References

1. Gupta H. N., Fundamentals of Internal Combustion Engines, PHI Learning.

Subsystems of Automobile

Course Title	Course Code	Type of course	T-P-Pr	Pre-Requisite
Subsystems of Automobile	CUAE2171	Theory + Practice	3-2-0	Nil

Objective

- To understand the construction and working principle of different sub-systems of automobile
- To get knowledge on latest technologies used in automobile engineering

Learning Outcome

- Identify various subsystems of automobiles including their components
- Will be able to disassemble and assemble major aggregates of the automobile

Course content

Module I **6 (hrs)**

Engine Emissions: Sources of Air Pollution from Automobiles and Their Control, Crank Case Emission Control System, Evaporative Emission Control System, Exhaust Emission Control System: Air Injection, EGR, Catalytic Converters, Selective Catalytic Reduction (SCR) Technology, EURO/Bharat Stage Norms: I, II, III, IV, V And VI, Road Map for Implementation of Bharat Stage Norms In India.

Practice

- Identification of Different Sub-Systems of Automobile.
- Studies of Exhaust Gas Recirculation System (EGR) in KNOW Vehicle.

Module II **5 (hrs)**

Ignition System: Effect of Spark Timing on Emission and Ignition Timing Controls, Drawbacks of Conventional Ignition Systems, Electronic Ignition Systems (TCI And CDI), Engine Cylinder Numbering Scheme and Firing Order of Multi Cylinder Engines.

Practice

- Study of Battery Ignition and Magneto Ignition System.
- Disassembly and Assembly of 6-Cylinder Diesel Engine

Module III **8 (hrs)**

Transmission System: Power Transmission in Automobile (Front Wheel Drive, Rear Wheel Drive, Four-Wheel Drive, All-Wheel Drive).

Clutch System: Key Design Considerations of Clutches, Types of Clutches, Construction and Working Principle of Single Plate Friction Clutch, Diaphragm Clutch, Cone Clutch, Centrifugal Clutch.

Gear Box: Purpose of Gear Box, Types of Automobile Gear Boxes, Construction and Working Principle of Sliding Mesh, Constant Mesh, Synchronizer Mechanism and Synchromesh Gear Boxes, Planetary Gear Mechanism, Fluid Coupling and Torque Converter, Construction and Working Principle of Automatic Transmission, Construction and Working Principle of Continuously Variable Transmission (CVT) and Automated Manual Transmission (AMT).

Practice

- Study of Single Plate Friction Clutches (Coil Spring Type And Diaphragm Type).
- Study of Synchronizer Mechanism And Synchromesh Gear Box, Continuously Variable Transmission (CVT).

Module IV

12 (hrs)

Propeller Shaft and Differential: Function and Need of Propeller Shaft, Hotchkiss Drive and Torque Tube Drive, Construction of Propeller Shaft, Universal/Hooke's Joints, Slip Joint, Constructional Features and Working Principle of Differential Mechanism, Types of Differentials (Locking Type Differential, Limited Slip Differential).

Axles: Types of Automotive Axles, Constructional Features, Types and Working Principle of Front Axles, Lift Axles, Rear Axle, Third Differential in Tandem Axle Vehicles, Construction and Working Principle of Manual Transaxles and Transfer Cases.

Practice

- Study of Propeller Shaft, Universal Joints, Slip Joints, Centre Bearing.
- Study of Front Axle System.
- Study of Rear Axle System Including Differential Mechanism.
- Disassembly and Assembly of Manual Transaxle of Front Wheel Drive Car.

Module V

10 (hrs)

Steering System: Purpose of Steering System, Components of Steering System, Steering Geometry (Castor, Camber, Toe-In, Toe-Out, King Pin Inclination), Types of Steering Gear Boxes and their Construction and Working Principles, Hydraulic and Electrically Power Assisted Steering Systems.

Braking System: Requirement and Key Design Parameters of Braking System, Classification and Types of Braking Systems, Mechanical Brake, Hydraulic Brake, Air Brake, Vacuum Brake, Disc Brake. Construction, Working Principle and Components of Anti-Lock Braking System (ABS)

Practice

- Study of Steering Gear Box And Hydraulic Power Assisted Steering System.
- Identifying the Different Components and Working Of Drum Brake, Disc Brake, Hydraulic Brake, Air Brake System.
- Study of Anti-Lock Braking System (ABS) In KNOW Vehicle.

Module VI

6 (hrs)

Auto Electric System: Wiring Diagram of Horn Circuit, Lighting Circuit, Cut-Out Circuit, Voltage and Current Regulator Circuit in Commutator Type Generator, Combined Three-Unit Regulator Circuit, Voltage and Current Regulator in Alternating Current Type Generator And Flasher Circuit (Sketch And Description), Common Ignition Troubles And Its Remedies, Basic Electronic Ignition Trouble Shooting Charts, Spark Plugs: Purpose, Construction and Specifications.

Module VII

8 (hrs)

Suspension System: Purpose and Classification of Suspension Systems, Sprung and Unsprung Mass, Major Components of Suspension System, Description of the Conventional Suspension Systems for Rear and Front Axle. Panhard Rod, Macpherson Strut, Double Wishbone Suspensions. Description of Independent Suspension System Used In Cars (Coil Spring And Torsion Bars), Constructional Features and Working of Air Suspension System, Anti-Roll Bars, Constructional Features, Types and Working of Telescopic Shock Absorber.

Practice

- Identification of Different Types of Suspension Systems: Coil Spring, Tension and Telescopic Suspension System.

Text Books

1. Gupta R. B., Automobile Engineering, Satya Prakashan New Delhi
2. Giri N. K., Automobile Technology, Khanna Publishers

References

1. Crouse William H and Donald Anglin, Automotive Mechanics, Tata Mcgraw Hill Publications.
2. Newton K., Steeds W, and Garrett T K, The Motor Vehicle, Butterworth Heinemann

Electric Vehicles

Course Title	Course Code	Type of Course	T-P-Pr	Pre-requisite
Electric Vehicles	CUAE2172	Theory+ Practice	2-1-0	Nil

Objective

- To study electric drive vehicles & its applications
- To know the basic maintenance of different parts of electric vehicle

Learning Outcome

- Understand the importance of EVs for environment, energy sustainability and climate change
- Decide the power rating of electric vehicle

Course content

Module I **5 (hrs)**

Introduction to Electric Vehicles: Electric Vehicles Advantages and Disadvantages, EV Market and Promotion, Main Components of Electric Vehicle and Its Functions (Electrical and Mechanical).

Practice:

- Study of Different Components of E-Rickshaw and Assembling Methods.
- Working of Circuits in Controllers with respect to Current and Voltage Rating.

Module II **3 (hrs)**

Electric Vehicle Drive Trains: EV Transmission Configurations, Basic Architecture of Electric Drive Trains, Single and Multi-Motor Drives, In Wheel Drives.

Module III **6 (hrs)**

Energy Sources: Working Principle of Battery, Types of Batteries, Lead-Acid Battery, Nickel-Cadmium Battery, Nickel-Metal-Hydride (Nimh) Battery, Lithium Batteries, Battery Parameters, Fuel Cells,

Practice:

- Maintenance of Lead Acid Batteries.
- Wiring & Harnessing of Battery Circuit.

Module IV **8 (hrs)**

Electric Motors: Classification of Electric Motors, DC Motor, Types of DC Motors, Brushless DC Motor, AC Motor, Types of AC Motors, Induction Motor, Synchronous Motor, Regenerative Braking.

Practice:

- Study of Different Parts of D.C. Motor and Make Connection.
- Performance Characteristics of a Shunt and Series DC Motor
- Load Test on Three Phase Induction Motor.
- Speed Control of DC Shunt Motor by Armature and Field Control.

Module V

5 (hrs)

Electric Vehicle Maintenance & Safety: Maintenance & Trouble Shooting of Different Components of EV, High Voltage Electrical Safety, Tool and Equipment Usage, High Voltage Safety Rules, Electrical Isolation.

Practice:

- Maintenance of BLDC Motor.
- Maintenance of Hub Motor.

Module VI

3 (hrs)

Design Concept of Electric Vehicle: Power and Torque Calculation of Electric Vehicles, Sizing of Components, Initial Acceleration, Maximum Velocity, Maximum Gradability.

Module VII

3 (hrs)

Hybrid Electric Vehicles: Types of Hybrids, Series and Parallel HEVs, Advantages and Disadvantages, Series-Parallel Combination, Hybrid Drivetrains, Sizing of Component

Text Books

1. Hussein Iqbal, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press
2. Chau K. T., Electric Vehicle Machines and Drives: Design, Analysis and Application, Wiley.

References

1. Chan C.C. and Chau K.T., Modern Electric Vehicle Technology, London: Oxford University.

Maintenance of Automobile

Course Title	Course Code	Type of Course	T-P-Pr	Pre-Requisite
Maintenance of Automobile	CUAE2173	Practice	0-3-0	Nil

Objective

- To be aware with the basic maintenance of four wheeler and two wheeler
- To learn the overhauling of each system of four wheeler and two wheeler

Learning Outcome

- Disassemble and assemble each system of an automobile
- To detect faults in various systems of automobile

Practice

- Safety Precautions in Automobile Maintenance.
- Identification and Functions of Various Tools and Equipments used in Automobile Workshop.
- Disassembling and Assembling of Engine of a Four Wheeler.
- Disassembling and Assembling of Engine of a Two Wheeler.
- Engine Troubleshooting.
- Nomenclature of a Spark Plug and Spark Plug Reading, Testing and Cleaning of Spark Plug.
- Checking and Replenishing Lubricating Oil, Engine Coolant, Power Steering Hydraulic Oil and Wind Screen Wiper Water.
- Overhauling and Servicing of Fuel System including Air Filter.
- Disassembling and Assembling Of Clutch, Clutch Troubles And Remedies.
- Repairing and Adjustment of Brake System.
- Disassembling and Assembling of Propeller Shaft.
- Inspection and Servicing of Gear Box.
- Inspection and Servicing Of CVT.
- Tire Change Operation, Wheel Balancing, Wheel Alignment, Tire Inspection (Tubeless & Tube) and Inflation.
- Overhauling of Suspension System.
- Disassembling and Assembling of Steering System and Adjustment of Drag Link.

- Preparation of Electrical Circuits using Switches and Fuses.
- Checking of Battery Terminal Voltage, Electrolyte Level and Specific Gravity.
- Inspection of Different Electrical Circuits and ECU.
- Checking of Ignition System Circuit & Components.

Reference Book:

1. Training Manual of Four Wheeler Maintenance (Ashok Leyland)
2. Training Manual of Two Wheeler Maintenance (Yamaha).