

UNIT I

Chapter 1 : Introduction to Automobile 1-1 to 1-36

Syllabus :

1.1 Automobile: Definition, Classification of Automobiles, Major Components of Automobiles with their Function and Location.

1.2 Vehicle Layout: Definition Significance of Vehicle Layout, Different types of Vehicle layouts (FEFWD, FERWD, RERWD, 4WD), Advantages, Disadvantages, Applications and Comparisons of Different types of vehicle layouts.

1.3 Function of Chassis, Frame and Body: Requirement of Chassis, Frame and Body, Load acting on Frame, Classification of Chassis Frames with advantages, disadvantages and applications (Conventional, Unitized Body, Sub Frame), Basic Body Nomenclature.

1.4 Significance of Body Streamlining: Need and Importance of aerodynamic Aspects, Basic terms related with Car Aerodynamics (e.g. Drag, Lift, Skin Friction, Form Drag, Wake, Coefficient of Drag)

1.5 Alternative Fuels: LPG and CNG: Need, Fuel Characteristics, Construction and Working, Advantages, Limitations; Layout of Electric Vehicles: Need, Working , Advantages, Limitations. Hydrogen as fuel.

1.1 Introduction to Automobile..... 1-1

1.1.1 Classification of Automobiles 1-2

1.1.2 Major Components of Automobile with Their Function and Location 1-4

1.2 Vehicle Layout..... 1-8

1.2.1 Significance of Vehicle Layout 1-8

1.2.2 Types of Vehicle Layout 1-9

1.2.3 Differentiate between Front and Rear Mount Engine Vehicle 1-16

1.2.4 Articulated Vehicles 1-16

1.2.5 Heavy Commercial Vehicles 1-16

1.2.6 Rigid Vehicles 1-17

1.3 Chassis, Frame and Body 1-17

1.3.1 Frame Construction 1-18

1.3.2 Functions of a Chassis, Frame and Body 1-18

1.4 Requirements of Chassis, Frame and Body..... 1-19

1.4.1 Load on Chassis Frame 1-20

1.4.2 Types of Frame Construction 1-20

1.5 Sub-Frame 1-23

1.5.1 Basic Body Nomenclature 1-24

1.6 Significance of Body Streaming..... 1-25

1.7 Need and Importance of Aerodynamics aspect..... 1-26

1.8 Alternative Fuel..... 1-28

1.8.1 Introduction 1-28

1.8.2 Need 1-29

1.8.3 Fuel characteristics of CNG and LPG..... 1-29

1.8.4 The CNG Engine..... 1-30

1.8.5 Liquid Petroleum Gas (LPG)..... 1-30

1.9 Electric Vehicles..... 1-32

1.9.1 Introduction 1-32

1.9.2 Need 1-32

1.9.3 Working of Electric Vehicles 1-33

1.9.4 Advantages of Electric Vehicles 1-34

1.9.5 Disadvantages of Electric Vehicles..... 1-34

1.9.6 Limitations of Electric Vehicles 1-35

1.10 Hydrogen Fuel Cell 1-35

UNIT II

Chapter 2 : Automobile Transmission Systems

2-1 to 2-42

Syllabus :

2.1 Function and Necessity of Clutch: Requirement of Clutch, Classification of Clutch, Working Principle of Clutch, Construction and Working of Single Plate (Coil Spring and Diaphragm), Multiplate Clutch and Centrifugal Clutch.

2.2 Function and Necessity of Gear Box Manual Transmission: Classification of Gear Box, Construction and working of Constant Mesh and Synchro Mesh Gear Box with power flow diagrams.



2.3 Semi Automatic Transmission: Function, Construction and Working of Overdrive, Automatic Transmission: Fluid Flywheel : Function Construction and Working of Fluid Flywheel; Torque Converter: Function, Construction and Working of Torque Converter; Epicyclic Gear Train: Function, Construction and Working of Epicyclic Gear Train.	2.8 Overdrive 2-20
2.4 Propeller Shaft Assembly: Function, Necessity and Types of Propeller Shaft, Function and necessity of Universal and Slip Joint.	2.8.1 Construction and Working of an Overdrive 2-20
2.5 Final Drive: Function and Necessity of Final Drive, Differential, Working Principle, Construction and Working of Differential.	2.9 Fluid Flywheel 2-21
2.6 Axles: Significance of Live and Dead Axle, Function and Requirement of Front Axle, Types of (Front) Stub axle, Function, Construction and Working of Semi Floating and Fully Floating Rear Axle.	2.9.1 Fluid flywheel or fluid coupling or fluid clutch 2-21
	2.9.2 Advantages of Fluid Flywheel 2-22
	2.9.3 Disadvantages of Fluid Flywheel 2-22
	2.9.4 Characteristic of Fluid Flywheel 2-23
	2.10 Torque Converter 2-23
	2.10.1 Comparison between Fluid Coupling and Torque Converter 2-25
	2.11 Epicyclic Gear Train (Box) 2-25
	2.12 Propeller Shaft 2-27
	2.12.1 Functions of the Propeller Shaft 2-28
	2.12.2 Construction and Working of Propeller Shaft 2-28
	2.12.3 Types of Propeller Shaft 2-29
	2.12.4 Whirling of Propeller Shaft 2-30
	2.13 Final Drive and its Type 2-30
	2.13.1 Final Drive Classification 2-30
	2.13.2 Functions of Final Drive 2-31
	2.13.3 Construction and Working of Final Drive 2-31
	2.13.4 Types of Bevel Gear Final Drive 2-32
	2.13.4.1 Spiral Bevel 2-32
	2.13.4.2 Hypoid Gear 2-33
	2.14 Differential 2-34
	2.14.1 Need of Differential 2-34
	2.14.2 Functions of the Differential 2-34
	2.14.3 Construction and Working of Differential 2-34
	2.15 Axle 2-36
	2.15.1 Introduction 2-36
	2.15.2 Functions and Requirements of Front axle 2-37
	2.15.3 Component of the Front Axle 2-37
	2.16 Stub Axle 2-38
	2.16.1 Type of Stub Axle 2-38
	2.17 Rear Axle 2-39
2.1 Introduction 2-1	
2.1.1 Definition and Necessity for a Clutch 2-1	
2.1.2 Requirements of Clutch 2-2	
2.1.3 Working Principle of Clutch 2-2	
2.1.4 Functions of Clutch 2-3	
2.1.5 Design Consideration of friction clutch 2-3	
2.1.6 Selection of Clutch 2-3	
2.2 Classification of Clutch 2-3	
2.2.1 Single Plate Clutch 2-4	
2.3 Diaphragm Clutch 2-5	
2.3.1 Difference between Coil Spring and Diaphragm Spring Type Clutch 2-6	
2.3.2 Multi-plate Clutch 2-7	
2.3.3 Semi Centrifugal Clutch 2-8	
2.3.4 Centrifugal Clutch 2-9	
2.4 Types of Transmission Systems 2-10	
2.5 Function and Necessity of Gear Box 2-11	
2.6 Types of Gear Box 2-12	
2.6.1 Constant Mesh Gear Box 2-12	
2.6.2 Synchromesh Gear Box 2-16	
2.7 Semiautomatic transmission (Automated manual transmission) 2-19	



2.17.1	Rear Axle Shaft Supporting	2-40
2.17.2	Difference between Live Rear Axle and Dead Rear Axle	2-41

UNIT III

Chapter 3 : Automobile Control Systems 3-1 to 3-35

Syllabus :		
3.1	Automobile Braking System: Function and Requirement of Braking System: Principle of Braking, Basic Terms related to Braking (Stopping Distance, Braking Efficiency, Fading of Brakes)	
3.2	Types of Braking System: Layout, Construction, Working of Drum, Disc, Hydraulic and Air Brakes.	
3.3	Master Cylinder, Wheel Cylinder, Tandem Master Cylinder, Significance and general procedure of Bleeding of Brake.	
3.4	Review of Anti Lock braking System: Layout of ABS, Pressure Modulation, Types of ABS.	
3.5	Automobile Steering System: Function and Requirements of Steering System: Basic Terms related to Steering (Steering Ratio, Turning Radius, Understeering and Oversteering), Basic Components of Steering Linkages.	
3.6	Types of Steering Gear Boxes: Construction and Working of Rack and Pinion, Recirculating Ball Type Steering Gear Box, Necessity and Principle of Power Steering, Construction and working of Hydraulic and Electronic Power Steering.	
3.7	Steering Geometry: Necessity of Steering Geometry, Significance and ranges of Caster (Positive, Negative), Camber (Positive, Negative), Toe-in, Toe out, King Pin Inclination (KPI), Steering Axis Inclination (SAI).	
3.1	Introduction to Brake	3-1
3.1.1	Requirements of Brake	3-2
3.1.2	Basic term related to Braking	3-2
3.1.3	Principle of Braking	3-4
3.1.4	Braking efficiency	3-5
3.2	Classification of Brakes	3-5
3.3	Mechanical Brake	3-7

3.3.1	Disc Brake System	3-8
3.4	Hydraulic Brake	3-9
3.4.1	Component of Hydraulic Brake System	3-10
3.4.2	Significance and general procedure of Bleeding of Hydraulic Brake	3-12
3.5	Power Brake	3-13
3.6	Pneumatic or Air Braking System	3-14
3.6.1	Advantages and disadvantages of airbrakes over mechanical brakes	3-15
3.7	Antilock Brake System (ABS)	3-16
3.7.1	Working of Antilock brake system :	3-17
3.7.2	Pressure Modulation Valve	3-17
3.7.3	Anti-Lock Brake Types	3-18
3.8	Difference between Mechanical and Pneumatic brake system	3-18
3.8.1	Difference between Hydraulic and Pneumatic Braking System	3-19
3.9	Comparison of Disc and Drum Brake	3-19
3.10	Steering System	3-20
3.10.1	Purpose (Requirement) of Steering System	3-20
3.10.2	Function of Steering System	3-21
3.11	Basic term related to Steering	3-21
3.11.1	Steering Ratio (Reduction Ratio)	3-21
3.11.2	Turning radius :	3-21
3.11.3	Understeering and Oversteering	3-21
3.11.4	Basic Components of Steering Linkage	3-23
3.12	Types of Steering Gear Boxes	3-24
3.12.1	Rack and Pinion Steering Gear	3-25
3.12.2	Recirculating Ball Type Steering Gear	3-26
3.12.3	Necessity and Principle of Power Steering	3-27
3.12.4	Electronic Power Steering	3-28
3.13	Steering Geometry	3-29

UNIT IV

**Chapter 4 : Automobile Suspension, Wheels and Tyres
4-1 to 4-39**

Syllabus :

- 4.1 Automobile Suspension System:** Function and Requirement of Rigid Suspension System: Basic Terms Related with Suspension System: (Jounce, Rebound, Sprung and Unsprung Weight, Spring Rate, Elasticity), Types and Constructional Features of Leaf Springs.
- 4.2 Function and Requirement of Independent Suspension System:** Advantages of Front Wheel Independent Suspension, Construction and Working of Mac-Pherson Strut Type, Wishbone Type Suspension system.
- 4.3 Shock Absorbers and Air Suspension:** Layout, Construction and Working of Air Suspension, Function and Types of Shock Absorber, Principle of Hydraulic Shock Absorber, Construction and Working of Telescopic Shock Absorber, Constructional Features and working of Gas Filled Shock Absorber.
- 4.4 Wheels, Rims and Tyres:** Function, Necessity and Requirement of Wheel, Rim and Tyres: Types of Wheels, Rims and Tyres, Construction and Working of Different Types of Wheels, Rims and Tyres.
- 4.5 Tyre Economy:** Consideration in Tyre Tread Design, Factors affecting to Tyre Life, Tyre Wear and Rotation, Tyre Designation.
- 4.6 Wheel Alignment and Balancing:** Purpose of Wheel Alignment, Procedure of Wheel Alignment, Purpose of Wheel Balancing, Significance of Static and Dynamic Balancing, Procedure for Static and Dynamic Balancing.

4.1	Need of Suspension System	4-1
4.1.1	Functions	4-2
4.1.2	Requirements of Rigid Suspension System	4-2
4.1.3	Basic Terms Related to Suspension	4-2
4.2	Types of Leaf spring	4-3
4.2.1	Construction and Working of Leaf Spring	4-3
4.2.2	Helper Springs	4-5
4.2.3	Components of leaf spring	4-5

4.3	Classification of Suspension Systems	4-6
4.4	Function and Requirement of Independent Suspension System	4-8
4.5	Advantages of Independent Suspension System	4-8
4.6	Types of Front Wheel Independent Suspensions	4-9
4.6.1	Mac-Pherson Strut Type Suspension System	4-9
4.6.2	Wishbone Type Suspension System	4-10
4.7	Air Suspension Spring	4-11
4.8	Air Suspension System	4-13
4.9	Shock Absorber	4-14
4.9.1	Telescopic Shock Absorber	4-15
4.9.2	Gas Filled Shock Absorbers	4-16
4.10	Wheels , Rims and Tyre	4-17
4.10.1	Types of Automobile Wheels	4-18
4.10.2	Necessity and function of Rims	4-20
4.10.3	Requirements of Rims	4-21
4.10.4	Types of Rims, their Construction and Working	4-21
4.11	Tyres	4-22
4.11.1	Desirable Properties (Requirement) of Good Tyres	4-22
4.11.2	Types of Tyres	4-23
4.12	Comparison of Radial and Cross Ply Tyre.....	4-29
4.13	Tyre Economy: Considerations in Tread Design	4-30
4.13.1	Factors Affecting Tyre Life	4-31
4.13.2	Types of Tyre Wear	4-32
4.13.3	Tyre Rotation	4-34
4.14	Specification of Tyre : (Designation of Tyre).....	4-35
4.15	Wheel Alignment.....	4-35
4.15.1	Procedure (Checking) of Wheel Alignment.....	4-36
4.16	Wheel Balancing	4-37
4.16.1	Static Balance of Front Wheels	4-38
4.16.2	Dynamic Balance of Front Wheels	4-38

**UNIT V****Chapter 5 : Automobile Electrical and Electronics****System****5-1 to 5-50****Syllabus :**

5.1 Introduction to Electrical-Electronic System: Basic Electrical-Electronics Principles (Current, Voltage, Resistance, Electricity, Magnetism, Electromagnetism, Induction, Rectification, etc) Basic Electrical- Electronics Components used in automobiles with their conventional symbols.

5.2 Battery: Function and Requirements of Battery, Types of Battery, Principle of Lead Acid Battery, Construction and Operation of Lead Acid Battery, Significance of Battery Rating and Battery Capacity, Battery Open Volt and Specific Gravity Test, Salient Features of Maintenance Free Battery.

5.3 Starting System: Function and Requirement of Starting System, Components of Starting System, Construction and Working of Standard Bendix Drive.

5.4 Charging System: Function and Requirement of Charging System, Components of Charging System, Construction and Working of Alternator.

5.5 Ignition System: Function and Requirement of Ignition System, Types of Ignition System, Construction and Working of Battery Ignition, Magneto Ignition and Electronic Ignition System with advantages, disadvantages, applications.

5.6 Lighting System: Function and Requirements of Lighting Systems, Types of Lights, Necessity and Importance of Cable Color Codes, Wiring Harness.

5.7 Miscellaneous: A Brief Review of Different types of Gauges, Windscreen wiper, Function and Location of Major Sensors and Actuators used in Automobile Electronics.

5.1	Introduction to Basic Electrical and Electronic	5-1
5.2	Electrical and Electronic Components of Vehicle.....	5-2
5.3	Battery	5-6
5.3.1	Functions and Requirements of Battery	5-6
5.3.2	Lead-Acid Battery	5-7
5.3.3	Working (Operation) of Battery.....	5-10
5.3.3.1	Factors Affecting Battery Life	5-11

5.3.4	Methods of Rating of Battery (Characteristic of battery)	5-12
5.3.5	Capacity of Battery OR Specification of Battery	5-14
5.3.6	Types of Battery Tests.....	5-14
5.3.7	Salient features of Maintenance free battery	5-16
5.4	Starting System.....	5-16
5.4.1	Requirements of the Starting System	16
5.4.2	Components and Functions of Automobile Starting System.....	5-17
5.4.3	Layout and Working of Starting System	5-17
5.4.4	Bendix Drive.....	5-18
5.5	Charging system	5-19
5.5.1	Function and Requirements of Charging system	5-19
5.5.2	Alternator	5-20
5.5.2.1	Working Principle :	5-20
5.5.2.2	Alternator Components and their Function :	5-20
5.5.2.3	Construction :	5-21
5.5.3	Charging of Battery by Alternator	5-22
5.6	Ignition System	5-23
5.6.1	Function and Requirement of Ignition System.....	5-23
5.6.2	Types of Ignition Systems.....	5-23
5.6.3	Difference between Battery Ignition System and Magneto Ignition System	5-27
5.7	Lighting System	5-29
5.7.1	Introduction	5-29
5.7.2	Function of Lighting System	5-30
5.7.3	Requirement of Lighting System.....	5-30
5.7.4	Types of Lights.....	5-30
5.7.5	Importance of Cable Color Codes Used for Wiring the Lighting System	5-35
5.7.6	Wiring Harness	5-36
5.8	Different Types of Gauges	5-38
5.8.1	Gauges	5-38
5.8.2	Wind Screen Wiper.....	5-43
5.8.3	Automotive Sensors and Actuator	5-44

UNIT VI

Chapter 6 : Motor Vehicle Act, Road Safety and Garage Practices 6-1 to 6-29

Syllabus :

- 6.1 Introduction and Objectives of Motor Vehicle Act:** Salient Features of M. V. Act 1988 and Central Motor Vehicle Rules 1989. Types and Significance of Traffic Signs, Important Transport Terms (Definitions) in M. V. Act (Motor Vehicle, Motor Cycle, HGV, MGV, LGV, Public Service Vehicle, Transport Vehicle, Driver, Passenger, Accident).
- 6.2** Organization Structure of Motor Vehicle (RTO) Department, Duties and Responsibilities of RTO, AIMV.
- 6.3 Passenger Comfort and Safety:** Function and requirements of Passenger Safety System. Features of Air Bags, Seat Belts, Collapsible Steering Column.
- 6.4 Automobile Maintenance Systems:** Significance of Garage, Workshop, Service Station, Dealership.
- 6.5** Types of Maintenance, Need and importance of Record Keeping, List of Records to be kept in Service Stations.
- 6.6** Site selection and amenities/facilities required to set up your own Garage/Service Station, Role and Responsibilities of Service Manager, Service Supervisor, Customer Care Manager in Service Stations.

6.1	Motor Vehicle Acts and its Salient Features.....	6-1
6.2	Registration of Motor Vehicles	6-2
6.3	Driving License	6-4
6.4	Control of Traffic.....	6-4
6.5	Insurance against Third Party	6-5

6.6	Claim for Compensation	6-5
6.7	Traffic sign	6-6
6.7.1	Central Motor Vehicle Rules	6-6
6.8	Classification and Definition of Vehicles	6-6
6.9	Enforcement of Emission Norms	6-8
6.10	Types and significance of Traffic Signs	6-8
6.11	Important Transport Term.....	6-16
6.12	Organization Structure of Motor Vehicle (RTO) Department	6-17
6.12.1	Regional Transport Office (RTO).....	6-17
6.12.2	Duties and Responsibility of RTO and AIMV	6-18
6.13	Passenger Comfort and Safety.....	6-18
6.14	Automobile Maintenance System	6-21
6.14.1	Significance of Garage, Workshop, Service station	6-22
6.15	Type of Maintenance	6-23
6.15.1	Need and importance of Record Keeping.....	6-24
6.15.2	List or record to be kept in service station	6-24
6.16	Site Selection and Facilities Required for Garage or Service Station	6-26
6.16.1	Role And Responsibilities of Service Manager in service station.....	6-27
6.16.2	Role And Responsibilities of Service Supervisor in service station.....	6-27
6.16.3	Role and Responsibilities of Customer Care Manager in service station	6-28

