

AUPC3001 AUTOMOTIVE CHASSIS (3-0-0)

Course Objectives:

1. To impart knowledge on various chassis layouts and frame types used in vehicles.
2. To study the structural and functional aspects of suspension, steering, braking, wheels, and tyres.
3. To enable students to understand recent advancements in chassis systems like ABS, EBD, and active suspensions.

Module-I Introduction to Chassis and Frames (06 Hours)

Functional requirements of a chassis. Classification of vehicle chassis: front-engine rear-drive, front-engine front-drive, all-wheel-drive. Types of vehicle frames: ladder, backbone, space frame, monocoque. Materials used in chassis and frames: high strength steel, aluminium, carbon fiber composites. Load distribution and stress analysis in frames. Torsional and bending stiffness concepts.

Module-II Front Axle and Steering Systems (09 Hours)

Functions and types of front axles: dead and live axles. Stub axle types: Elliot, Reverse Elliot, Lamoine. Steering geometry: caster, camber, kingpin inclination, toe-in and toe-out. Ackermann and Davis steering mechanisms. Power steering systems: hydraulic, electro-hydraulic, electric power steering (EPS). Advanced systems: steer-by-wire, variable ratio steering. Steering gearboxes: worm and roller, rack and pinion, recirculating ball.

Module-III Suspension Systems (09 Hours)

Objectives and classification: dependent vs. independent suspension. Leaf spring, coil spring, torsion bar, and air suspension systems. MacPherson strut, multi-link suspension, trailing arm suspension. Damping mechanisms: hydraulic dampers, gas-filled shock absorbers. Anti-roll bars and suspension geometry. Active and semi-active suspension systems: Skyhook theory, magnetorheological dampers. Electronic suspension control.

Module-IV Braking Systems (09 Hours)

Principles of braking: weight transfer and stopping distance. Types of brakes: drum, disc, mechanical, hydraulic, pneumatic. Components: master cylinder, wheel cylinder, brake liners, calipers. Brake fade, brake bleeding. Anti-lock Braking System (ABS): working principle, wheel speed sensors, hydraulic modulator. Electronic Brake-force Distribution (EBD) and Brake Assist (BA). Regenerative braking in electric and hybrid vehicles.

Module-V Wheels and Tyres (07 Hours)

Wheel construction: pressed steel wheels, alloy wheels, spoke wheels. Rim types and designations, offset, and balancing. Tyre construction: cross ply and radial, tubed and tubeless tyres. Tyre materials and tread design for various terrain. Tyre specifications and markings (IS/ISO standards). Tyre maintenance: rotation, balancing, alignment, tread wear indicators. Tyre retreading and recycling.

Course Outcomes:

Upon completion of this course, the students will be able to:

- CO1: Classify chassis and frame types used in different vehicles.
- CO2: Analyze the design principles and working of front axle and steering mechanisms.
- CO3: Compare various suspension systems and their dynamic behavior.
- CO4: Explain the functioning of conventional and advanced braking systems.
- CO5: Identify types, construction, and maintenance needs of wheels and tyres.

Textbooks:

1. Kirpal Singh – Automobile Engineering Vol. I, Standard Publishers.
2. R.K. Rajput – A Textbook of Automobile Engineering, Laxmi Publications.
3. Heinz Heisler – Vehicle and Engine Technology, SAE International.

Reference Books:

1. William H. Crouse & Donald L. Anglin – Automotive Mechanics, McGraw Hill.
2. Gillespie, Thomas D. – Fundamentals of Vehicle Dynamics, SAE.
3. Heldt, P.M. – Automotive Chassis, Chilton Co.