AUTOMOBILE CHASSIS

ENAM 351

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:
The objective of this course is to provide fundamental knowledge of automobile chassis components, including frames, transmission, steering, suspension, and braking systems. It aims to develop understanding of their construction, working principles, and integration. Upon completion, students will be able to analyze transmission systems and evaluate the performance of braking systems, wheels, and tires.

1 Introduction (4 hours)

- 1.1 Definition and function of chassis
- 1.2 Layout of automobile systems
- 1.3 Types of vehicles and chassis layouts
- 1.4 Types of frames
  - 1.4.1 Conventional frame
  - 1.4.2 Integral (Monocoque) frame
  - 1.4.3 Semi-integral frame
- 1.5 Frame construction and materials
- 1.6 Loads and stresses on frame
- 1.7 Safety considerations in frame design

2 Transmission system (15 hours)

- 2.1 Clutch system
  - 2.1.1 Purpose, functions, operation and types
  - 2.1.2 Troubleshooting and remedies
- 2.2 Gear box
  - 2.2.1 Purpose, functions and operation
  - 2.2.2 Manual (Sliding mesh, constant mesh, synchro mesh) gear box
  - 2.2.3 Epicyclic gearbox
  - 2.2.4 Fluid coupling and torque converter
  - 2.2.5 Automatic gear box
  - 2.2.6 Gear box lubrication
  - 2.2.7 Troubleshooting and remedies
- 2.3 Transfer case
  - 2.3.1 Purpose, functions and operation

2.3.2 Drive: High and low speed
2.3.3 Troubleshooting and remedies

2.4 Universal joint and propeller shaft
2.4.1 Purpose and functions
2.4.2 Types of propeller shaft
2.4.3 Troubleshooting and remedies

2.5 Final drive
2.5.1 Purpose, functions and operation
2.5.2 Differential: Components and working principle; Differential lock and limited slip differential; Differential lubrication
2.5.3 Troubleshooting and remedies

2.6 Axle
2.6.1 Purpose, functions, operation and types
2.6.2 Troubleshooting and remedies

3 Brake system (8 hours)

3.1 Functions and requirements of brakes
3.2 Types of braking systems: Mechanical, hydraulic and air brakes
3.3 Drum brake: Components and working principle
3.4 Disc brake: Components and working principle
3.5 Advanced braking systems
3.5.1 Anti-lock braking system (ABS)
3.5.2 Regenerative braking system
3.6 Brake performance and efficiency
3.7 Troubleshooting and remedies

4 Steering system (6 hours)

4.1 Purpose, components and functions
4.2 Types of steering gear box and mechanisms
4.3 Steering geometry
4.3.1 Ackermann steering geometry
4.3.2 Camber, caster, toe-in, toe-out
4.4 Power steering systems: Hydraulic, electric
4.5 Steering linkage and components

5 Suspension system (6 hours)

5.1 Functions and requirements of suspension
5.2 Types of suspension systems
5.2.1 Rigid axle suspension
5.2.2 Independent suspension
5.3 Suspension components
5.3.1 Springs (Leaf, coil, air, torsion bar)

5.3.2 Shock absorbers (Telescopic, single tube, double tube)

5.4 Ride comfort and vehicle stability

6 Wheel and tires (6 hours)

6.1 Purpose, functions and types of wheels
6.2 Tire construction: Radial and bias-ply
6.3 Tire coding
6.4 Tire pressure
6.5 Factors affecting tire life
6.6 Tire rotation and tire changing
6.7 Wheel alignment and wheel balancing

Tutorial (15 hours)

1. Calculation of maximum bending stress in a chassis frame
2. Determination of deflection under given loading
3. Comparison of different frame sections
4. Gear ratio calculations and torque flow of a typical gear box
5. Calculation of stopping distance at given speed
6. Finding braking force required
7. Calculation of load transfer during braking
8. Numerical calculations of stiffness of coil/leaf spring
9. Calculation of ride frequency
10. Determination of deflection under load
11. Determination of stability during cornering
12. Analysis of rollover condition
13. Determining inner and outer steering angles
14. Verification of correct steering geometry
15. Calculation of turning radius

Practical (22.5 hours)

1. Chassis frame: Identification of chassis components and identification of different frame structures
2. Clutch and gear box: Types, main parts identification and study of clutch, gear box, transfer case, checking condition of clutch plate, pressure plate, release bearing gear teeth, synchronizer ring, demonstrating working of automatic transmission
3. Propeller shaft, final drive, differential and axle shaft: Main parts identification, demonstration of differential mechanism, checking of propeller shaft, universal joint, final drive, back lash setting and axle shaft
4. Brakes: Types, identification of main parts, checking the condition of master cylinder, servo brake, brake drum, disc, wheel cylinder, pipe lines, pneumatic mechanism, demonstration of anti-lock braking mechanism in training bench and car
5. Steering system : Types, main parts identification, steering gear boxes and power steering mechanism demonstration

6. Suspension system: Types, main parts identification of parts, checking the condition of shock absorber
7. Wheel and tire: Main parts identification, read tire codes, wheel alignments, wheel balancing

Final Exam

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

Chapters	Hours	Mark distribution*
1 and 4	10	14
2	15	20
3	8	10
5	6	8
6	6	8
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Crouse, W. H., Anglin, D. L. (2007). Automotive mechanics. McGraw-Hill Education.
2. Singh, K. (2020). Automobile engineering. Standard Publishers Distributors.
3. Gill, P. S. (2012). Automobile engineering. S. K. Kataria & Sons.
4. Heisler, H. (2002). Advanced vehicle technology. Butterworth-Heinemann.
5. Reimpell, J., Stoll, H. (2001). The automotive chassis: Engineering principles. Butterworth-Heinemann.