INTRODUCTION TO AUTOMOBILE

presented by :-

3rd sem.
• CHASSIS
• SUSPENSION
• BRAKE
• ANTI BRAKE
• TRANSMISSION
• IC ENGINE
• Chasis is a French term which denotes the whole vehicle except body in case of heavy vehicles.

• In case of light vehicles of mono construction it denotes the whole body except additional fitting in the body.

• Chassis consists of engine, brakes, steering system & wheel mounted on the frame, differential, suspension.
• **Chassis in electronic device** consists of the metal frame on which the circuit boards & other electronics are mounted.
• **In absence of a metal frame** the chassis refers to the circuit boards & component themselves, not the physical structure.
• **In computer chassis** refers to the rigid framework on which motherboard, memory, disk drives & other equipments are mounted.
ITS PRINCIPAL FUNCTION:

- To safety carry the maximum load.
- Holding all components together while driving.
- Accommodate twisting on even road surface.
- Endure shock loading.
- It must absorb engine & driveline torque.
CLASSIFICATION OF CHASSIS

According to control:

• conventional-forward chassis
• Semi-forward chassis
• Full-forward chassis
**Conventional chassis:**

- *Engine is fitted in front of the driver cabin or driver seat such as in cars.*
- *Chassi portion can not be utilized for carrying passengers and goods*
Semi-forward chasis

- Half portion of the engine is in the driver cabin & and remaining half is outside the cabin such as in tata trucks

- In this arrangement a part of the chassis is utilized for carrying extra passengers
Full-forward chassis

- Complete engine is mounted inside the driver cabin
- Driver seat is just above the front wheel
ACCORDING TO FITTING TO ENGINE:

- Engine at front
- Engine fitted in front but crosswise
- Engine fitted at the centre of the chassis
- Engine fitted at the back
ENGINE AT FRONT:

- Conventionally the engines are fitted at front & drive is given to the wheels from the “rear”

**Advantage:**

- Enough space is available for luggage behind the rear seat
- The weight of vehicles is well balance
- Increased efficiency of cooling system
Rear Wheel Drive Layout

- Torque Converter
- Engine
- Transmission
- Final Drive
- Driveshaft
• **Engine is fitted at front & drive is given to front wheel**

**Advantage:**

- Low floor is available.
- Vehicle has more road holding capacity.
- Clutch, gear box & differential are usually made as one unit, thereby cost is reduced.
Disadvantage:

• Weight of the vehicle shift to the rear wheels which is not desirable for better adhesion/attachment.
Engine is fitted in front but crosswise:

- Drive is given to front wheel
- As in Maruti & B.M.C
Engine fitted at the centre of the chassis:

- Drive is given to the rear
- As in royal tiger world master buses previously piled by
- This arrangement provide full space of floor for use
Engine fitted at the centre of the chassis:
Engine fitted at the centre of the chassis:
Engine fitted at back:

- Real engine drive
- Vehicles employing this system is dolphin
Engine fitted at back
Engine fitted at back
**Advantage:**

- Flat floor is available since long propeller shafts are eliminated
- With elimination of propeller shaft the centre of gravity lowered giving stable driving
- Better adhesion onroad specially when climbing hill.
Disadvantage:

• While Climbing hills proper adhesion may be affected since the weight of vehicles moves to the rear, thereby reducing the weight on the front wheel.

• As a result of grouping of the engine with clutch, gear box and differential, the repair and adjustment become difficult due to congestion at the rear.
According to the Number of Wheels fitted in the vehicles and the number of driving wheels

- 4x2 drive chassis vehicle.
- 4x4 drive chassis vehicle.
- 6x2 drive chassis vehicle.
- 6x4 drive chassis vehicle.
FRAME:

- Frame is the main part of chassis on which remaining part of chassis are mounted.

- Frame should be extremely rigid and strong so that it can withstand shocks, twist, stresses and vibrations when vehicle is moving on road.
Frame are made of following sections:

- Channel sections
- Box sections
- Tubular sections

Note - Channel section good in bending, tubular in torsion & box in bending & torsion
• **Channel sections**

Used in long section of the frame
• **Box sections**

• Used in short members of frames
• **Tubular sections**

*Tubular section is used these days in three wheelers, scooters, pick-ups.*
Types of Chassis frame:

- Conventional Frame
- Integral Frame
- Semi Integral frame
**Conventional Frame:**

- It is also known as non load carrying frame. Here loads on the vehicles are transferred to the suspensions by frame.
- This type of frame is not suited to resist torsion.
Conventional Frame.
Semi Integral Frame:

- In this type of frame load is transferred to the body structure also.
- This Frame however is heavy.
- In semi integral frame half frame is fixed in the front end on which engine gear box and front suspension is mounted.
- This type of frame is used in some of the European & american cars
Semi Integral Frame
Semi Integral Frame
**Integral Frame:**

- In this type of construction there is no frame and all assembly units are attached to the body.
- The chassis, floor and body are assembled by from a large number of mild steel pressings.
- This is the modern form of construction for almost all cars and lighter commercial vehicles.
Integral Frame
Some of important Chassis are:

- Ladder Frame
- Tabular Space Frame
- Monocoque Frame
- ULSAB Monocoque
- Backbone Frame
- Aluminum Space Frame
- Carbon Fibre
• **Ladder frame:**

  - The ladder frame is the simplest and oldest of all designs.
  - It consists merely of two symmetrical rails, or
  - This design offers good beam resistance because of its continuous rails from front to rear
  - poor resistance to torsion
• **Tubular space frame:**

  • *It is 3-dimensional design*
  • *Tubular space frame chassis employs dozens of circular section tube, positions in different directions to provide mechanical strength against force from anywhere.*
  • *These tubes are welded & forms a very complex structure.*
  • *For higher strength required by sports cars, tubular space frame chassis usually incorporate a strong structure under both doors.*
• **Tubular space frame:**
Advantage:

• Very strong in any direction (compared with ladder chassis and Monocoque chassis of the same weight)
Disadvantage:

- Very complex, costly and time consuming to be built.
- It engages a lot of spaces rise the door seal and result in difficult to access to the cabin.
- Impossible for robotized production.
Who use it?

All Ferrari before the 360M, jaguar Xj220, TVR etc.
Monocoque:

- Monocoque is a one-piece structure which defines overall shape of the car. while ladder, tabular & backbone provide only stress members
- Today 99% car produced in this planet are made of steel Monocoque chassis.
- Chassis are made by welding of several pieces. *(Spot winding)*
- Monocoque is made of steel.
• Monocoque:
• **Spot-winding:**

  - Two plates are connected by resistance to electric current flow & work piece are held together under pressure exerted by electrodes.
  - The spot welded together by robot arm in stream production line.
• **Advantage:**
  
  • *Space-efficiency*
    
    *(the whole structure is actually an outer shell.)*
    
    • *Monocoque chassis benefit crash production.*
    • *because it uses a lot of metal.*
    • *Cheap for mass production.*
• Disadvantage:
  
  • It is very heavy.
  • Impossible for small volume production.
• **ULSAB MONOCOQUE:**

  • Ultra light steel auto body.
  • It has same structure as a conventional Monocoque.
  • It differs from its donor is in minor detaild-the use of “hydroform” parts, sandwich steel & laser beam winding.
• Hydroform technology:
Advantage:

- Stronger & lighter than conventional Monocoque without increasing production cost

- Compare with conventional Monocoque it is 36% lighter & 50% stiffer.
Disadvantage:

Still not strong or light enough for the best sport cars.

Who use it???

Opel astra, BMW 3-series, Audi A8, A2.
Backbone chassis:

- Colin chapman invented backbone chassis in his elan roadstar
- A strong tubular backbone connects the front & rear axle & provide nearly all mechanical strength.
- The whole drivetrain, engine & suspensions are connected to both ends of the backbone.
- The body is built on backbone are usually made of glass-fibre.
- Its strong enough for small sports car but not upto the job high-end one.
Backbone chassis
Backbone chassis
Advantage:

- Easy to be made by hand thus heap for low volume production
- Space efficient
- Good crash production
**Disadvantage:**

*Does not provide protection against side impact or crash.*

**Who use it??**

lotus esprit, elan MK11, TVR, Marcos.
**Carbon frame Monocoque:**

- Carbon fibre is found in aircraft, superbikes, spaceship, racing cars because of superior rigidity to weight.
- Carbon fibres are used in the body panels or in areas where extreme stiffness & lightweight is beneficial.
Carbon frame Monocoque
**Advantage:**

- The lightest & stiffst chassis.

**Disadvantage:**

- Most expensive.

**Who use it??**

*Ferrari f50, Bugati EB11055..*
Aluminium space frame:

- ASF consist of extrude aluminium sections, vacuum diecast component, and aluminium sheet of different thickness.
- Audi 8 is the first mass production car featuring aluminium space frame chassis.
- Developed in conjunction with US aluminium maker Alco, ASF is intended to replace conventional steel monocoque mainly for the benefit of lightness.
- Audi A8 ASF is 40% lighter than BMW 740i.
Aluminium space frame:
• **ADVANTAGE:**

Lighter than monocoque

• **Disadvantage:**

Still expensive or mass production.