Q.1 Drive the equation of motion and maximum tractive effort for a car inclined at angle θ. Also give the expression of maximum gradeability for a 4 wheel drive.

Let acceleration be ~~f~~ fx

Ra be aerodynamic resistance

height, h → hight of cg

The vehicle is inclined at angle θ.

Weight will be act downwards

W cosθ and W sinθ $W \sin\theta = R_{Rf} + R_{Rr}$ $F_{TF} + F_{TR}$

→ Rg :. Gravitational resistance Rg

$R_g = W \sin\theta$

θ - gradient angle.

~~θ°~~ when θ be 0°, Rg = 0

when θ at 90°, Rg = W

→ Rolling Resistance (RR)

$R_R = R_{Rf} + R_{Rr}$

or

$R_{Rr} = x \cdot R_{Rf}$

→ Traction Force (FT)

Traction force will act on the wheel & contact patch

$F_T = F_{TF} + F_{TR}$

For front wheel drive → $F_T = F_{Tf}$

Rear wheel drive → $F_T = F_{TR}$

$\therefore F_T - (R_a + R_R + R_g) = m \times a$

5. Consider a car with the following specification that is parked on a level road. Find the load on the front and rear axles, $m = 1765$ kg, $l = 2.84$ m $a_1 = 1.22$ m, $a_2 = 1.6$ m

Ans. Given data

$l = 2.84$ m $\quad a_1 = 1.22$ m $\quad a_2 = 1.6$ m $\quad m = 1765$

Force on the front wheels

$$F_{21} = mg\left(\frac{a_2}{l}\right)$$

$$= 1765 \times 9.81 \left(\frac{1.6}{2.84}\right) = 9754.73 \text{ N}$$

Force on the rear wheel

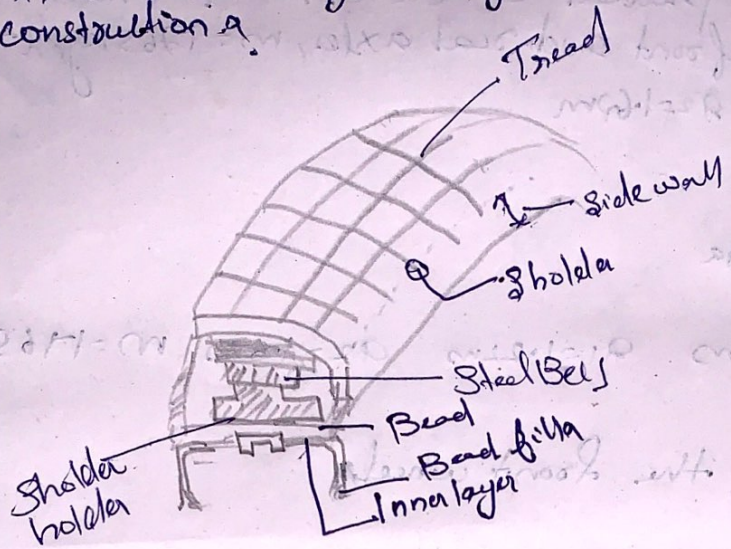
$$F_{21} = mg\left(\frac{a_1}{l}\right)$$

$$= 1765 \times 9.81 \left(\frac{1.22}{2.84}\right)$$

$$= 1765 \times 9.81 \times 0.4295$$

$$= 7437.98 \text{ N}$$

Q. What are the different parts of tires, Differentiate between types of tyres on the basis of their construction?



Tire Bead - A rubber coated loop of high strength steel cable that allow a tire to stay seated on a rim.

Inner liner - The inner lining is a rubber compound bonded to the inside of the cord body that retains air under pressure

Side wall - The area of a tire from the bead to the

Thread - the side of the tire - is called the side wall.

Tread :- The tread is the portion of the tire that comes in contact with the road surface. The thread compound and its design have to balance wear, traction, handling, fuel economy, resistance and other characteristics

→ Bead filla :- It is a rubber component inside the tyre beads. It provide stability to the lower side wall and bead area.

→ Steel belt :- It will provide strength to the tire. The presence is to prevent bending.

→ Sholder :- It is the weakest and thinest position of tire

→ Sholder Insert :- Provide proper strength to the sholder

By construction tyres are classified into 2, Bias ply & Radial ply.

Bias ply / Cross-ply tyre

These construction utilises rubber layers called ~~piles~~ plies that are placed diagonally from one bead to another bead at an angle not exceeding 30 degrees to each other. One ply is set on a bias in one direction and succeeding plies are set alternately in opposing direction as they cross each other and the ends are wrapped around the beadwires.

Radial tyres

Radial tyres are constructed with rubber coated, reinforcing steel cable belts that are assembled parallel and run from side to side. bead to bead at an angle of 90° degree to the circumferential centre line of the tyre. Over the bia-ply / cross ply, radial are more flexible which in turn reduce rolling resistance and improve fuel economy.