Assignment - 1

1AY18AU025
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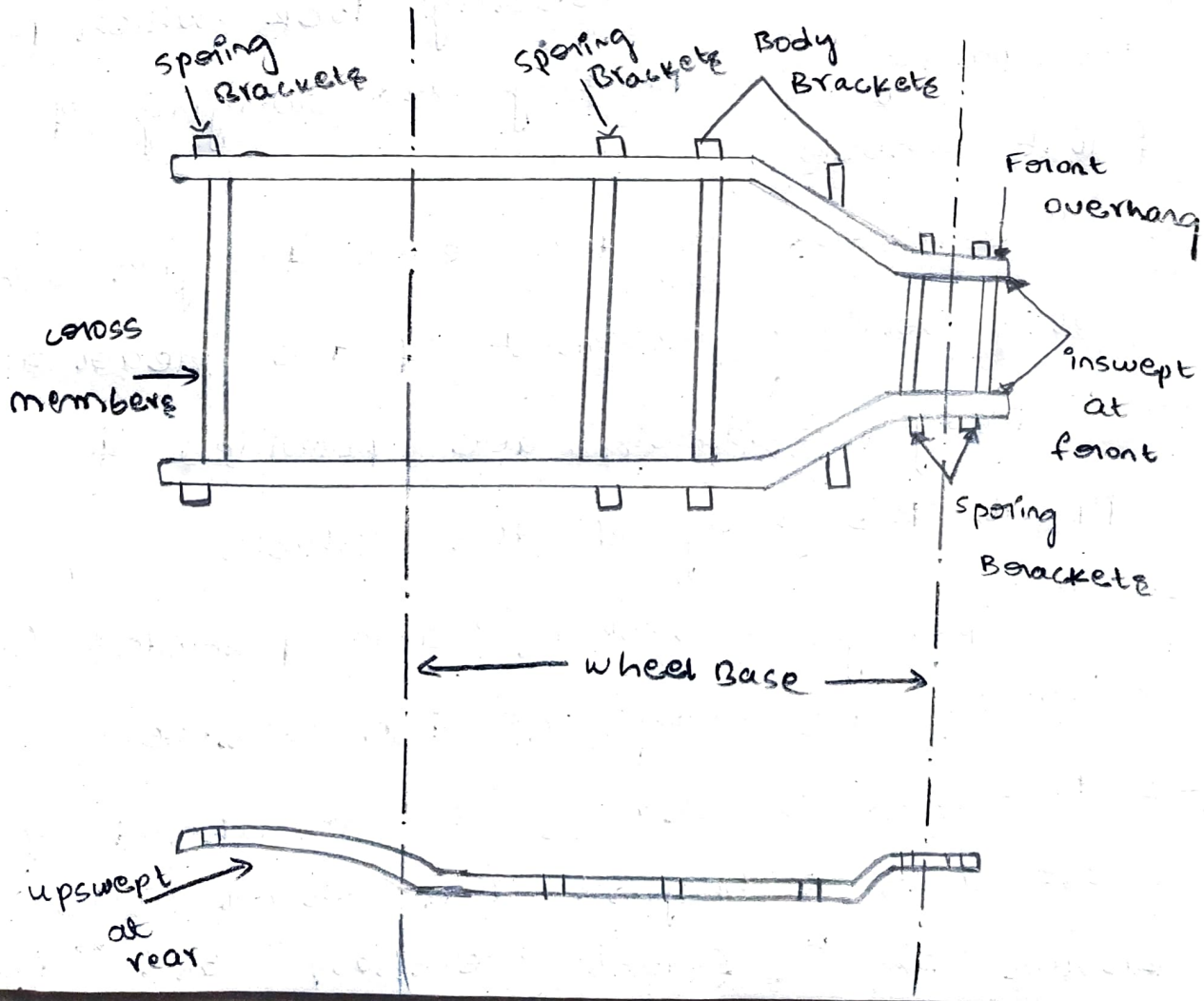
Sub:; ACS.

1) Explain construction of chassis frame.

Ans: **FRAME** :- it's the supporting component of automobile vehicle. the frame is made of box, tubular channels or U-shaped sections, welded / riveted together.

CHASSIS :- when engine, transmission systems, steering and wheels are fitted on the frame, the assembly is known as chassis.

i) **Conventional Frame** :-



⇒ construction of frame varies according to the type of vehicle.

⇒ generally made of "forged steel" sections.

⇒ this type of frame has "2 longitudinal members" and "5-6 cross members" joined together with the help of rivets/bolts.

⇒ "cross members" are used to increas-e strength of frame.

⇒ they are "inswept (narrow)" at the front and "upswept (Broad)" at the rear.

⇒ the frame is "narrowed" at the front to have better steering lock which provi-des spacing for pivoting and swinging of front wheels.

⇒ "Broaded" at the rear to give room for vertical movement of the rear axle.

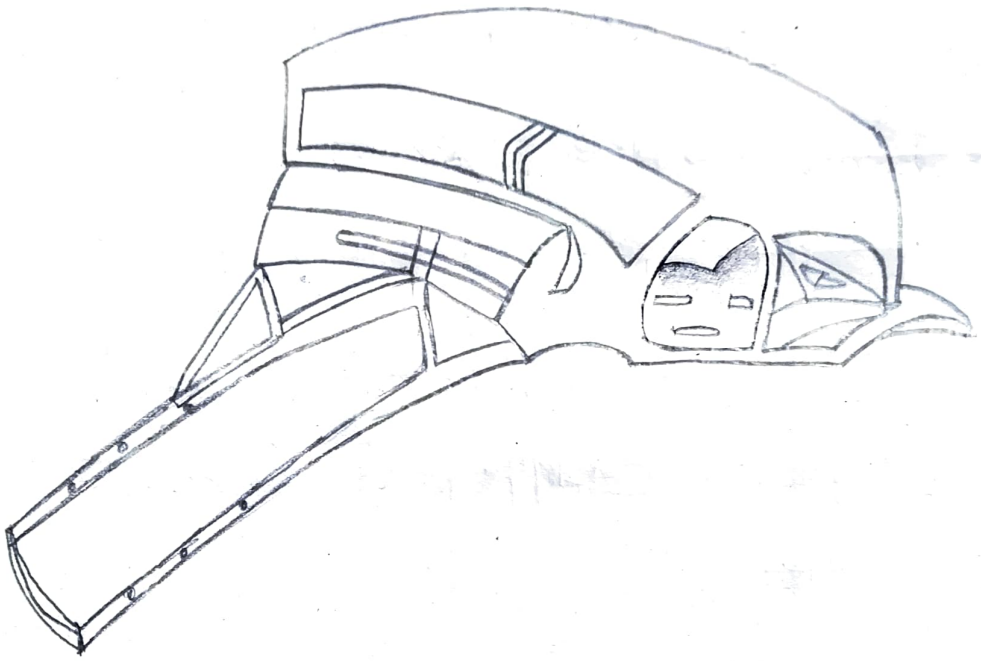
⇒ "Body Brackets" are provided to support the body of the vehicle

⇒ "Spring Brackets" are provided for mounting the body of the vehicle.

⇒ Extension of chassis frome ahead of front axle & beyond the rear axle known as "front overhang" and "rear

overhang" respectively

(iii) Integrated Frame chassis or frameless chassis.



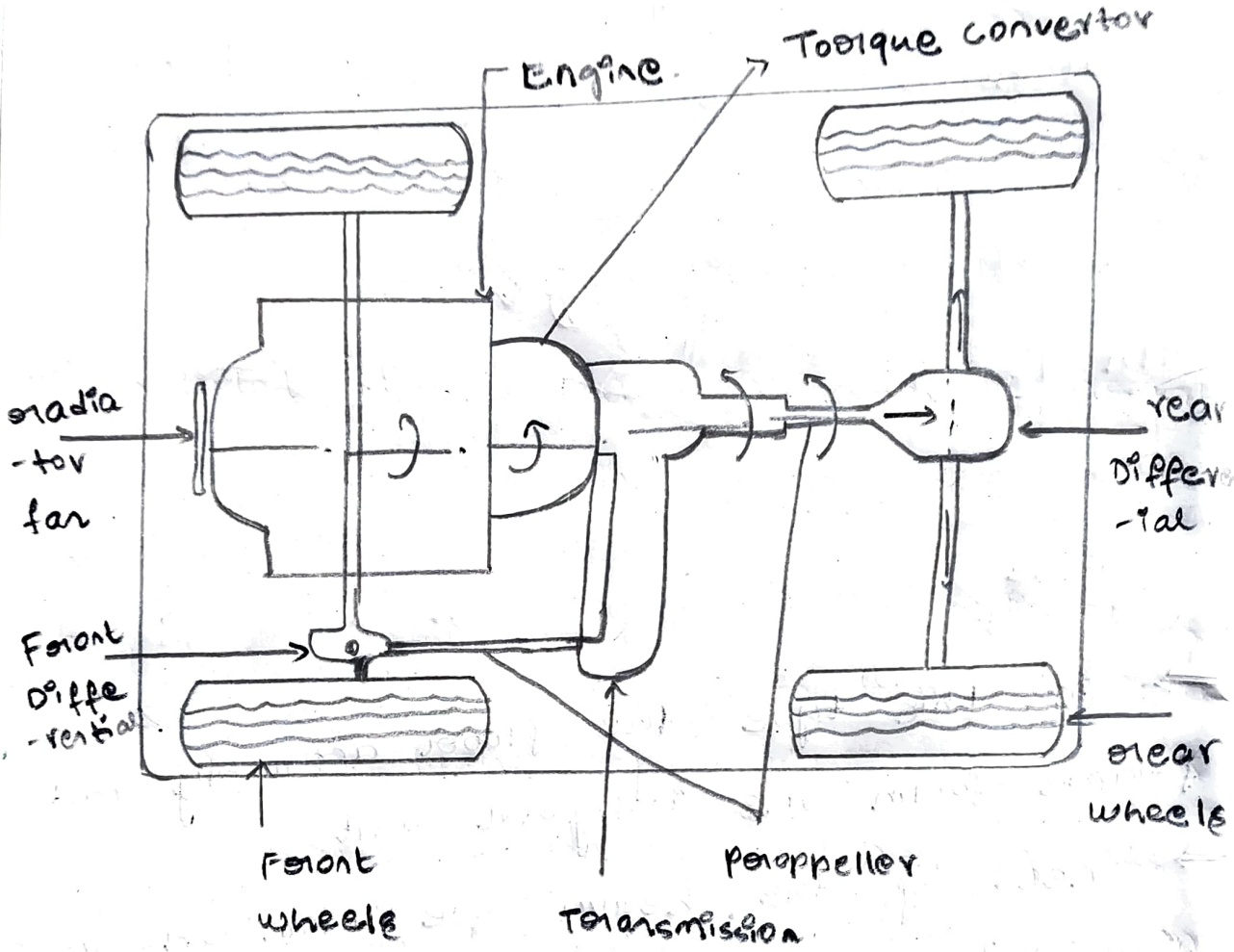
⇒ In this type the floor assembly and frame form one integral unit.

⇒ need of the heavy side members are eliminated, which is used in conventional frame and the floor is strengthened by cross members and body, all welded toge-ther.

⇒ sub-frames are used to provide isolat-on, flexibility and simplified production.

⇒ this type of construction gives more strength and rigidity.

② Explain with a neat sketch the layout of a 4-wheel drive automobile.



⇒ A four wheel drive system is used to send power from the engines to all four wheels of the car to assist in traction-demanding situation.

⇒ after starting of the vehicle, the engine runs and produces power which is sent to the torque convertor and to the transmission box to provide different output speed.

⇒ the power is transmitted through the propulsion shaft of rear and front wheels.

⇒ here, the front and rear differential provides equal power to both of the wheels; hence provides equal speed.

⇒ by this a vehicle is said to be 4-wheel driven.

(3) Explain the following;

Ans: i) Camber :- It is the inward or outward tilt of the front/rear tires as viewed from the front.

ii) Caster :- caster is the force or angular space of the steering axis. the steering axis is a line drawn through the upper and lower ball joints of the knuckle.

iii) King pin inclination :- the kingpin inclination is the angle, measured in degrees, that forms the line passing through the kingpin and the perpendicular to the ground, looking at the

vehicle from the front.

iv) Toe-in and toe-out :- Toe-in is the front wheel pointing towards the centre-line of the vehicle.

Toe-out is the front wheel pointing away from the centreline of the vehicle

v) Included angle :- the combination of negative camber and king pin inclination.

vi) oversteer

⇒ It is what occurs when a car turns by more than the amount commanded by the driver.

understeer.

⇒ It is what occ when a car turns by less than the amou -nt commanded by the driver.

4) Derive expression for stability of vehicle on slope.

Sol:- let the vehicle rest on a slope of inclination "θ" to the horizontal this alters the distribution of the weight b/w the front and rear axle and gives

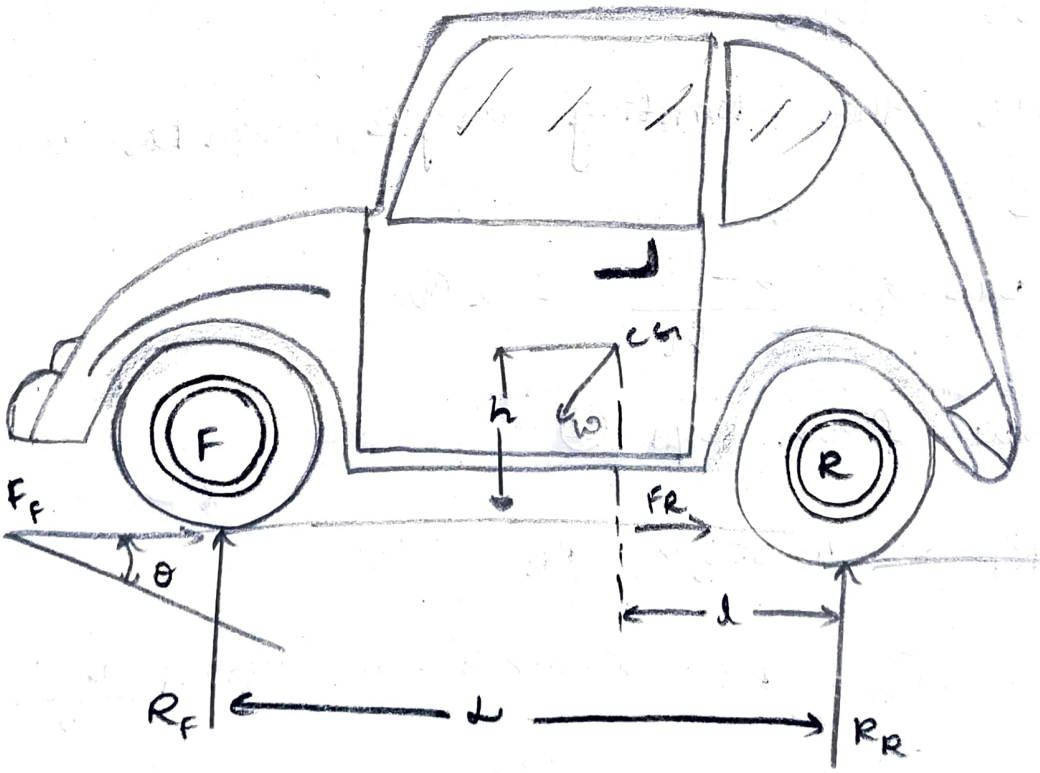
arise to reaction which can have compo-nents along the perpendicular to the inclined plane

∴ b = wheel base.

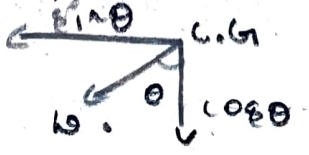
h = height from C.G to the ground

F_F, R_F and F_R, R_R = Force and reaction force at both front and rear wheels.

l = dist from C.G axle to the rear wheel axle.



now resolving forces horizontally and vertically (⊥ˣ) to the slope respectively;



$W \sin\theta = F_F + F_R \rightarrow (1)$.

$W \cos\theta = R_F + R_R \rightarrow (2)$

and $\Sigma m_F = 0$ gives ; $W \sin\theta \times h + R_R \times b = W \cos\theta \, (b - l)$

$\therefore \quad R_R = \frac{W}{b}\left[(b-l)\cos\theta - h \sin\theta \right] \rightarrow (3)$.

If the angle θ is increased gradually a situation arises when ;

a) either the vehicle is about to over - turn

or

b) the vehicle is about to slide down the slope.

thus the limiting angle, can be written as

$\tan\theta_L = \frac{b - l}{h} \rightarrow (4)$.

now from eqn (2).

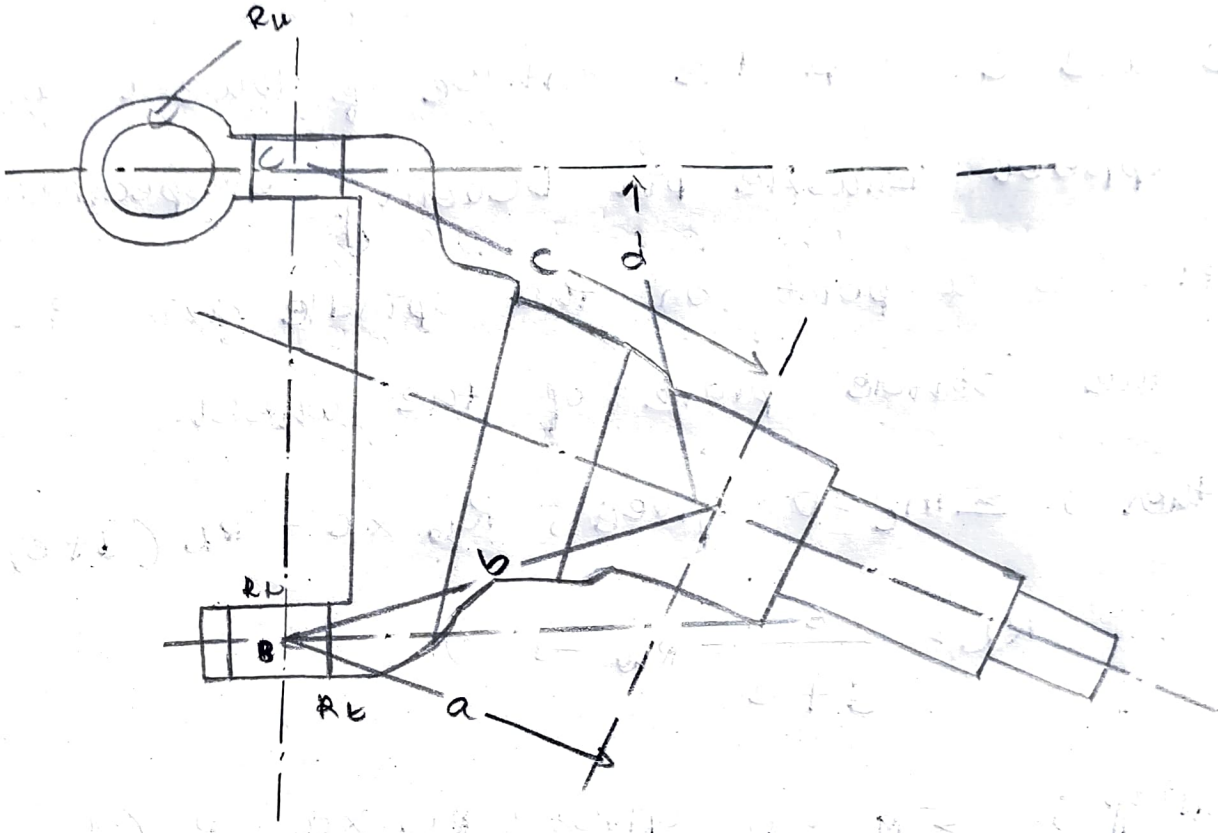
$R_F = W \cos\theta - R_R \rightarrow (5)$.

(3) & (5) $\Rightarrow R_F = W\cos\theta - W\cos\theta + \frac{Wl}{b}\cos\theta + \frac{Wh}{b}\sin\theta$.

$\therefore \quad R_F = \frac{W}{b}\left[l\cos\theta + h\sin\theta \right] \rightarrow (6)$.

5) Derive expression for bearing load on front axle.

Ans:-



the figure illustrates the forces and the reactions on steering knuckle. when the vehicle is at rest the thrust load and the knuckle pin bearing load can be expressed in terms of reaction of wheel on wheel spindle.

let ;

Rw = rxn of the wheel on the spindle acting vertically through the centre of contact of tyre on ground.

R_t = load on thrust bearing.

R_u = load on upper knuckle pin bearing

R_L = load on lower knuckle pin bearing.

B and C = rep. the centres of lower and upper knuckle pin bearing respectively.

A = is a point on the spindle axis in the centre plane of the wheel.

then ; $\Sigma m_C = 0$ gives ; $R_w \times c - R_L (d+e) = 0$.

$$\therefore \quad R_L = \frac{c}{d+e} R_w \rightarrow (1).$$

Similarly ; $\Sigma M_B = 0$ gives ; $R_w \times a - R_u (d+e) = 0$.

$$\therefore \quad R_u = \frac{a}{a+e} R_w \rightarrow (2).$$

Similarly ; $\Sigma m_A = 0$ gives ; $R_t \times b - R_L \times e - R_u \times d = 0$.

$$\therefore \quad R_t b = R_L e + R_u d \longrightarrow (3).$$

Sub eqn (1) & (2) in (3).

we get ; $R_t b = \frac{c}{d+e} \cdot R_w \cdot e + \frac{a}{a+e} R_w \cdot d$.

$$\therefore \quad R_t = \frac{ce + ad}{b(d+e)} R_w \longrightarrow (4)$$