

1804234

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Vehicle Technology

14/05/2020

13:00 start time

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Q1i. Define Camber



Neutral



Negative



Positive

* Front view *

Camber is the inclination of wheel axis w.r. to the road surface in a vertical plane. It also creates camber thrust.

Q1ii) Caster angle



Neutral



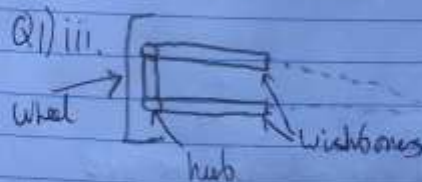
Positive



Negative

* Side view *

Caster angle is the distance from the wheel contact patch to the point of steering axis intersects the road. It is the angle from the steering axis and the vehicle.



Wheel

hub

Wishbones

* IC

IC (Instant centre) is the effective pivot point of linkage system. It moves in relation to what the

steering and suspension are doing. IC is designed in relation to the suspension as IC can change the camber.

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Q1. IV) Roll centre



Roll centre (RC) is the effective pivot point of the chassis at instant in time. RC is constructed from ICs from each wheel. It also defines the roll stiffness

Having a short R

Q2. i) $m = 915 \text{ kg}$ $\frac{mah}{T} = \frac{915 \times 25 \times 0.375 \times 4.81}{1.16}$
 $V = 25 \text{ m/s}$
 $r = 130 \text{ m}$
 $h = 0.375 \text{ m}$
 $T = 1.16 \text{ m}$
 $= 1422.74 \text{ N}$

$$A = \frac{V^2}{R} = \frac{25^2}{13} = 4.81 \text{ m/s}$$

Q2. ii) $\frac{mah}{T} = \frac{915 \times 4.81 \times 0.375}{1.16} = 1422.74$

Lateral load = 1422.74 N

Q2. iii) Load transfer is when the outside tyre has increased load due to the motion of the car. The inside tyre therefore has reduced load creating less friction meaning an overall reduced grip level.

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Q2. IV)



Slip angle is generated when a tyre tries to change direction while moving across the ground. The tyre's path changes ~~when~~ when the angle the tyre is traveling to changes. The rubber moves with the direction of the road until it moves through the contact patch where it then moves back.

Slip angle no more than 8°

Q3. i) $M_s = 215 \text{ kg}$
 $k_1 = 13 \times 10^3 \text{ N/m}$
 $k_2 = 28 \times 10^3 \text{ N/m}$

$$k_{\text{total}} = k_1 + k_2 = 13 \times 10^3 + 28 \times 10^3 = 41 \text{ 000 N/m}$$

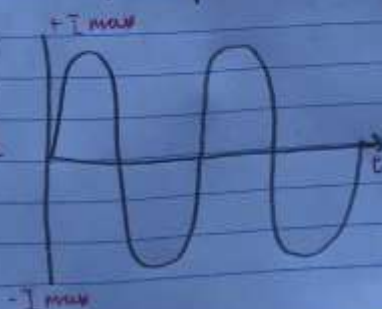
$$2 \times \left(\frac{1}{\frac{1}{13000} + \frac{1}{28000}} \right) = 17 \text{ 700 N/m}$$

Q3. ii) $f_n = \frac{1}{2\pi} \sqrt{\frac{k}{m}} = \frac{1}{2\pi} \sqrt{\frac{17000}{215}} = 1.42 \text{ Hz}$

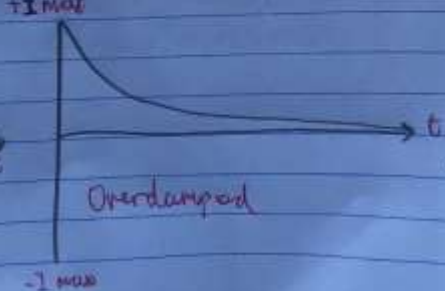
Q3. iii) The frequency given ~~would~~ would not be enough to suit an off-roading vehicle. 1.42 Hz is more ~~not~~ suitable to a saloon car or estate car. An off-roader would have to have a frequency of at least 2 Hz.

Q3. iv)

Undamped



Overdamped



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Q5. i) $F_a = 1.1 \text{ m}^2$
 $V = 35 \text{ m/s}$
 $\rho = 1.223 \text{ kg/m}^3$

i) The ~~more~~ greater amount of velocity will mean an increase of pressure on the car.

ii) Lift force = $C_L \times \frac{1}{2} \rho V^2 A$ Front force + Rear force

$1115 \text{ N} + 1485 \text{ N} = 2600 \text{ N}$ of $\downarrow$ -ve lift (downforce)

iii) Drag force = $C_D \times \frac{1}{2} \rho V^2 A = 0.67 \times \frac{1}{2} \times 1.223 \times (35)^2 \times 1.1$

Drag produced = 5152.1 N

iv) $C_{op} = \frac{\text{Front load}}{\text{Total load}} = \frac{1115}{1115 + 1485} = \frac{1115}{2600} = 43\%$