Problems related to Rear axle drive

1) A four-start worm is driven by a propeller shaft at 2500 rpm and meshes with a crown ~~wheel~~ wheel on the rear axle shaft. The crown wheel has 21 teeth. Calculate the speed of the vehicle in km/h if the effective diameter of road wheels is 0.7m

Given data

Propeller Shaft Speed = 2500 rpm

No of teeths on crown wheel = 21

No of start on worm = 4

Effective road wheel diameter = 0.7m

To find:

(i) Speed of Vehicle (km/hr)

Solution:

Speed of Vehicle = Angular Speed of road wheel × Circumference of road wheel

$$\text{Rear axle ratio} = \frac{\text{No of teeth on crown wheel}}{\text{No of starts on worm}}$$

$$= \frac{21}{4} = 5.25$$

Rear axle ratio = 5.25 : 1

Angular Speed of propeller Shaft $= \frac{\text{Propeller Shaft Speed}}{\text{Rear axle ratio}}$

$= \frac{2500}{5.25}$

Angular Speed of propeller Shaft = 476 rpm

Speed of ~~vehe~~ vehicle = Angular Speed × circumference

$= 476 \times (\pi \times d)$

$= 476 \times \pi \times 0.7$

$= 1047.19$ m/min

$= 1047.19 \times \frac{60}{1000}$ km/hr

Speed of Vehicle = 62.83 Km/hr

Result:

Speed of Vehicle = 62.83 km/hr

2) A vehicle has a third gear ratio of 1.5:1 and rear axle ratio of 4.5:1. Calculate (a) Overall gear ratio and b) the number of revolutions made by the crown wheel per minute if the engine speed is 2700 rpm

Given data:

Gearbox ratio = 1.5:1 = 1.5

Rear axle ratio = 4.5:1 = 4.5

Engine speed = 2700 rpm

To find:

(i) Overall gear ratio

(ii) Number of ~~revo~~ revolution made by crown wheel per minute

Solution:

Overall gear ratio = Gearbox ratio × Rear axle ratio

= 1.5 × 4.5

= 6.75

Overall gear ratio = 6.75:1

Number of revolutions made by crown wheel per minute = $\frac{\text{Engine Speed}}{\text{Overall gear ratio}}$

$$= \frac{2700}{6.75}$$

No of revolution = 400 rpm
made by crown wheel

Result:

(a) Overall gear ratio = 6.75 : 1

(b) No of revolution made by crown wheel = 400 rpm

3. Torque developed by an engine is 82 Nm at 2000 rpm. The final drive ratio is 4.73 : 1. In top gear the inside road wheel makes 60 rpm. Calculate the torque and Power at the inner and outer driving road wheels.

Given data:

$T_E = 82\ Nm$

$N = 2000\ rpm$

$D_R = 4.73 : 1 = 4.73$

$N_i = 60\ rpm$

To find:

(i) Torque at Inner & Outer driving road wheel

(ii) Power at Inner & Outer driving road wheel

Solution:

Torque at differential housing and road wheel

$$T_R = T_E \times D_R$$

$$= 82 \times 4.73$$

$$\boxed{T_R = 387.86 \text{ Nm}}$$

Torque at each shaft $= \frac{T_R}{2} = \frac{387.86}{2}$

$$= 193.93 \text{ Nm}$$

Revolution of differential $N_c = \frac{N}{D_R} = \frac{2000}{4.73}$

$$\boxed{N_c = 422.8 \text{ rpm}}$$

$$N_o = 2N_c - N_i$$

$$= 2(422.8) - 60$$

$$\boxed{N_o = 785.6 \text{ rpm}}$$

$$P_R = \frac{T_R \times \pi \times N_i}{60 \times 10^3}$$

$$= \frac{387.9 \times \pi \times 60}{60 \times 10^3}$$

$$\boxed{P_R = 1.22 \text{ kW}}$$

$$P_R = \frac{T_R \pi \times N_o}{60 \times 10^3} = \frac{387.9 \times \pi \times 785.6}{60 \times 10^3}$$

$$\boxed{P_R = 15.6\ kW}$$

Result:

Torque on each Shaft = 193.93 mm

Power on Inner wheel = 1.22 kW

Power on Outer wheel = 15.6 kW