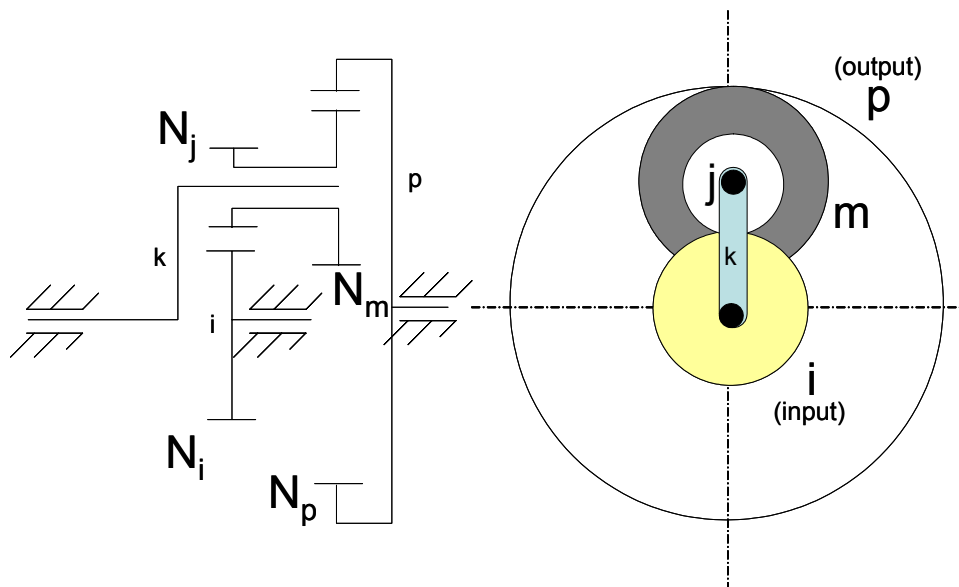# Gear Kinematics

For the gear train shown in the figure, calculate the rotational speed of the output gear if the rotational speeds of the input gear and the arm are 500 rpm and 300 rpm respectively.

$N_i = 40$	
$N_m = 60$	
$N_j = 20$	
$N_p = 150$	

Solution:

$$\frac{\omega_j - \omega_k}{\omega_i - \omega_k} = -\frac{N_i}{N_j} \qquad \text{(external)}$$

$$\frac{\omega_m - \omega_k}{\omega_p - \omega_k} = \frac{N_p}{N_m} \qquad \text{(internal)}$$

Observe that $\omega_j = \omega_m$

Then,

$$\frac{\omega_p - \omega_k}{\omega_i - \omega_k} = -\frac{N_m}{N_p}\frac{N_i}{N_j}$$

$$\frac{\omega_p - 300}{800 - 300} = -\frac{60}{150}\frac{40}{20}$$

$$\omega_p = 700 \; rpm$$