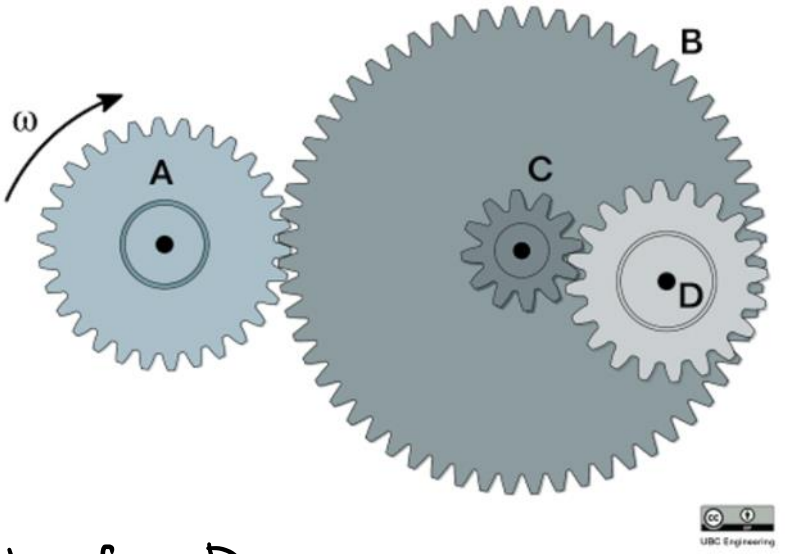
Problem 2

In the following gear train, gear A is in contact with gear B. Gear B and gear C are rigidly attached, and gear C is in contact with gear D. If we wish to have an output torque of 5kNm at gear D, what is required input torque at A? Assume the gears have negligible mass and that r_A=1m, r_B=3m, r_C=0.5m, and r_D=1.5m.



Work backwards from D

D → C

$$\frac{T_D}{r_D} = -\frac{T_C}{r_C} \rightarrow \frac{5kNm}{1.5m} = -\frac{T_C}{.5m} \rightarrow T_C = -1.667\,kNm$$

C → B

$$T_C = T_B = -1.667\,kNm$$

B → A

$$\frac{T_B}{r_B} = -\frac{T_A}{r_A} \rightarrow \frac{-1.667\,kNm}{3m} = -\frac{T_A}{1}$$

$$\boxed{T_A = .556\,kNm}$$