ME 328 – Machine Design
Quiz 1– Closed book, closed notes, NO calculator
January 31, 2020

This quiz is MY work, and my work ONLY:

Signature:

Print name:

1. Gear ratios are expressed as fractions or ratios: $\omega_{driving} / \omega_{driven}$ or typically $\omega_{driving}:\omega_{driven}$ or $\omega_{in}:\omega_{out}$ (input speed to output speed). Consider a DC electric motor with the performance curve shown below. If the gear ratio is 2:1, what is the output speed (the speed of the lifting drum) if no load (0kg) is applied? Express your answer in revolutions per minute.
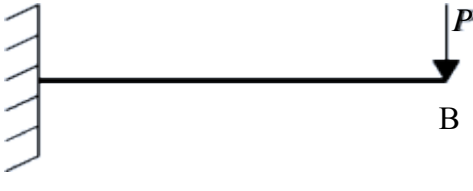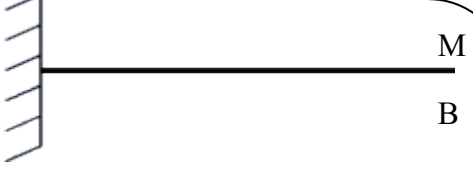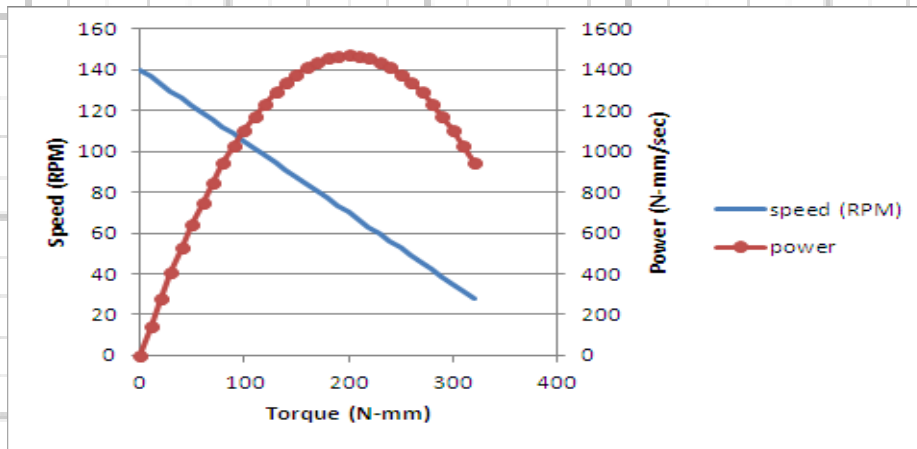

40mm dia.
lifting drum
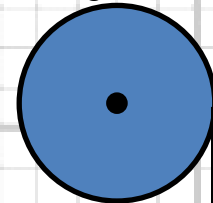
Weight

If no load is applied, the motor will spin freely at 140RPM.

Gear ratio: $\omega_{in}:\omega_{out}$ (input speed to output speed) = 2:1 means that the motor (input) is spinning twice as fast as the drum (output). Therefore, the drum is spinning half as fast as the motor.
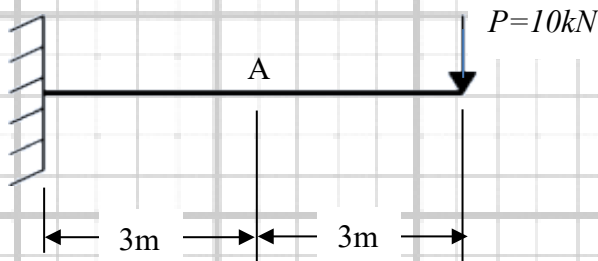
Drum speed = 70RPM

Problem 2 is on the backside….

Beam deflection charts, L is the total length of the beam:

Chart 1

$$\delta_B = \frac{PL^3}{3EI}$$

$$\theta_B = \frac{PL^2}{2EI}$$

Chart 2

$$\theta_B = \frac{ML}{EI} \qquad \delta_B = \frac{ML^2}{2EI}$$

2. A 6m long cantilever beam has a 10kN load at the end as shown below. What is the angular deflection at the mid-length (point A)?

a) **Create FBD of the equivalent system necessary to solve this problem with the information given in the charts above:**

$P=10kN$

A

$P=10kN$

A

M=10kN(3m)
M=30kNm

3m
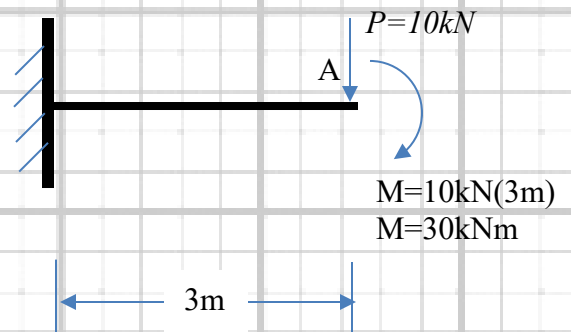
b) **Set up the appropriate equations in variable form:**

$\Theta_A = PL^2/(2EI) + ML/(EI)$

c) **As much as possible, include numbers in-place of the variables, but do not solve:**

$\Theta_A = (10kN)(3m)^2/(2EI) + (30kNm)(3m)/(EI)$