EML2322L Calculations Review

Answer the following questions based on the information presented in class.

Given a motor shaft speed of 100 rpm, a 6″ diameter wheel and 75% efficiency, what is the linear (loaded) velocity of the robot [ft/sec]?

$V = \pi \times D \times N \times \eta$
$V = \pi \times$ _____ $\times$ _____ $\times$ _____
$\times$ _____ ft/in $\times$ _____ min/sec
$V \approx 2.0$ ft/sec

Calculate the spindle speed [rpm] and feedrate [in/min] for a ½ inch HSS drill bit in mild steel (0.2-0.3 C) when using a manual milling machine:

from Table 1: $V \approx$ _____ ft/min
$N = 12$ in/ft $\times V$ ft/min / ($\pi \times D$ in/rev)
$N = 12$ in/ft $\times$ _____ ft/min / ($\pi \times$ _____ in/rev)
$N =$ _____ rpm

from Table 2: $f_r \approx$ _____ in/rev
$f = N$ rev/min $\times f_r$ in/rev
$f = 764$ rev/min $\times$ _____ in/rev
$f =$ _____ in/min

scale back 60% since oil is being applied manually: $N \approx 460$ rpm, $f \approx 3.7$ in/min

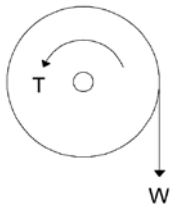
Calculate the spindle speed [rpm] and feedrate [in/min] used when milling an aluminum part with a 1/2 inch diameter, 2 flute HSS endmill on a manual milling machine in lab.

from Table 1: $V \approx$ _____ ft/min
$N = 12$ in/ft $\times V$ ft/min / ($\pi \times D$ in/rev)
$N = 12$ in/ft $\times$ _____ ft/min / ($\pi \times$ _____ in/rev)
$N =$ _____ rpm

from Table 3: $f_t \approx$ _____ in/rev
$f = N$ rev/min $\times f_t$ in/tooth $\times m$ teeth/rev
$f = 1910$ rev/min $\times$ _____ in/tooth $\times$ ____ teeth/rev
$f =$ _____ in/min

scale back 60% since oil is being applied manually: $N \approx 1150$ rpm, $f \approx 9.2$ in/min

Calculate the torque [lb-ft] required to lift 10 pounds of sand with a motor connected to a 4″ radius pulley?



$T = F \times d$
$T =$ _____ lb $\times$ _____ $in \times 1$ ft / 12 in

$T \approx 3.3$ lb-ft

Calculate the tightening torque [lb-ft] for a grade 5, ¼-20 fastener using the following information (not all may be applicable):

proof (yield) strength = 85,000 psi
tensile (ultimate) strength = 120,000 psi
tensile stress area = 0.0318 in^2
shank stress area = 0.0491 in^2

$T = 0.2 \times F_i \times d$

$\sigma_t = 0.9 \times \sigma_y = 0.9 \times$ _____ psi

$F_i = \sigma_t \times A_t =$_____ psi $\times$ _____ in^2
$F_i =$ _____ lb

$T = 0.2 \times F_i \times d$
$T = 0.2 \times$ _____ lb $\times$ _____ in $\times 1$ ft / 12 in

$T \approx 10.1$ lb-ft