

## ME 328, Exam 1, 2020

Expect problems similar to those on assignments 1 through 4.

Things to memorize (and know how to apply):

$$\sigma = F/A, \sigma = My/I, \tau = Tr/J$$

$$\sigma_{\max} = K_t \sigma_{\text{nom}} (\sigma_{\text{nom}} = \sigma_0)$$

$$\text{Power} = T_1 \omega_1 = T_2 \omega_2$$

$$\text{dia}_1 / \text{dia}_2 = \omega_2 / \omega_1 = T_1 / T_2$$

Hooke's law for uniaxial loading

Convert revolutions per minute (RPM) to radians per second

Determine the weight of objects if mass is given in kilograms (you may use  $a_g = 10\text{m/sec}^2$ )

Be able to define in words, equations, or sketches:

- Young's modulus (modulus of elasticity)
- Poisson's ratio
- Ductility (%EL)
- Toughness
- Yield strength
- Tensile strength
- Dislocation
- Dislocation slip
- Ductile fracture
- Brittle fracture
- Maximum shear stress failure theory
- Maximum normal stress failure theory

Imperial/US/British and SI units for: force, work, energy, power, strain, stress, bending moments, torque

Unit prefixes:  $\mu$ , m, k, M, G; such as:  $\mu\text{m}$ , mm, km, Mm, Gm

NOTE regarding "no calculator". I am confident that you can perform complex arithmetic on a calculator, but not by hand on an exam – so you will not be expected to do complex arithmetic. Examinations are meant to test your understanding of concepts and ability to identify and apply appropriate equations, it is not meant to test your advanced arithmetic skills. Therefore, if you encounter a problem that requires long division or multi-digit multiplication, square roots, etc., if you properly set up the equations in variable form, and then insert appropriate quantities in the correct locations in the equation (with units), you will receive full credit – but your answer must be as clear and complete as possible without a calculator, and it must include proper units.

I do expect all engineering students to be able to multiply and divide by 2's, 3's, 5's and 10's, 100's, 1000's, etc. and their reciprocals.

Last year's exam is provided to give you a sense of the complexity of questions to expect.