Practice ME Comprehensive Exam
Fall Semester (ME481)

The questions provided below are similar in scope to those on the Mechanical Engineering Comprehensive Exam. On the exam there will be a total of 25 questions, five in each of these subjects: statics, dynamics, materials science, manufacturing, and strength of materials. Practice questions for materials science and manufacturing are not provided here. The exam is open book and open notes.

Statics and dynamics:
1. The machine shown below consists of 6 elements – the weight, the rope from the weight that attaches at B, the pulley at A, and members AE, CG, and DF. All connections are pinned. Which single answer is true?
   a) Members DF and CG are two-force members
   b) Members DF and CG are either 2-force member(s) or zero-force member(s)
   c) Member DF is a two-force member
   d) Member DF is a zero force member
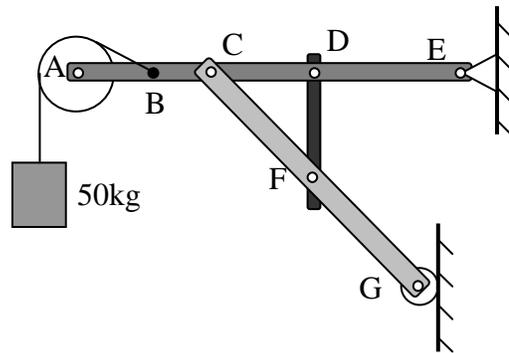
2. The system below is in static equilibrium. The crate weighs 220 lbs. What is the horizontal force necessary to maintain an angle of θ = 45°?
   a) 0 lbs
   b) 156 lbs
   c) 220 lbs
   d) 311 lbs
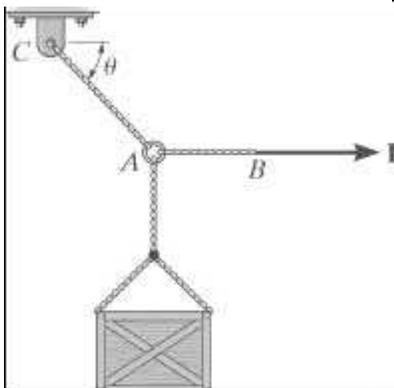
3. A 3 m tall ladder resting against a wall begins to slip. At the instant shown in the figure, the velocity of end A is 6 m/s in the direction indicated by the arrow. What is the angular velocity of the ladder?
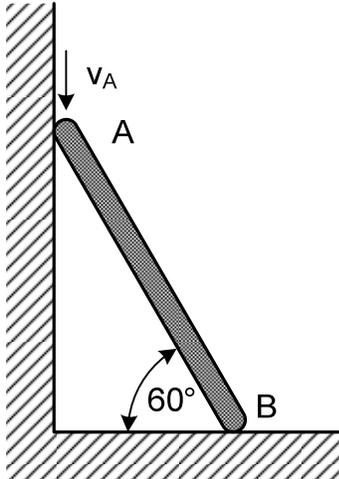
a. 1.7 rad/s
b. 1.3 rad/s
c. 1.4 rad/s
d. 4 rad/s
e. none of the above

4. A "punk kid" stomps on the gas as he is leaving a parking lot to impress his friends. His rear wheel drive 1970's compact pickup has a weight of 2500 lb. Assuming the tires don't slip, what is the maximum acceleration of his pickup such that the front wheels do not leave the ground? Ignore the inertia of the wheels.
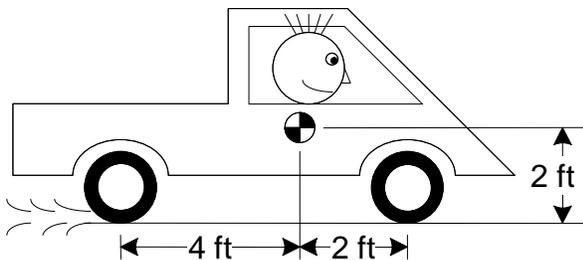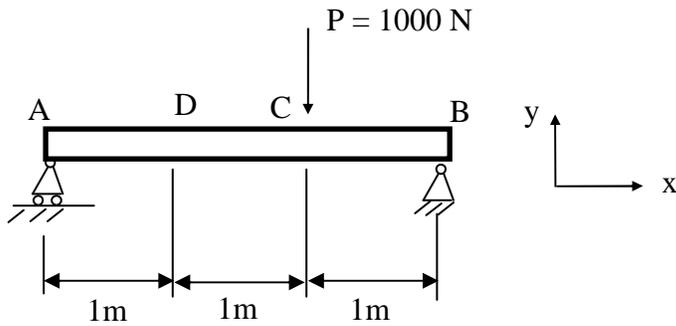
a. 32.2 ft/s^2
b. 64.4 ft/s^2
c. 16.1 ft/s^2
d. 2.0 ft/s^2
e. none of the above

Answers statics and dynamics:
   c. DF is a two-force member; c. 220 lbs; d. 4 rad/s; b. 64.4 ft/s^2

Strength of Materials

P = 1000 N

A   D   C   B   y

                            x

1m   1m   1m
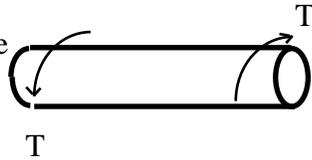
1) What is the shear force at D in the beam shown above?
   a) 333 N
   b) 500 N
   c) 1000 N
   d) 2000 N

2) A cylindrical solid steel shaft has a 3 inch diameter. There is a torsion load applied. If the torsion load (T) is 20,000 in-lb, what is the maximum shear stress in the bar?
   E=30Mpsi, $\nu = 0.32$
   a) 1000 psi
   b) 3770 psi
   c) 7550 psi
   d) 12.7 ksi

T

T

Strength of materials answers: a, b