

MEEN 2210 Electromechanical Engineering Systems Spring 2011

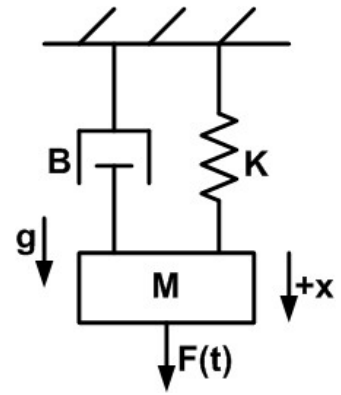
Class Quiz #7 Class Period # 18 March 28, 2011

Name: \_\_\_\_\_ Section: \_\_\_\_\_

True – False Questions: If the statement is true, state why it is true; if the statement is false, state why it is false and correct it.

1. (5 points) **T/F** A rigid body moving at a constant velocity will require less force to bring to a state of rest in a specified time if its mass is large.
  
  
  
  
  
  
  
  
  
  
2. (10 points) Name the two types of forces that are encountered in typical engineering situations. Give an example of each type of force.
  
  
  
  
  
  
  
  
  
  
3. (5 points) Could an airplane ever be treated as a particle? Explain.
  
  
  
  
  
  
  
  
  
  
4. (10 points) State the definition of the number of degrees of freedom of a mechanical system.
  
  
  
  
  
  
  
  
  
  
5. (5 points) **T/F** The degrees of freedom of a mechanical system changes depending on the coordinates chosen to describe its motion.

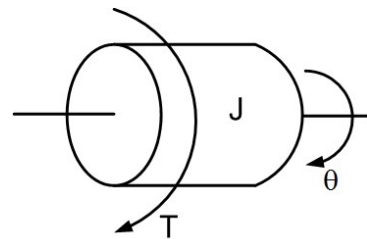
6. (10 points) Refer to the one-degree-of-freedom physical model shown. What do  $K$ ,  $B$ , and  $M$  represent and why are they so important in the study of mechanical systems?



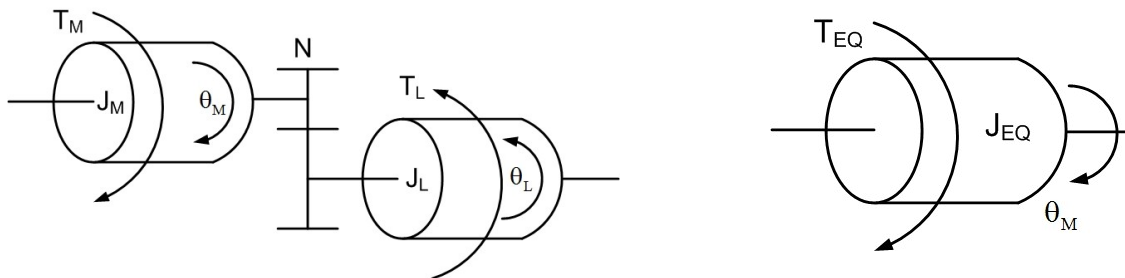
7. (10 points) State the steps in drawing a Free Body Diagram (FBD) and apply those steps to the physical model in question #6.

8. (10 points) Apply the appropriate law of nature to the FBD in question #7 and obtain the mathematical model, i.e., the equation of motion, for that physical model. State the Law of Nature used and explain why the choice of where  $x$  is measured from matters.

9. (10 points) Refer to the physical model shown which consists of a rotational inertia  $J$  mounted on a fixed axis through the geometric center of its face and parallel to its sides. A torque  $T$  about this axis is applied to the inertia. There are no other torques about this axis. State the law of nature that applies here and write the mathematical model, i.e., differential equation of motion, for this physical model.



10. (10 points) If someone were to show you a rigid body and ask you what the mass moment of inertia was for that rigid body, how would you respond? What does the mass moment of inertia represent physically?
11. (5 points) **T/F** If two rigid bodies have the same shape, the same total mass, and the same location for the center of mass, then they must have the same mass moment of inertia with respect to the same axis through the center of mass.
12. (10 points) Shown on the left below are two rotational inertias on fixed axes with externally-applied torques. They are connected by an ideal gear train with  $N = \omega_M/\omega_L$ . This system has one degree of freedom. Explain why. This system can be represented by an equivalent rotational system shown below on the right. What are  $T_{EQ}$  and  $J_{EQ}$  in terms of the parameters of the system on the left?



Bonus Question (10 points) In the video shown, explain what the person is doing and why what he is doing represents an important observation about a law of nature.