ESE 406/505 & MEAM 513 – 2012-Jan-25 – Quiz – Name:_________________

- Choose only one answer (A through D) for each question by circling the letter.
- A correct answer is worth 2 points.
- No answer is worth 0 points.
- An incorrect answer is worth -1 point. Random guessing will lower your grade on average.

1. Which of the following is correct concerning the equation $\frac{d^2y}{dt^2} + 2\zeta\omega_n \frac{dy}{dt} + \omega_n^2 y = \omega_n^2 u$?
   - A. ω_n is the natural frequency.
   - B. ζ is the complementary frequency.
   - C. All of the other answers are correct.
   - D. The equation is non-linear because ω_n is squared.

2. Which of the following is a correct statement about the equation $M = I\frac{d^2\theta}{dt^2}$?
   - A. M is the moment about an arbitrary point on the body.
   - B. I is the electrical current flowing through the body.
   - C. $\frac{d^2\theta}{dt^2}$ is the angular acceleration of the body.
   - D. The equation applies to each axis of a body undergoing arbitrary 3-dimensional rotational motion.

3. Which of the following is NOT a correct explanation of an equation we used in our description of a DC motor?
   - A. The back-EMF, due to Faraday's Law, is proportional to angular speed of the motor: $\varepsilon = K\Omega$.
   - B. Due to the Lorenz forces inside the motor, the motor torque is proportional to current: $Q = Ki$.
   - C. The motor torque and external torque balance the gyroscopic torque of precession inside the motor: $2J\Omega^2 = Q - Q_{EXT}$.
   - D. The voltage applied to the motor is balanced by back-EMF (ε) plus the voltage due to coil resistance and inductance: $e = \varepsilon + Ri + L\frac{di}{dt}$.

4. Which of the following is correct concerning the equation $\frac{d^2\vec{r}}{dt^2} = \frac{1}{m}\vec{F}\left(\vec{r}, \frac{d\vec{r}}{dt}\right)$?
   - A. It is a Fredholm equation of the second kind.
   - B. It is a vector version of Newton's second law, F=ma.
   - C. All of the other answers are correct.
   - D. It only applies to weak electro-magnetic fields.

5. In the figure at right, if the charge on the capacitor is $q(t) = \int^{t} i(t)dt$,

   then the voltage drop across the capacitor is given by...
   - A. None of the other answers.
   - B. $C\frac{di}{dt}$
   - C. $RCq(t)$
   - D. $\frac{1}{C}q(t)$