

	<b>Alexandria Higher Institute of Engineering &amp; Technology (AIET)</b>		
	Department of: Mechatronics	Fourth Year	4th Year
	EME403	Dynamic System Analysis	Midterm-of-Semester-1 Exam, Dec., 1, 2014
	Examiners:	Dr. Rola Afify and committee	Time: 1.5 hour

**Answer the following questions:**

**Question one: (7 marks)**

- A) Define: Modeling, Response, External disturbance, and Initial conditions.
- B) Prove that the solution of the first order differential equation using step input  $u(t) = u_o$  will be in this form  $x(t) = x_o e^{-t/\tau} + Gu_o [1 - e^{-t/\tau}]$

**Question Two: (6 marks)**

- A) Determine the time constant, response variable, external input and Gain for this differential equation  $LDi_L + Ri_L = e_o$ , if  $L = 6\text{mh}$  and  $R = 100\Omega$ .
- B) Determine response variable, external input, natural frequency, damping ratio and Gain for this differential equation  $LCD^2e_2 + RCDe_2 + e_2 = e_o$ , if  $L = 1\text{mh}$ ,  $C = 10\mu\text{F}$  and  $R = 14\Omega$ .

**Question Three: (7 marks)**

Develop, using neat sketches, an equation describing the motion of each of the following:-

- a) A 500 kg mass is mounted on a spring of stiffness  $2.5 \times 10^3 \text{ N/m}$ .
- b) The left end of the shaft is fixed and the disk on the right end has a torque of 2 N.m applied to it. Assume that the shaft inertia is very small in comparison to that of the disk. Given that the inertia of disk ( $J = 0.5 \text{ kg.m}^2$ ) and torsional spring constant ( $k_t = 20 \text{ N.m}$ ).

