MCG 3301
CONTROL SYSTEMS I

Quiz # 1 — Time 1h 30 min
09 Oct 2007 — Prof. D. Necsulescu

Closed book. | Calculators permitted | All 4 problems of equal value.

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1) Obtain the inverse Laplace transform of

$$F(s) = \frac{4}{s(2s^2+8)} + \frac{18}{2s^2+10s+8}$$

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2) Using the Laplace transform method, solve the following differential equation

$$4\cdot\ddot{y} + 8\cdot\dot{y} + 20\cdot y = 12\cdot u(t) \qquad \dot{y}(0) = 0 \qquad y(0) = 0$$

where u(t) is unit step function.

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3) For the complex function

$$F(s) = \frac{1}{s^2 + b\,s + 17}$$

a) which of the following values result in complex poles: b= 2 or b=10?
b) For the value of b that results in complex poles, obtain the inverse Laplace transform.

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4) For the mechanical system shown below F(t) is the external force applied. For the case of no friction between the mass m and the ground, at the moment of application of the force F, its point of application has zero initial conditions, while initial conditions are

$$x(0) = 0.1 \ \text{[m]} \qquad \dot{x}(0) = 0.01 \ \text{[m/s]}$$

a) Obtain X(s) for a impulse force input of amplitude 3[N], F=3δ(t), and m=1 [Kg], k=4[N/m]
b) What is the natural frequency of oscillation in Hz?
c) Calculate steady state value of x(t) using final value theorem.