NAME: _____ **ROLL #:** _____

ChE381 Process Dynamics & Control **Jan-Apr 2013**

Quiz 1 Paper **A** **45 minutes; 20 points**

• Fill your name and roll no. above.
• Circle the correct answer among the four choices given.
• 2 marks for a correct answer. *Negative marking*: One point will be deducted per wrong answer.

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1. In the case of feed-forward control, which of the following is **NOT TRUE**:

   1. It is insensitive to modelling errors.
   2. Cannot cope with unmeasured disturbances.
   3. It waits until the effect of disturbance has been felt by the system before control action is taken.
   4. Requires good knowledge of the process model.
   5. Requires identification of all possible disturbances and their measurement.

   (a) 1 and 4 (b) 1 and 3 (c) 2 and 5 (d) 3 and 4 (e) 3 and 5

2. The inverse Laplace transform of the function $f(s) = \frac{1}{s(1+s)}$ is:
   (a) $1+\exp[t]$ (b) $1-\exp[t]$ (c) $1+\exp[-t]$ (d) $1-\exp[-t]$ (e) $-1+\exp[-t]$

3. The following ODE can be classified as:

$$\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + \sin(x)\frac{\mathrm{d}y}{\mathrm{d}x} + y\exp[x] = \sinh(x)$$

   (a) first order and linear
   (b) first order and nonlinear
   (c) second order and linear
   (d) second order and nonlinear

4. The unit-step response of a first-order system with steady-state gain K and time constant τ is:
   (a) $K(1-\exp[-t/\tau])$ (b) $K(1+\exp[-t/\tau])$ (c) $K(1-\exp[-2t/\tau])$ (d) $K\exp[-t/\tau]$

5. The unit impulse response of a first-order process is $2\exp[-0.5t]$. The gain and time constant of the process are, respectively:
   (a) 4 and 2 (b) 2 and 2 (c) 2 and 0.5 (d) 1 and 0.5

6. A unit-step input is given to a process that is described by the transfer function $(s+2)/(s+5)$. The initial value (at $t = 0^+$) of the response of the process to the step-input is:
(a) 0 (b) 2/5 (c) 1 (d) ∞

7. The inverse Laplace transform of the following function of s is:

$$\frac{1}{2s^2+3s+1}$$

(a) $\exp[-t/2]-\exp[-t]$ (b) $2\exp[-t/2]-\exp[-t]$
(c) $\exp[-t]-2\exp[-t/2]$ (d) $\exp[-t]-\exp[-t/2]$

8. The inverse Laplace transform of the following function is:

$$\frac{s}{(s-2)(s^2+4)}$$

(a) $\frac{1}{4}(\exp[-2t]+\cos[2t]-\sin[2t])$

(b) $\frac{1}{2}(\exp[2t]-\cos[2t]+\sin[2t])$

(c) $\frac{1}{2}(\exp[-2t]+\cos[2t]-\sin[2t])$

(d) $\frac{1}{4}(\exp[2t]-\cos[2t]+\sin[2t])$

9. The steady-state gain of a process described by the transfer function (given below) is:

$$G(s) = \frac{3(s+2)}{s^2+2s+3}$$

(a) 3/2 (b) 0 (c) 1/2 (d) 2

10. The inverse Laplace transform of $\exp[-4s]/(s+8)$ is given by (with $\Theta(t)$ being the unit step function):

(a) $\exp[-4(t-4)]\Theta(t-4)$
(b) $\exp[-8(t-4)]\Theta(t-4)$
(c) $\exp[-8(t-4)]\Theta(t+4)$
(d) $\exp[-4(t-4)]\Theta(t+4)$