KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE380 [091] sec # _____		quiz # 2
Name:_____	ID:_____	Grade:_____

Solve the following initial value problem using the Laplace transform

$$\ddot{y}(t) + 4\dot{y}(t) + 3y(t) = 3 \quad \text{—(1)}$$
$$y(0) = 1 \quad \dot{y}(0) = 0$$

Verify your result by finding the solution using the method of EE 205 (time domain method) Taking L.T. of (1)

$$\left(s^2 Y(s) - sy(0) - \dot{y}(0)\right) + 4\left(sY(s) - y(0)\right) + 3Y(s) = \frac{3}{s}$$

Substituting Initial Conditions $\Rightarrow (s^2 + 4s + 3)Y(s) = \frac{3}{s} + s + 4$

$$\therefore (s^2 + 4s + 3)Y(s) = \frac{s^2 + 4s + 3}{s} \Rightarrow Y(s) = \frac{1}{s} \Rightarrow \boxed{y(t) = 1}$$

Time domain method:

$y_f = 1$ forced response

Ch. Eqn: $s^2 + 4s + 3 = 0 \Rightarrow$ roots are $-1, -3$

$y_n(t) = A_1 e^{-t} + A_2 e^{-3t}$ natural response

$y(t) = y_f + y_n = 1 + A_1 e^{-t} + A_2 e^{-3t}$

$\dot{y}(0) = -A_1 - 3A_2 = 0 \quad \text{—(*)}$

$y(0) = 1 + A_1 + A_2 = 1 \Rightarrow A_1 + A_2 = 0 \quad (**)$

Solving (*) & (**) $\Rightarrow A_1 = A_2 = 0$

$\therefore \boxed{y(t) = 1}$ same as before