DAVID OCHOECHI DANIEL
16/ENG02/012.
COMPUTER ENGINEERING.

$$\frac{d^2y}{dx^2} + 5\frac{dx}{dt} + 6x = \cos t.$$

$m^2 + 5m + 6 = 0$
$(m^2 + 3m) + (2m + 6) = 0$
$m(m+3) + 2(m+3) = 0$
$(m+2)(m+3) = 0$
$m = -2$ or $m = -3$.
$C.F = Ae^{-2t} + Be^{-3t}$.
$x = C\cos t + D\sin t$.
$dx/dt = -C\sin t + D\cos t$.
$d^2x/dt^2 = -\cos t - D\sin t$.

$-(\cos t - D\sin t + 5(-C\sin t + D\cos t) + 6(\cos t + D\sin t) =$
$-(\cos t - D\sin t - 5(\sin t + 5D\cos t + 6\cos t + 6D\sin t) \cdot \cos$
$(-C + 5D + 6C)\cos t + (-D - 5C + 6D)\sin t = \cos t.$
$-C + 5D + 6C = 1$
$5C + 5D = 0$.
$-D - 5C + 6D = 0$.
$10C = 1$
$C = 1/10 = 0.1$

$5(t) + 5D = 1$
$1/2 + 5D = 1$.
$5D = 1 - 1/2$
$5D = 1/2$.
$D = 1/10$
$G.S = y = C.F + P.I$
$= Ae^{-2t} + Be^{-3t} + 1/10\cos t + 1/10\sin t$.

ii) Write a mat lab program to plot the relationship x if the

Solution:
- Command window
- Clear.
- clc
- close all
- Syms x.

$x = 0.1x(\exp(-3t) - \exp(-2nt) + (\cos t) + \sin$

tn = (0.001:15)

fn = subs(

Figure 1.
plot (tn, xn).
Axis tight
xlabel (Timi)
ylabel (Ibrahim)

iii) Write the steady solution of the system in

solution

$x = 1/10\,(e^{-3t} - e^{-2t} + \sin t + \cos t)$

steady state $\frac{\partial x}{\partial t} = 0$ i.e.

$\partial x/dt = 1/10\,(-3e^{-3t} - e^{-2t} + \cos t - 3\sin t)$.

; the exponential result shows

$0 = \cos t - \sin t$

$\cos t = \sin t$

$t = 45°$

$= 1/10\,(\cos 45 + \sin 45) = \sqrt{2}/10$

$A\cos t \neq B\sin \omega t = k\cos(\omega t - \theta)$

ii) Write a mat lab program to plot the relationship x if the

Solution:
- Command window
- Clear.
- clc
- close all
- Syms x.

- x = 0.1x(exp(-3t) - exp(-2.1t) + (cost) + sin
tn = (0.001:15)
fn = subs(

Figure 1.
plot (tn, xn).
Axis tight
xlabel (Emi)
ylabel (Ibrahim)

iii) Write the steady solution of the system in

solution
$x = 1/10 (e^{-3t} - e^{-2t} + \sin t + \cos t)$.
steady state $\frac{\partial x}{\partial t} = 0$ i.e.
$\partial x/dt = 1/10 (-3e^{-3t} - e^{-2t} + \cos t - 3\sin t)$.
; the exponential result shows
$0 = \cos t - \sin t$
$\cos t = \sin t$
$t = 45°$
$= 1/10 (\cos 45 + \sin 45) = \sqrt{2}/10$
$A\cos t + B\sin \omega t = k\cos(\omega t - \theta)$

But ; $\cos(\omega t - \theta) = \sin(\omega t - \theta + 90°)$.

where $k = \sqrt{A^2 + B^2}$

$= \sqrt{1/10^2 + 1/10^2} = \sqrt{2}/10$

$\theta = 0^2$.

Recall $x = k\sin(t + a)$

$\frac{\sqrt{2}}{10} - \frac{\sqrt{2}}{10} \quad \sin(45 + a)$

$a = 90 - 45 = 45^0$.

Steady state equation

$x = \frac{\sqrt{2}}{10}(\sin t + x/4)$