EMCF Quiz 7 Due February 28 at 11:59 PM

1. An object in simple harmonic motion has period $\frac{1}{4}\pi$. At time $t = 0$, $y(0) = 3$, $y'(0) = 0$. The equation of motion is:

   (a) $y = 3\sin\left(6t + \frac{1}{2}\pi\right)$
   (b) $y = 2\sin\left(8t + \frac{1}{4}\pi\right)$
   (c) $y = 3\sin\left(8t + \frac{1}{2}\pi\right)$
   (d) $y = 4\sin\left(4t + \frac{1}{4}\pi\right)$
   (e) None of the above.

2. An object in simple harmonic motion has period $\frac{1}{2}\pi$. At time $t = 0$, $y(0) = 0$, $y'(0) = 6$. The amplitude of the motion is:

   (a) $A = 3$
   (b) $A = 4$
   (c) $A = \frac{3}{2}$
   (d) $A = \frac{2}{3}$
   (e) None of the above.

3. $y'' + 6y' + 10y = 3\cos\, 2t$ is the mathematical model for a vibrating system. The transient solution is:

   (a) $y = C_1e^{3t}\cos\, t + C_2e^{3t}\sin\, t$
   (b) $y = C_1e^{-3t}\cos\, t + C_2e^{-3t}\sin\, t + \frac{1}{10}\cos\, 2t + \frac{1}{5}\sin 2t$
   (c) $y = \frac{1}{10}\cos\, 2t + \frac{1}{5}\sin 2t$
   (d) $y = C_1e^{-3t}\cos\, t + C_2e^{-3t}\sin\, t$
   (e) None of the above.

4. $y'' + 4y' + 8y = 10\cos\, 2t$ is the mathematical model for a vibrating system. The steady state solution is:

   (a) $z = C_1e^{-2t}\cos\, 2t + C_2e^{-2t}\sin\, 2t$
   (b) $z = C_1e^{-2t}\cos\, 2t + C_2e^{-2t}\sin\, 2t + \frac{1}{2}\cos\, 2t + \sin\, 2t$
   (c) $z = \frac{1}{2}\cos\, 2t + \sin\, 2t$
   (d) $z = 2\cos\, 2t + 4\sin\, 2t$
   (e) None of the above.

5. The transient solution of the vibrating system

$$y'' + 2y' + 2y = \cos\, 2t, \quad y(0) = 0,\ y'(0) = 3$$

is:

(a) $y = C_1 e^{-t} \cos\, t + C_2 e^{-t} \sin\, t$
(b) $y = C_1 e^{-t} \cos\, t + C_2 e^{-t} \sin - \frac{1}{2} \cos\, 2t + \sin\, 2t$
(c) $y = -\frac{1}{2} \cos\, 2t + \sin\, 2t$
(d) $y = C_1 e^{-t} \cos\, t + C_2 e^{-t} \sin\, t + 2\cos\, 2t + 4\sin\, 2t$
(e) None of the above.

6. The steady-state solution of the vibrating system

$$y'' + 4y' + 8y = 6 + 10e^{2t}, \quad y(0) = 2,\ y'(0) = 1$$

is:

(a) $z = \frac{3}{4} C_1 e^{-2t} \cos\, t - \frac{3}{4} e^{-t} \sin\, t$
(b) $z = \frac{3}{4} C_1 e^{-2t} \cos\, t - \frac{3}{4} e^{-t} \sin\, t + \frac{3}{4} + \frac{1}{2} e^{2t}$
(c) $z = \frac{3}{4} + \frac{1}{2} e^{2t}$
(d) $z = \frac{4}{3} + \frac{1}{2} t e^{2t}$
(e) None of the above.

7. The general solution of $y^{(4)} + 5y'' - 36y = 0$ is:

(a) $y = C_1 \cos\, 3x + C_2 \sin\, 3x + C_3 e^{2x} + C_4 e^{-2x}$
(b) $y = C_1 \cos\, 3x + C_2 \sin\, 3x + C_3 \cos\, 2x + C_4 \sin\, 2x$
(c) $y = C_1 \cos\, 2x + C_2 \sin\, 2x + C_3 e^{3x} + C_4 e^{-3x}$
(d) $y = C_1 \cos\, 2x + C_2 \sin\, 2x + C_3 e^{3x} + C_4 x e^{3x}$
(e) None of the above.

8. The general solution of $y^{(4)} - y''' - 3y'' + 17y' - 30y = 0$ is:

(a) $y = C_1 \cos\, 3x + C_2 \sin\, 3x + C_3 e^{-3x} + C_4 e^{2x}$
(b) $y = C_1 e^{x} \cos\, 2x + C_2 e^{x} \sin\, 2x + C_3 e^{-3x} + C_4 e^{2x}$
(c) $y = C_1 \cos\, 2x + C_2 \sin\, 2x + C_3 e^{-3x} + C_4 e^{2x}$
(d) $y = C_1 e^{x} \cos\, 2x + C_2 e^{x} \sin\, 2x + C_3 e^{3x} + C_4 e^{-2x}$
(e) None of the above.

9. The general solution of $y''' - y'' - 8y' + 12y = 0$ is:

   (a) $y = C_1e^{-2x} + C_2xe^{-2x} + C_3e^{-3x}$
   (b) $y = C_1e^{-3x} + C_2e^{2x} + C_3xe^{2x}$
   (c) $y = C_1e^{2x} + C_2xe^{2x} + C_3e^{3x}$
   (d) $y = C_1e^{3x} + C_2e^{-2x} + C_3xe^{-2x}$
   (e) None of the above.

10. The order of the linear, constant coefficient, homogeneous equation of least order that has

$$y = 4e^{2x} - 5e^{3x} + 4\cos\, 2x + 5$$

    as a solution is:

   (a) 4
   (b) 5
   (c) 6
   (d) 7
   (e) None of the above.

11. The linear, constant coefficient, homogeneous equation of least order that has

$$y = 2\cos 2x + e^{-2x} + e^{2x} + 2$$

    as a solution is:

   (a) $y^{(5)} + 16y' = 0$
   (b) $y^{(4)} - 16y = 0$
   (c) $y^{(5)} - 16y' = 0$
   (d) $y''' - 16y = 0$
   (e) None of the above.

12. The linear, constant coefficient, homogeneous equation of least order that has

$$y = 3\sin\, 2x - 3xe^{-x}$$

    as a solution is:

   (a) $y^{(4)} + 2y''' + 5y'' + 8y' + 4y = 0$
   (b) $y^{(4)} + 2y''' + 6y'' + 8y' + 4y = 0$
   (c) $y^{(5)} + 2y''' + 5y' + 4y = 0$
   (d) $y^{(4)} + 2y''' + 5y'' + 4y' = 0$
   (e) None of the above.