

PRINT YOUR NAME HERE:

HONOR CODE PLEDGE: "I have neither given nor received aid on this exam, nor have I concealed any violations of the honor code." Closed book; 2 sides of 8.5×11 "cheat sheet."

SIGN YOUR NAME HERE:

20 multiple-choice questions, worth 5 points each, for a total of 100 points. **LECTURE** Write your answer to each question in the space to the right of that question. **SESSION** Do NOT write your answers on a separate sheet of paper or in a blue book. NOTE: Problems vary in difficulty. Some problems are harder than others.

$$\sin \frac{\pi}{6} = \cos \frac{\pi}{3} = \frac{1}{2}; \quad \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}; \quad \sin \frac{\pi}{3} = \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}; \quad \sin \frac{\pi}{2} = \cos(0) = 1.$$

$$\text{For \#1-\#3 let } x(t) = \begin{cases} -2 & \text{for } 3 \leq t \leq 6; \\ 0 & \text{for otherwise} \end{cases}.$$

1. The mean of $x(t)$ is: (a) 0 (b) -1 (c) -2 (d) -4.5 (e) -9

2. The rms value of $x(t)$ is: (a) 1 (b) -1 (c) 2 (d) -2 (e) $\sqrt{2}$

3. The support of $x(3t - 3)$ is interval: (a) [0,1] (b) [1,2] (c) [2,3] (d) [3,6] (e) [4,7]

4. The correlation between $\cos(\frac{\pi}{5}t)$ and $\cos(\frac{\pi}{6}t)$ is: (a) 0 (b) 1 (c) -1 (d) $\sqrt{2}$ (e) $-\sqrt{2}$

5. The correlation between two signals $x(t)$ and $y(t)$ is 30. The energy of $x(t)$ is 25. If $y(t) = ax(t)$, the energy of $y(t)$ is: (a) 25 (b) 35 (c) 36 (d) 54 (e) Need to know a .

6. The histogram of $\cos(\frac{\pi}{2}n)$ over 1 period is plotted using 10 bins. How many bins have a nonzero number of values in them? (a) 0 (b) 2 (c) 3 (d) 5 (e) 10

7. Fundamental period of $3 \cos(\frac{\pi}{5}t) + 2 \cos(\frac{\pi}{6}t)$ is: (a) $\frac{1}{60}$ (b) $\frac{1}{30}$ (c) 11 (d) 30 (e) 60

$$\text{For \#8-\#10 let } x(t) = \cos(t) + 3 \cos(2t) + 5 \cos(3t).$$

8. The amplitude of the fundamental is: (a) 0 (b) 1 (c) 2 (d) 3 (e) 5

9. The average power of $x(t)$ is: (a) 0 (b) 4.5 (c) 9 (d) 17.5 (e) 35

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10. If $x(t)$ is passed through a **low-pass filter** that passes frequencies below **0.5 Hz** and rejects frequencies above **0.5 Hz**, the result is:
(a) 0 (b) $\cos(t)$ (c) $\cos(t) + 3 \cos(2t)$ (d) $\cos(t) + 3 \cos(2t) + 5 \cos(3t)$

11. $e^{j\pi/3} - \sqrt{3}e^{j\pi/6} =$: (a) $1 - \sqrt{3}$ (b) -1 (c) $e^{j2\pi/3}$ (d) $\sqrt{2}e^{-j\pi/6}$ (e) 0

12. If $(3 + j3)^{10} = Me^{j\theta}$ in polar form, then $\theta =$: (a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) $\frac{3\pi}{4}$ (e) π

13. $Re[(1 + j)e^{j3\pi/4}] =$: (a) 0 (b) $-\sqrt{2}$ (c) $\sqrt{2}/2$ (d) $\sqrt{3}/2$ (e) $-\sqrt{3}/2$

14. $Ae^{j\pi/4} + e^{-j\pi/3}$ is real for $A =$: (a) 0 (b) $1/\sqrt{2}$ (c) 1 (d) $\sqrt{2}$ (e) $\sqrt{6}/2$

15. The amplitude of $3 \cos(t + \frac{\pi}{3}) + 4 \cos(t - \frac{\pi}{6})$ is: (a) 0 (b) 1 (c) $\sqrt{2}$ (d) 5 (e) 7

16. $3 \cos(t + 20^\circ) + 4 \cos(t + 140^\circ) + 3 \cos(t - 100^\circ) =$:
(a) 0 (b) $\cos(t - 220^\circ)$ (c) $3 \cos(t + 140^\circ)$ (d) $3\sqrt{3} \cos(t)$ (e) $10 \cos(t)$

17. $5 \cos(t + \frac{\pi}{3}) + 4 \cos(t - \frac{\pi}{4}) =$:
(a) $6 \cos(t - 0.13)$ (b) $5.54 \cos(t + 0.27)$ (c) $9 \cos(t + \frac{\pi}{12})$ (d) $\cos(t)$ (e) $3.32 \cos(t + \frac{\pi}{6})$

18. $\sqrt{3} \cos(t + \frac{\pi}{3}) + \cos(t + \theta) = A \sin(t)$ for $\theta =$: (a) 0 (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$ (e) $\frac{5\pi}{6}$
Here A is a constant; you don't have to know what A is to solve this problem.

19. Line spectrum of $3 + 4 \cos(2t - 1)$ at $\omega = -2$: (a) 0 (b) $2e^j$ (c) $2e^{-j}$ (d) $4e^j$ (e) $4e^{-j}$

20. The line spectrum of $\cos(2t) \cos(3t)$ has how many non-zero components?
(a) 2 (b) 4 (c) 6 (d) 8 (e) No line spectrum

DID YOU REMEMBER TO SIGN THE HONOR PLEDGE?
