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:

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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: No partial credit if an error on one problem leads to an error on another problem.
NOTE: Multiple-choice problems vary in difficulty. Some problems are harder than others.
NOTE: Don't spend too much time on any one problem! If trouble, go on to another one.

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

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1. $2e^{j\pi/3} - \sqrt{6}e^{j\pi/4} =$: **(a)** $1 - \sqrt{3}$ **(b)** $j\sqrt{2}$ **(c)** $e^{j2\pi/3}$ **(d)** $\sqrt{2}e^{-j\pi/6}$ **(e)** 0

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2. The **Phase** of $(4 - 3j) + 13e^{j1.176}$ is: **(a)** $-.643$ **(b)** 0 **(c)** $.533$ **(d)** $\frac{\pi}{4}$ **(e)** $\frac{\pi}{2}$

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

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4. $(\sqrt{3} + j)^{-3} =$: **(a)** 0 **(b)** $-\frac{\sqrt{2}}{2} - \frac{\sqrt{6}}{2}$ **(c)** $-\frac{\sqrt{2}}{2} - j\frac{\sqrt{6}}{2}$ **(d)** $-\frac{j}{8}$ **(e)** $e^{-j\pi/6}$

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5. $\cos(t + \frac{\pi}{3}) + \sqrt{3}\cos(t - \frac{\pi}{6}) =$:
(a) 0 **(b)** $\sqrt{2}\cos(t + \frac{\pi}{2})$ **(c)** $2\cos t$ **(d)** $2\sin(t)$ **(e)** $\sqrt{2}\cos(t - \frac{\pi}{2})$

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6. $2\cos(7t + \pi/6) + 2\cos(7t + 5\pi/6) + 3\sin(7t) =$:
(a) $2\cos(7t + \pi/3)$ **(b)** $2\sqrt{3}\cos(7t)$ **(c)** $\cos(7t)$ **(d)** $\sin(7t)$ **(e)** 0

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7. $2\cos(t + \frac{\pi}{3}) + A\cos(t + \frac{5\pi}{4}) = B\cos t$ for $A =$: **(a)** 1 **(b)** $\frac{\sqrt{2}}{2}$ **(c)** $\sqrt{2}$ **(d)** $\sqrt{3}$ **(e)** $\sqrt{6}$
Here B is a constant; you don't have to know what B is to solve this problem.

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8. 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

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For #9-#12 let $x(t) = \begin{cases} t & \text{for } 0 < t < 2; \\ 0 & \text{for otherwise} \end{cases}$.

9. The **mean value** of $x(t)$ is: **(a)** 0 **(b)** 1/2 **(c)** 1 **(d)** 3/2 **(e)** 2

10. The **mean square** value of $x(t)$ is: **(a)** 0 **(b)** 1/2 **(c)** 1 **(d)** 3/2 **(e)** 4/3

11. The correlation $C(x, x^2)$ of $x(t)$ with $x(t)^2$ is:**(a)** 1 **(b)** 2 **(c)** 4 **(d)** 8 **(e)** 16

12. The **support** of $y(t) = 3x(2t-1)$ is:
(a) $\frac{1}{2} < t < \frac{3}{2}$ **(b)** $0 < t < 1$ **(c)** $0 < t < 2$ **(d)** $1 < t < 2$ **(e)** $-\frac{1}{2} < t < \frac{1}{2}$

For #13-#16: Let $x(t) = (3 - j4)e^{-j2t} + (1 + j)e^{-jt} + (1 - j)e^{jt} + (3 + j4)e^{j2t}$.

13. The average power of $x(t)$ is: **(a)** 0 **(b)** $5 + \sqrt{2}$ **(c)** $10 + 2\sqrt{2}$ **(d)** 27 **(e)** 54

14. The sinusoidal component at $\omega = 1$ is:
(a) $\sqrt{2}\cos(t + \frac{\pi}{4})$ **(b)** $\sqrt{2}\cos(t - \frac{\pi}{4})$ **(c)** $2\sqrt{2}\cos(t + \frac{\pi}{4})$ **(d)** $2\sqrt{2}\cos(t - \frac{\pi}{4})$ **(e)** 0

15. If $x(t)$ is passed through a **high-pass filter** that passes frequencies **above 1 Hz** and rejects frequencies **below 1 Hz**, the result is:
(a) $\sqrt{2}\cos(t + \frac{\pi}{4})$ **(b)** $\sqrt{2}\cos(t - \frac{\pi}{4})$ **(c)** $2\sqrt{2}\cos(t + \frac{\pi}{4})$ **(d)** $2\sqrt{2}\cos(t - \frac{\pi}{4})$ **(e)** 0

16. To sample $x(t)$ so that no aliasing occurs, $T_s <$: **(a)** $\frac{1}{2}$ **(b)** 4 **(c)** 2π **(d)** $\frac{\pi}{2}$ **(e)** $\frac{1}{2\pi}$

17. 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)** $-\sqrt{2}$

18. 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

For #19-#20: $x(t)$ has Fourier series $x(t) = \cos(t) + \frac{1}{2}\cos(2t) + \frac{1}{3}\cos(3t) + \ldots$

19. $x(t)$ is: **(a)** Even **(b)** Odd **(c)** 0-mean **(d)** (a) and (c) **(e)** (b) and (c)

20. $\int_{-\pi}^{\pi} x(t)\cos(3t)dt =$: **(a)** 0 **(b)** 1/3 **(c)** $\frac{\pi}{6}$ **(d)** $\frac{\pi}{3}$ **(e)** $\frac{2\pi}{3}$

DID YOU REMEMBER TO SIGN THE HONOR PLEDGE?