

**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  $8.5 \times 11$  "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.

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

1.  $22e^{j5\pi/3} + 14e^{j5\pi/4} =$ :  
 (a)  $9.2e^{j1.45}$  (b)  $9.2e^{-j1.45}$  (c)  $29e^{j1.53}$  (d)  $29e^{-j1.53}$  (e)  $35.5e^{-j0.95}$

2. The **Magnitude** of  $\frac{3+j4}{5+j12} =$ : (a)  $\frac{5}{13}$  (b) 2.6 (c) 13 (d) 26 (e) 65

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

4.  $Re[(\sqrt{3} - j)7e^{-j\theta}] = 0$  for  $\theta =$ : (a)  $\frac{\pi}{6}$  (b)  $\frac{\pi}{4}$  (c)  $\frac{\pi}{3}$  (d)  $\frac{\pi}{2}$  (e)  $\frac{2\pi}{3}$

5.  $13 \cos(7t + 1.176) + 5 \cos(7t - 0.643) =$ : (a)  $9.05 \cos(7t + 1.46)$  (b)  $9.05 \cos(7t - 1.46)$   
 (c)  $9\sqrt{2} \cos(7t + \frac{\pi}{4})$  (d)  $17.5 \cos(7t + 1.63)$  (e)  $17.5 \cos(7t - 1.63)$

6.  $6 \cos(7t + \frac{7\pi}{6}) - 3 \sin(7t) + A \cos(7t) = 0$  for  $A =$ :  
 (a) 1 (b)  $2\sqrt{2}$  (c)  $3\sqrt{3}$  (d) 8 (e) No value of  $A$

7. The amplitude of  $5 \cos(7t + 0.927) + A \sin(7t)$  is 3 for  $A =$ :  
 (a) 0 (b)  $\sqrt{2}$  (c) 2 (d) 4 (e) Many values of  $A$

8. If  $x(t)$  has support  $[3, 7]$  then  $y(t) = 3x(4t - 5)$  has support:  
 (a)  $[-2, 2]$  (b)  $[2, 3]$  (c)  $[-8, 8]$  (d)  $[8, 12]$  (e)  $[32, 48]$

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**For #9-#12:**  $x(t)$  has a line spectrum with components at these frequencies:  
 $6e^{j^2}$  at  $\omega = -5$ ;  $4e^{-j}$  at  $\omega = -3$ ;  $4e^j$  at  $\omega = 3$ ;  $6e^{-j^2}$  at  $\omega = 5$ .

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9. The average power of  $x(t)$  is: (a) 0 (b) 20 (c) 52 (d) 104 (e) 208

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10. The fundamental period of  $x(t)$  is: (a)  $\frac{1}{15}$  (b)  $\frac{2\pi}{15}$  (c) 1 (d)  $2\pi$  (e) 15

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11.  $x(t) =$ : (a)  $2 \cos(3t + 1) + 3 \cos(5t - 2)$  (b)  $2 \cos(3t - 1) + 3 \cos(5t + 2)$  (c)  $4 \cos(3t + 1) + 6 \cos(5t - 2)$  (d)  $8 \cos(3t - 1) + 12 \cos(5t + 2)$  (e)  $8 \cos(3t + 1) + 12 \cos(5t - 2)$

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12. 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) 0 (b)  $3 \cos(5t + 2)$  (c)  $3 \cos(5t - 2)$  (d)  $12 \cos(5t + 2)$  (e)  $12 \cos(5t - 2)$

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**For #13-#16:**  $x(t)$  has Fourier series  $x(t) = \cos(t) + \frac{1}{2} \cos(2t) + \frac{1}{3} \cos(3t) + \dots$

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13. The fundamental period of  $x(t)$  is: (a)  $\frac{1}{2\pi}$  (b)  $\frac{1}{\pi}$  (c) 1 (d)  $\pi$  (e)  $2\pi$

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

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

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16.  $C(x(t), \sin(3t)) =$ : (a) 0 (b)  $1/3$  (c)  $\frac{\pi}{6}$  (d)  $\frac{\pi}{3}$  (e)  $\frac{2\pi}{3}$

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**For #17-#20:**  $x[n] = n^2$  for  $n = 0, 1, 2, 3, 4$ ;  $x[n] = 0$  otherwise.

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17.  $M(x) =$ : (a) 0 (b) 1 (c) 2 (d) 6 (e) 10

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18. Energy =: (a) 0 (b) 30 (c) 34.8 (d) 70.8 (e) 354

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19. Variance =: (a) 0 (b) 30 (c) 34.8 (d) 70.8 (e) 354

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20. A histogram of  $x[n]$  with 3 bins of equal width is drawn.  
The height of the first bin is: (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

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**DID YOU REMEMBER TO SIGN THE HONOR PLEDGE?**

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