

1) Mathematics Review

$$a) \int_0^{\infty} e^{-t} dt = 1$$

$$b) \int_1^{\infty} e^{-t} dt = \frac{1}{e}$$

$$c) \int_{-1}^{\infty} e^{-t} dt = e$$

$$d) \int_{-\infty}^{\infty} e^{-2|t|} dt = 1$$

$$e) \int_0^{\infty} t e^{-t} dt = 1$$

$$f) \int_0^{\infty} e^{-\beta t} dt = \left\{ \frac{1}{\beta}, \text{ if } \beta > 0, \text{ DNE, if } \beta \leq 0 \right\}$$

For this integral to converge, the exponential term $e^{-\beta t}$ must decay to 0 as $t \rightarrow \infty$. This happens when $\beta > 0$. If $\beta \leq 0$, the exponential term either remains constant ($\beta = 0$) or grows unbounded ($\beta < 0$), causing the integral to diverge.

$$g) 4 + 4j = 4\sqrt{2}(\cos \frac{\pi}{4} + j \sin \frac{\pi}{4}) = (4\sqrt{2}, \frac{\pi}{4})$$

$$h) (4 + 3j) - (2 - 6j) = 2 + 9j$$

$$r = \sqrt{x^2 + y^2} = \sqrt{2^2 + 9^2} = \sqrt{85}$$

$$\Theta = \tan^{-1} \frac{y}{x} = \tan^{-1}(\frac{9}{2}) \approx 1.35 \text{ radians}$$

$$\sqrt{85}(\cos 1.35 + j \sin 1.35)$$

$$i) e^{jt} = \cos t + j \sin t \quad e^{-jt} = \cos t - j \sin t$$

$$e^{jt} - e^{-jt} = (\cos t + j \sin t) - (\cos t - j \sin t) = 2j \sin t$$

$$2e^{3jt} = 2\cos(3t) + 2j \sin(3t)$$

$$f(t) = 2\cos(3t) + 2j \sin t + 2j \sin(3t)$$

$$j) g(t) = 1 + \cos(t) + \sin(2t)$$

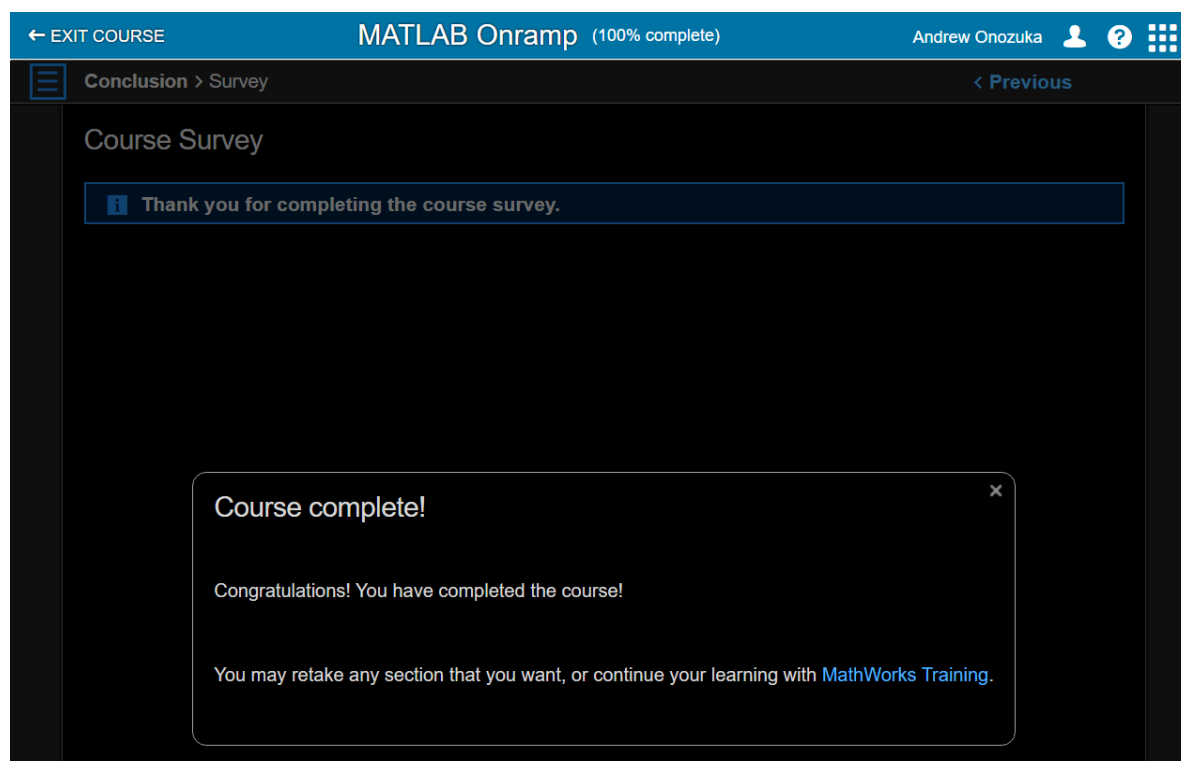
$$g(t) = 1 + \frac{e^{jt} + e^{-jt}}{2} + \frac{e^{j2t} - e^{-j2t}}{2j}$$

$$g(t) = 1 + \frac{1}{2}e^{jt} + \frac{1}{2}e^{-jt} + \frac{1}{2j}e^{j2t} - \frac{1}{2j}e^{-j2t}$$

$$k) A = 4, \text{ Phase} = -\frac{\pi}{4}$$


$$V = 4e^{-j\frac{\pi}{4}}$$

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Homework #1
2) MATLAB Onramp




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3) AI Prompt Sequence

 Lecture_schedule_ECE_45_Heath_v1.pdf
PDF

ece45 at ucsd taught by professor heath is an electrical engineering class on circuits and systems. attached is the lecture schedule. given the topics for each class/weeks, give me relevant topics and concepts to know or brush up on

 Based on the lecture schedule for ECE 45, here are the key topics and concepts to review or brush up on for each week:

Week 1-3: Signals and Systems

1. Signals:

- Definitions: Signals, systems, circuits.
- Sinusoids, complex exponentials, phasors.
- Even and odd signals, periodicity, rectangle, and step functions.
- Exponential signals and Dirac/Kronecker delta functions.

2. Mathematics and Transformations:

- Basics of signal transformations (time-shifting, scaling).
- Properties of exponential and sinusoidal signals.


Week 4-5: Linear Time-Invariant (LTI) Systems in Time

1. LTI System Fundamentals:

- Definition of LTI systems.
- Properties: Linearity, time invariance.
- Impulse response.

2. Convolution:

- Computing convolution integrals.
- Convolution properties and physical interpretation.
- Relation between convolution and phasors.



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- Convolution properties and physical interpretation.
 - Relation between convolution and phasors.
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Week 6-7: Fourier Series

1. Fourier Series:

- Basic formulation.
- Trigonometric and exponential forms.
- Convergence properties and practical applications.

2. Properties:

- Linearity, symmetry, time-shifting, frequency-shifting.
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Week 8-10: LTI Systems in Frequency

1. Frequency Response:

- Deriving and interpreting the frequency response.
 - Filters (low-pass, high-pass, band-pass).
 - Bode plots: Gain and phase plots.
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Week 11-14: Fourier Transform

1. Fourier Transform Basics:

- Transforming signals from time to frequency domain.
- Sine functions, rectangular functions, and their transforms.
- Convolution in the Fourier domain.

2. Properties:

- Linearity, scaling, duality.
- Multiplication and convolution properties.



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Week 15: Sampling

1. Sampling Theorem:

- Nyquist criterion.
- Aliasing and reconstruction.

General Skills to Brush Up On:

1. Mathematics:

- Integration and differentiation (especially for convolution and Fourier transforms).
- Complex numbers and Euler's formula.

2. Tools:

- Use of phasors in AC circuit analysis.
- Familiarity with signal plotting and spectral analysis.

3. Applications:

- Real-world applications of LTI systems, Fourier transforms, and sampling in circuits and systems.

This breakdown aligns with the lecture schedule and will help you target your review for the course. Let me know if you'd like detailed notes on specific topics!

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4) Acknowledgments

I acknowledge that I have read through and reviewed all of the course policies from the syllabus including but not limited to the requirement of marking problems on GradeScope and no late submissions.