

Circuit and System Analysis

EHB 232E

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Outline I

1 Mathematical Systems Theory

- Linear State Equations
- Distinct Eigenvalues
- Series expansion of Homogeneous Solution
- State transition matrix
- Properties of state transition matrix
- Non-homogeneous state equations
- Controllability
- Observability

2 Sinusoidal Steady-State Analysis

- Phasor analysis
- Properties of phasors
- Representation of state-space equations
- Transfer function
- Kirchhoff's Laws in the Frequency Domain
- The Passive Circuit Elements in the Frequency Domain

Outline II

- The Concept of Impedance and Admittance

3 Sinusoidal Steady-State Analysis

- Sinusoidal Steady-State Power Calculation
- Average Power
- Complex, Real and Reactive Powers
- Tellegen Theorem
- Maximum Power Transfer

4 Sinusoidal Steady-State Analysis

- Mesh-Current Method in Frequency Domain
- Node-voltage Method in Frequency Domain
- Network functions
- Superposition of Sinusoidal Steady States
- Thevenin - Norton Equivalent Circuits

5 Three-Phase Systems

- Y-connected source
- Line-to-line voltage

Outline III

- Delta-connected source
- Load in Three Phase Circuit
- Δ -to-Y
- Power calculation in balanced three-phase circuits

6 Laplace Transform in Circuit Analysis

- Laplace Transform
- Inverse Laplace Transform
- Analysis of state space equation
- Characteristic polynomial
- Stability and the Routh-Hurwitz Criterion
- Routh-Hurwitz Criterion
- Circuit elements in the s-domain
- s-Tanım Bölgesinde Devre Denklemleri
- Network Parameters
- Combinations of two-port networks
- Reciprocal Network

Outline IV

- Thevenin - Norton Equivalent Circuits

7 Laplace Transform in Circuit Analysis

- Circuit elements in the s-domain
- Circuit Analysis in the s-domain
- Network Parameters
- Combinations of two-port networks
- Reciprocal Network
- Thevenin - Norton Equivalent Circuits

8 Block diagrams and signal-flow graph

- Block diagrams
- Block diagram reduction
- Feedback
- Example
- Signal-Flow Graphs

9 Bode plot

- Bode plot

Basic course information

Day(s)/Time/Place/

It will be announced on

<https://web.itu.edu.tr/yalcinmust/dersler.html>

Exams

Final Exam: The date of the exam will be announced on

http://www.sis.itu.edu.tr/tr/sinav_programi/

Grading

It will be announced on

<https://web.itu.edu.tr/yalcinmust/dersler.html>

Web

<https://web.itu.edu.tr/yalcinmust/ehb232.html>

Schedule

1. Week	Lecture	
2. Week	Lecture	
3. Week	Lecture	
4. Week	Lecture	
5. Week	Midterm I	
6. Week	Lecture	
7. Week	Lecture	Homework I
8. Week	Exercise session	
9. Week	Lecture	Homework I Return
10. Week	Midterm II	
11. Week	Lecture	
12. Week	Lecture	Homework II
13. Week	Lecture	
14. Week	Exercise session	Homework II Return

Handouts & Reading Materials

Handouts

A copy of the handouts can be obtained from
<https://web.itu.edu.tr/yalcinmust/ehb232.html>.

Textbook:

- James W. Nilsson and Susan A. Riedel, "Electric Circuits," Pearson Prentice Hall, 2008.
- Richard C. Dorf, James A. Svoboda, "Introduction to Electric Circuits," Wiley 2013.

Handouts & Reading Materials

Reading Materials:

- Leon O. Chua, Charles A. Desoer, Ernest S. Kuh, "Linear and Nonlinear Circuits," McGraw-Hill, 1987.
- Yılmaz Tokat, "Devre Analizi Dersleri: Kısım I," Çağlayan Kitapevi, 1986.
- Cevdet Acar, "Elektrik Devrelerinin Analizi," İstanbul Teknik Üniversitesi, 1995.
- Müştak E. Yalçın, "Devre ve Sistem Analizi Ders Notları", 2012.

Video

<https://www.youtube.com/channel/UCunDN-zYoYoN4WZUX4no4oA>.