EE 3446-001
Circuit Analysis II

Fall 2018

Dr. Howard T. Russell, Jr.
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Catalog Course Description:

EE 3446 CIRCUIT ANALYSIS II (3-3) Analysis and design of filters, oscillators, feedback configurations, and operational amplifiers. Dependent sources, device models, two-port networks, and mutual inductance and transformers. Network response functions, poles and zeros, network theorems, resonance, and the analysis and design of active filters. Application of phasors in steady-state circuit analysis. Introduction to distributed networks and transmission lines. Introduction to single-phase and three-phase balanced and unbalanced power networks, complex power, power factor correction, and maximum power transfer. Concurrent laboratory experiments complement lecture topics. Prerequisite: Grade C or better in both EE 2347 and EE 2415.

Topics:

This course is a continuation of the material covered in EE 2415. Specific topics include the following:

- the Laplace transform –
  definition and applications
  transform circuit components
- s-domain network analysis matrix equations –
  algorithms for formulation of the MAME and NAME
  matrix solution methods and Cramer's rule
- frequency-domain response functions –
  immittance and transfer functions
  poles and zeros
  frequency response plots; the Bode plot
- network theorems –
  Tellegen's, superposition, reciprocity, Thevenin's and Norton's, substitution
- two-port networks –
  two-port parameters and formulation
  properties
- applications of two-port models –
  feedback amplifier analysis and design
- op-amps –
  parameters and models
- oscillator designs, frequency of oscillation, conditions for oscillation
- active RC filters –
  filter specifications
  design methods
- sinusoidal steady-state –
  steady-state networks
  phasors
  complex power
  three-phase networks.

Prerequisites:

EE 2415, EE 2347.

Textbook & Supplements:

1. R.C. Dorf and J.A. Svoboda, *Introduction to Electric Circuits*, *9h Edition*, John Wiley & Sons, Inc., 2004, ISBN 0-471-44795-1.
2. H.T. Russell, Jr., *Circuits Lab Manual, V2.1*, OPAL$_{tx}$, Fort Worth, TX, 2010.
3. EE3446Materials*xx*V2.0 – a series of compressed (zipped) supplemental files made available on blackboard in timely intervals.

Tools:

1. Scientific calculator with matrix operations. Calculators such as the TI-89 Titanium, TI-Nspire™, CX CAS, HP-50G, and Casio FX-CP400-L are recommended. Calculators as components in communication devices are not allowed on exams.
2. PSPICE – found in the Cadence OrCAD 16.6 Lite Software package downloaded free from the Cadence Design Systems, Inc. website (www.cadence.com). Procedure for downloading the package is included in EE3446Materials1.
3. Toolbox (mandatory) – containing an assortment of electronics tools consisting of needle nose pliers, diagonal cutters, tweezers, precision knife set, pocket screwdrivers, and breadboard.
4. A good web browser.

Times and Locations:

Section 001 Lecture – Monday, Wednesday, and Friday, 2:00 pm to 2:50 pm, NH106.
Section 101 Lab – Monday, 9:00 am to 11:50 am, NH148A.
Section 102 Lab – Wednesday, 9:00 am to 11:50 am, NH148A.
Section 103 Lab – Friday, 11:00 am to 1:50 pm, NH129A.

Instructor:

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GTAs:

Lecture: TBD
Lab: TBD

EE 3446-001 Fall 2018
Lecture Schedule

Week/Date		Lecture Topics	Reading Assignment
1	8-20	*The Laplace transform* – definition, linearity, transforms of simple time-domain functions; solution methods, inverse Laplace transforms, PFE methods.	Chapter 14 – 14.1 to 14.4. Materials01.
2	8-27	Transformed circuit components; applications on RLC networks, MAME and NAME algorithms for RLC networks; s-domain network response functions; dp immittance and transfer functions; poles and zeros.	Chapter 14 – 14.5 to 14.11. Materials02, Materials03.
3	9-3	*Network theorems* – applications of the MAME and NAME, ODE generation, superposition, reciprocity, Thevenin's and Norton's equivalents.	Chapter 13 – all. Materials03.
4	9-10	Frequency-domain response; magnitude, phase, and group delay; Bode plots; complex s-plane plots, stability using s-domain models; significance of poles and zeros.	Chapter 5 – 5.1 to 5.7. Materials04.

5	9-17	Op-amp parameters and models; ideal and non-ideal op-amp models.	Chapter 6 – 6.1 to 6.5. Materials05.
6	9-24	**Mid-Term Exam 1**. Sinusoidal oscillator design; conditions for and frequency of oscillation.	Handouts.
7	10-1	*Two-port networks* – port definition and measurements; two-port immittance, hybrid, and transmission parameters; two-port models.	Chapter 17 – 17.3 to 17.4. Materials06.
8	10-8	Properties of two-port networks; application of two-port models in feedback amplifier analysis and design.	Chapter 17 – 17.5 to 17.7. Materials06.
9	10-15	Feedback amplifier topologies, loop gain, return ratio and difference, effect on transfer and dp immittance functions.	Materials06.
10	10-22	*Active RC filters* – definitions, applications, properties; catalog of SAB response functions, pole/zero locations, SAB parameters.	Chapter 16 – 16.1 to 16.3. Materials07.
11	10-29	**Mid-Term Exam 2**. SAB active filters; Sallen and Key topologies and designs.	Chapter 16 – 16.4. Materials07.
12	11-5	Multiple-feedback topologies and designs.	Chapter 16 – 16.5. Materials07.
13	11-12	*Phasors* – sinusoidal steady-state voltage and current, phasor definition, application of phasors, complex immittance, phasor diagrams.	Chapter 10 – 10.1 to 10.5. Materials08.
14	11-19	*Complex power* – instantaneous, average, RMS; power factor; ideal transformers; three-phase networks; three-phase voltage and current.	Chapter 10 – 10.6 to 10.11. Chapter 11 – 11.1 to 11.10.
15	11-26	Δ-to-Y transformation, Y-to-Δ transformation; balanced and unbalanced three-phase networks.	Chapter 12 – 12.1 to 12.6.
16	12-3	**Final Exam** **Friday, December 7, 2018 2:00 pm to 4:30 pm**	

References:

1. T.L. Floyd, *Electric Circuits Fundamentals, 7th Edition*, Pearson Education, Inc., UpperSaddle River, NJ, 07458, 2007.
2. J.D. Irwin and R.M. Nelms, *Basic Engineering Circuit Analysis, 8th Edition*, John Wiley and Sons, Inc., Hoboken, NJ,07030, 2005.
3. R.T. Paynter and B.J.T. Boydell, *Electronics Technology Fundamentals, 3rd Edition*, Pearson Education, Inc., Upper Saddle River, NJ, 07458, 2009.
4. M.E. Van Valkenburg, *Network Analysis, 3rd Edition*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1974.
5. B. Friedland, O. Wing, and R. Ash, *Principles of Linear Networks*, McGraw-Hill Book Co., Inc., New York, NY, 1961.
6. P.M. DeRusso, R.J. Roy, and C.M. Close, *State Variables for Engineers*, John Wiley and Sons, Inc., New York, NY, 1967.
7. O. Wing, *Circuit Theory With Computer Methods*, Holt, Rinehart, and Winston, New York, NY, 1972.
8. L.O. Chua and P.M. Lin, *Computer-Aided Analysis of Electronic Circuits*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1975.
9. J. Vlach and K. Singhal, *Computer Methods for Circuit Analysis and Design*, Van Nostrand Reinhold Company, New York, NY, 1983.

Student Learning Outcomes:

EE 3446 Course Learning Objectives and Assessment Approach			
Number	Course Learning Objective (CLO)	ABET Outcome	Assessment Approach
1	An understanding of complex power calculations, power factor, the maximum power transfer theorem, coupled inductors, and ideal transformers.	a, e	exam problems
2	An understanding of the basics of three-phase systems, Y and Δ connections, balanced and unbalanced systems, and power calculations and measurements.	a, e	exam problems
3	An understanding of frequency response in passive and active circuits, series and parallel resonance, and a working knowledge of Bode plots.	a, e	exam problems
4	An understanding of Laplace transforms, relationships between time and frequency domains, network response functions, significance of network poles and zeros, and the convolution theorem.	a, e	exam problems
5	An ability to mathematically formulate multiple mesh and node analysis matrix equations for linear networks with and without dependent sources.	a, c, e	exam problems
6	An understanding of network theorems such as Tellegen's, theorem, superposition, reciprocity, and Thevenin's and Norton's theorem.	a, e	exam problems
7	An understanding of operational amplifiers, and a working knowledge of first and second-order active RC filters.	a, e	exam problems
8	An ability to analyze two-and three-port networks, and an understanding of two-port network applications.	a, e	exam problems
9	The application of computer tools and software in the solution of circuit design problems.	a, k	lab experiments
10	An ability to use conventional electrical engineering instruments and equipment.	a, e, k	lab experiments
11	A working understanding of important analytical principles.	a, b, c	lab experiments
12	An ability to work as a member of a team.	d	lab experiments
13	An ability to understand and resolve professional ethical issues.	f	lab experiments

Outcomes a-k
(a-k as listed by ABET)

a. an ability to apply knowledge of mathematics, science, and engineering;
b. an ability to design and construct experiments, as well as to analyze and interpret data;
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
d. an ability to function on multidisciplinary teams;
e. an ability to identify, formulate, and solve engineering problems;
f. an understanding of professional and ethical responsibility;
g. an ability to communicate effectively;
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context;
i. a recognition of the need for, and an ability to engage in lifelong learning;
j. a knowledge of contemporary issues;
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

General Class Information:

1. There are 43 class meetings scheduled for the 16 weeks of the Fall 2018 Semester. Forty of these meetings are devoted to in-class lectures while three are reserved for examinations (two mid-terms and one final) and one for the Thanksgiving holiday.
2. Your 100% attendance in lectures and labs is mandatory and required. This requirement will not be waived for any reason.
3. There will be five to six homework assignments usually given on two-week intervals. Each assignment requires about five to ten hours for completion. These assignments will be graded and will be included as part of your total course grade. Experience has shown that students who spend the necessary time to work these assignments usually do quite well on the examinations. Solutions to homework problems will be placed on blackboard for all students by the end of the day the assignment is due. Homework turned in after the solutions have placed on blackboard will not be counted and will receive a grade of zero.
4. Mid-term examinations will be given on the 6^{th} and 11^{th} weeks, and will be one hour written exercises.
5. The final examination will be given on **Friday, December 7, 2018** and will be a comprehensive written examination. **NOTICE**: The UTA registrar has demanded a firm, unforgivable final date (four calendar days after the last final examination date) for the submission of course grades from all instructors. Because of this rigid schedule, the date scheduled for the final examination (**Friday, December 7, 2018, 2:00 pm to 4:30 pm**) is fixed and will not be changed for any reason. Therefore, all students, without exception, **must** take the final examination at this time.
6. You are respectively requested to turn off all electronic devices (including but not limited to cell phones of any type, desktop computers, laptop computers, iPads, tablets, towers, and any device capable of communication inside or outside the classroom) while in the Lecture/Lab Sections. Communication devices of any type are not allowed to be used on all exams. No exceptions. Calculators without communication capability are permitted.
7. All examinations will be pencil, paper, and calculator exercises. All students will take these exams at the scheduled times in the classroom.
8. There will be no late or make-up mid-term examinations given unless a written request has been submitted to and approved by the instructor at least two weeks prior to the examination date. As a rule, make-up examinations are several orders of magnitude more difficult than examinations given on the scheduled dates. Please be advised that illness or any other absence on the examination date does not constitute a valid reason for a make-up examination.
9. **NOTICE**: A total score of '0' on any exam (MTE1, MTE2, and/or FE) will automatically result in a course letter grade of 'F'. This includes the failure to take any of the given exams scheduled or approved make-up. You are required to take all exams.
10. The *total grade* (T) for this course is based upon homework, recitation lab, two mid-term exams, and final exam grades. The total T is computed from

$$T = 0.1 \cdot (HW + RA) + 0.25 \cdot (MTE1 + MTE2) + 0.3 \cdot FE \quad (1)$$

HW = homework average
RA = recitation grade
MTE1 = mid-term exam 1 grade
MTE2 = mid-term exam 2 grade
FE = final exam grade

The letter grade is based on the range of the total grade shown below.

Percentage for Grades	
Total grade (T) range	Letter grade
87% - 100%	A
74% - 86%	B
62% - 73%	C
50% - 61%	D
0% - 49%	F

11. Office hours are posted outside my office (NH526). If you have any questions and/or adverse difficulty with the lectures or class material, I strongly suggest that you call or e-mail me (during regular working hours, of course). If necessary, a scheduled office visit can be arranged.
12. Additional important dates:
    End of late registration: – **Monday, August 27, 2018**.
    Census date – **Friday, September 7, 2018**.
    Last day to drop classes – **Friday, November 2, 2018.**
    Spring 2019 registration begins – **Friday, November 9, 2018**.
    Thanksgiving Holidays – **Wednesday, November 21, 2018 to Friday, November 23, 2018**.
    Last day of classes – **Tuesday, December 4, 2018**.
    Final Exam date – **Friday, December 7, 2018**

Drop Policy:
Please refer to the University policy for dropping courses.

Americans With Disabilities Act:
The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 92-112 - The Rehabilitation Act of 1973 as amended. With the passage of federal legislation entitled *Americans with Disabilities Act (ADA)*, pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens. As a faculty member, I am required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty of their need for accommodation and in providing authorized documentation through designated administrative channels. Information regarding specific diagnostic criteria and policies for obtaining academic accommodations can be found at www.uta.edu/disability. Also, you may visit the Office for Students with Disabilities in room 102 of University Hall or call them at (817) 272-3364.

Student Support Services Available:
The University of Texas at Arlington supports a variety of student success programs to help you connect with the University and achieve academic success. These programs include learning assistance, developmental education, advising and mentoring, admission and transition, and federally funded programs. Students requiring assistance academically, personally, or socially should contact the Office of Student Success Programs at 817-272-6107 for more information and appropriate referrals.

Final Review Week:

A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabi. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. Classes are held as scheduled during this week and lectures and presentations may be given.

E-Culture Policy:

The University of Texas at Arlington has adopted the University email address as an official means of communication with students. Through the use of email, UT-Arlington is able to provide students with relevant and timely information, designed to facilitate student success. In particular, important information concerning registration, financial aid, payment of bills, and graduation may be sent to students through email. All students are assigned an email account and information about activating and using it is available at www.uta.edu/email. New students (first semester at UTA) are able to activate their email account 24 hours after registering for courses. There is no additional charge to students for using this account, and it remains active as long as a student is enrolled at UT-Arlington. Students are responsible for checking their email regularly.

Ethics:

Student Responsibility

Undergraduate and graduate students assume full responsibility for knowledge of all University rules, regulations and deadlines published in the Undergraduate and Graduate Catalogs and of all departmental and program requirements concerning their degree programs.

Academic Dishonesty

All students are expected to pursue their academic careers with honesty and integrity. Academic dishonesty includes, but is not limited to, cheating on a test or other coursework, plagiarism (offering the work of another as one's own) and unauthorized collaboration with another person. Students found responsible for dishonesty in their academic pursuits are subject to penalties that may range from disciplinary probation, suspension or expulsion from the University. In accordance with the Rules and Regulations of the Board of Regents of The University of Texas System (Part One, Chapter VI), institutional procedures regarding allegations of academic dishonesty are outlined in Part Two, Chapter 2, of the U.T. Arlington Handbook of Operating Procedures. This information may be obtained by accessing the Dean of Students' Web site at www.uta.edu/studentaffairs/dos or the Student Judicial Affairs' Web site at www.uta.edu/studentaffairs/judicial affairs. Copies of each regulation can be obtained in the Dean of Students' Office on the lower level of the University Center.

Definitions (UTA Handbook of Operating Procedures)

F. scholastic dishonesty, including, but not limited to, cheating on an examination or an assignment, plagiarism, and collusion;

1. *cheating on an examination or an assignment* includes:
   a. copying the work of another, engaging in written, oral or any other means of communication with another, or giving aid to or seeking aid from another when not permitted by the instructor;
   b. using material during an examination or when completing an assignment that is not authorized by the person giving the examination or making the work assignment;
   c. taking or attempting to take an examination for another, or allowing another to take or attempt to take an examination for a student;
   d. using, obtaining, or attempting to obtain by any means, the whole or any part of an un-administered examination or work assignment;
   e. any act designed to give unfair advantage to a student or the attempt to commit such an act;
2. *plagiarism* means the unacknowledged incorporation of the work of another in work that is offered for credit;
3. *collusion* means the unauthorized collaboration with another in preparing work that is offered for credit.

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The following is an excerpt from the College of Engineering's statement on Ethics, Professionalism, and Conduct of Engineering Students. Read the statement carefully, sign it, and return it to your instructor. You may make a copy for your records. Additional copies of this statement can be obtained from your instructor or the Office of the Dean of Engineering.

STATEMENT ON ETHICS, PROFESSIONALISM, AND CONDUCT FOR ENGINEERING STUDENTS

COLLEGE OF ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON

The College cannot and will not tolerate any form of academic dishonesty by its students. This includes, but is not limited to cheating on examination, plagiarism, or collusion.

Cheating on an examination includes:

1. Copying from another's paper, any means of communication with another during examination, giving aid to or receiving aid from another during examination;
2. Using any material during examination that is unauthorized by the proctor;
3. Taking or attempting to take an examination for another student or allowing another student to take or attempt to take an examination for oneself.
4. Using, obtaining, or attempting to obtain by any means the whole or any part of an un-administered examination.

Plagiarism is the unacknowledged incorporation of another's work into work which the student offers for credit.
Collusion is the unauthorized collaboration of another in preparing work that a student offers for credit.

I have read and I understand the above statement.

In addition, I understand that, in order to ensure fairness to all students, exams will be proctored and possibly videotaped.

Course and section number: ____EE 3446-001/102/103_____

Date: _____

Student's signature: _____

Student's name, printed: _____

Student's ID number: _____

Student's e-mail address: _____
(please print clearly)

Detach this page and return it to the instructor or GTA.