MESABI RANGE COMMUNITY & TECHNICAL COLLEGE – VIRGINIA/EVELETH

Course Outline

Course Title: Linear Electric Circuits with Laboratory
Semester Course Prefix and Number: ENGR 2462
Old Quarter Course Prefix and Number:
Submitted By: M. Threapleton
Approval Date: April 2002
Revision Date: April 2002

Number of Credits: 4
Semester(s) Offered: Spring
Negotiated Class Size: 30
Number of Lecture Credits: 3
Number of Lab Credits: 1 **Number of Lab Hours:** 2
Number of Studio/Demonstration/Internship Credits:

Course Purpose Code:

_____ **0 –** Developmental Courses
_____ **1 –** Non-transferable, General Education
_____ **2 –** Technical course related to career programs
_____ **3 –** College course which has the primary goal of applying certain concepts (e.g. vocal ensemble)
X **4 -** Other college course not considered a part of general education (MNTC) e.g. computer science, health, physical education
_____ **5 –** Course which is intended to fulfill the Minnesota Transfer Curriculum (MNTC) requirements.
_____ **9 –** Continuing Education/Customized Training specialized credit course (not occurring in 0-5)

Catalog Description:
This course examines linear electric circuits in steady-state and transient conditions, single and polyphase systems, transformers, filter design wave analysis, and semiconductor circuits. This course is intended for electrical and some mechanical engineering majors. The lab component provides hands-on learning of the lecture concepts and introduces proper use of the laboratory equipment.

Prerequisites and/or recommended entry skills/knowledge:
Course Prerequisite(s): ENGR 2461 Circuit Analysis and Lab
Reading Prerequisite: None
Composition Prerequisite: None
Mathematics Prerequisite: None

Career Programs and Transfer Majors Accessing this Course:
Engineering transfer students in electrical and mechanical engineering.

Minnesota Transfer Curriculum Goal(s) partially met by this course if applicable: Notes: No more than two goals may be met by any one course. (Curriculum Committee review and the Chief Academic Officer's approval are required).

0. **X** None
1. ____ Communications
2. ____ Critical Thinking
3. ____ Natural Sciences
4. ____ Mathematical/Logical Reasoning
5. ____ History and the Social and Behavioral Sciences
6. ____ The Humanities and Fine Arts
7. ____ Human Diversity
8. ____ Global Perspectives
9. ____ Ethical and Civic Responsibility
10. ____ People and the Environment

Learning outcomes, including any relevant competencies listed in the Minnesota Transfer Curriculum:

The student will:

1. perform steady state power calculations.
2. analyze AC power in both single phase and three phase circuits.
3. use transfer functions both as phasers and Laplace Transforms.
4. apply transfer functions to the analysis of Bode diagrams in the analysis of frequency selective circuits.
5. analyze low pass, high pass, bandpass, and bandreject filter circuits.
6. analyze active filter circuits.
7. analyze natural inductance in circuits and transformers.
8. analyze diode and transistor semiconductor circuits.
9. complete an extensive capstone design project in a team environment and submit a professional report.
10. investigate, through simulations, the major analysis results encountered in the lecture sessions.
11. investigate, through hands-on training, the major analysis results encountered in the lecture sessions.
12. design investigations that meet required laboratory standards.
13. prepare professional laboratory reports.
14. design and perform experimental investigation in teams.

Student assessment methods:

The final grade is determined by grades earned on homework problems, laboratory assignments, periodic examinations, a comprehensive design project, and a comprehensive final examination.

Use of instructional technology (includes software, interactive video and other instructional technologies):

The students will use Microsoft Office computer software, Graphical Analysis computer software, Mathcad, Derive, Mathematica, and computer projection equipment.

Outline of the major course content:

Sinusoidal steady-state power calculations

I. A. Real and reactive power
   B. The effective (rms) value of a sinusoidal signal
   C. Complex power
   D. Power calculations
   E. Appliance ratings
   F. Maximum power transfer

II. Balanced three-phase circuits
   A. Balanced three-phase voltages
   B. Three-phase voltage sources
   C. Analysis of the wye-wye circuit
   D. Analysis of the wye-delta circuit
   E. Analysis of the delta-wye circuit
   F. Analysis of the delta-delta circuit
   G. Power calculations in balanced three-phase circuits

III. Introduction to the Laplace Transform
   A. Definition of the Laplace Transform
   B. The step function
   C. The impulse function
   D. Functional transforms
   E. Operational transforms
   F. Inverse transforms
   G. Poles and zeros of f(s)
   H. Initial- and final-value theorems

IV. The Laplace Transform in circuit analysis
  A. Circuit elements in the s-domain
  B. Circuit analysis in the s-domain
  C. The impulse function in circuit analysis
V. The transfer function
  A. An s-domain application of superposition
  B. The transfer function
  C. The transfer function in partial-fraction expansions
  D. The transfer function and the convolution integral
  E. The transfer function and the steady-state sinusoidal response
  F. Bode diagrams
  G. Bode diagrams with complex poles and zeros
  H. The decibel
VI. Introduction to frequency selective circuits
  A. Low-pass filters
  B. High-pass filters
  C. Bandpass filters
  D. Bandreject filters
  E. Bode diagrams and filters
VII. Active filter circuits
  A. First order filters
  B. Scaling
  C. Op amp bandpass and bandreject filters
VIII. Mutual inductance and transformers
  A. The concept of mutual inductance
  B. Polarity of mutually induced voltages and the dot convention
  C. The linear transformer
  D. The ideal transformer
IX. Semiconductor
  A. Diodes
  B. Transistors

Additional special information (special fees, directives on hazardous materials, etc.)
A scientific calculator with exponential and logarithmic capabilities is required for this course. Engineer's paper will be required for all homework assignments.

Transfer Information: (Please list colleges/majors that accept this course in transfer.)
University of Minnesota; University of Minnesota-Duluth; Minnesota State University, Mankato; St. Cloud State University; Michigan Technological University; North Dakota State University; University of North Dakota all accept for engineering majors.

Approvals:

Body	Representative Signatures	Date
Curriculum Committee	Kim Giermann	
Faculty Association	Georgia Suoja	
Meet and Confer	Dr. Jill Peterson	
Chief Academic Officer	Dr. Jill Peterson	

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