



ELEN 142
CIRCUIT ANALYSIS
2019 Winter

COURSE OUTLINE

The calendar description is available on the web @ _____

Ω Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.

CALENDAR DESCRIPTION

This course introduces students to concepts of circuit analysis for AC and DC circuits. Topics include: fundamental electrical quantities, series and parallel circuits, network analysis and theorems, resistance, capacitance and inductance. Instruments, instrumentation and troubleshooting concepts are introduced. Use is made of complex numbers and phasor diagrams to explain the operation of AC circuits.

1. Instructor Information

(a) Instructor	John J. Yang	_____
(b) Office hours	_____	_____
(c) Location	TEC 268	_____
(d) Phone	250-370-4213	Alternative: _____
(e) E-mail	yang@camosun.bc.ca	_____
(f) Website	http://camosun.ca/learn/programs/electronics-computer-engineering-technolog	

2. Intended Learning Outcomes

(If any changes are made to this part, then the Approved Course Description must also be changed and sent through the approval process.)

Upon completion of this course the student will have a complete understanding of DC and AC circuit operation, including the analysis of circuits containing capacitors and inductors.

3. Required Materials

(a) Texts

- Introduction to Circuit Analysis
Walls Johnstone ISBN 0-314-93386-7
- Circuit Analysis with Devices 2nd Edition (or newer)
Robbins and Miller ISBN 140187984-5

(b) Other

- Laboratory Exercises, Handouts and Course Outline

4. Course Content and Schedule

(Can include: Class hours, Lab hours, Out of Class Requirements and/or Dates for quizzes, exams, lecture, labs, seminars, practicums, etc.)

OUTLINE	Estimated Time
1. Introduction (review)	(1 hour)
1.1 SI Units	
1.2 Scientific Notation and Engineering Notation	
2 Nature of Electricity (review)	(1 hour)
2.1 Theory of Electrical Charge	
2.2 Structure of the Atom	
2.3 Conductors, Insulators and Semi-Conductors	
2.4 Conventional versus Electron Current Flow	
2.5 Definition of the Coulomb, Ampere, Volt and Ohm	
3. Resistance	(3 hours)
3.1 Types of Resistors including Linear Resistors and Non-Linear Resistors	
3.2 Resistor Color Code	
3.3 Ohm's and Watt's Law	
3.4 Work, Energy, Power in Resistive Circuits	
4. Resistive Networks and Simple Circuit Analysis	(7 hours)
4.1 Series Circuits	
4.2 Kirchhoff 's Voltage Law (KVL)	
4.3 Parallel Circuits	
4.4 Kirchhoff's Current Law (KCL)	
4.5 Voltage Divider Rule	
4.6 Current Divider Rule	
4.7 Series - Parallel Circuits	
4.8 The Voltage Divider	
4.9 Voltmeter, Ammeter, Ohmmeter and other DC Measuring Instruments	
4.10 Wheatstone Bridge Circuit	
4.11 Delta - Wye Conversions	
5. Circuit Analysis using Basic Network Theorems	(9 hours)
5.1 Equivalent Circuits	
5.2 Constant Voltage Sources	
5.3 Practical Sources	
5.4 Internal Resistance	
5.5 Constant Current Sources	

- 5.6 Current Sources in Parallel and Series
- 5.7 Thevenin's Theorem
- 5.8 Maximum Power Transfer Theorem
- 5.9 Superposition Theorem
- 5.10 Mesh Current Analysis

- 6. Capacitance (2 hours)
 - 6.1 Electric Fields
 - 6.2 Electrostatic Induction
 - 6.3 Dielectrics
 - 6.4 Capacitance
 - 6.5 Capacitors in Series
 - 6.6 Capacitors in Parallel

- 7. Capacitance in DC Circuits (7 hours)
 - 7.1 Charging/Discharging
 - 7.2 Time Constant
 - 7.3 Stored Energy
 - 7.4 Capacitor Response to step and rectangular inputs
 - 7.5 Capacitor as an Integrator and Differentiator

- 8. Inductance (2 hours)
 - 8.1 Electromagnetic Inductance
 - 8.2 Faraday's Law
 - 8.3 Lenz's Law
 - 8.4 Self-Inductance
 - 8.5 Inductors in Series
 - 8.6 Inductors in Parallel

- 9. Inductance in DC CIRCUITS (4 hours)
 - 9.1 Rise/Fall of Current in an RL Circuit
 - 9.2 Time Constant
 - 9.3 Stored Energy
 - 9.4 RL Circuit Response to a Step input

- 10. Introduction to Alternating Current (4 hours)
 - 10.1 Sine Wave Generation and Phase Relationships
 - 10.2 Period, Frequency and Phasor Representations of Sine Waves
 - 10.3 Purely Resistive AC Circuits
 - 10.4 Peak, Average, and Effective (RMS) Value of A Sine Wave
 - 10.5 Other Types of Periodic Waveforms

- 11. Capacitance in AC Circuits (5 hours)
 - 11.1 Capacitive Reactance
 - 11.2 Analysis of Series RC Circuits
 - 11.3 Analysis of Parallel RC Circuits
 - 11.4 Power In A Capacitive Circuit

12. Inductance in AC Circuits	(5 hours)
12.1 Inductive Reactance	
12.2 Analysis of Series RL Circuits	
12.3 Analysis of Parallel RL Circuits	
12.4 Power in an Inductive Circuit	
13. Non Resonant AC Circuits	(4 hours)
13.1 Analysis of Series RLC Circuits	
13.2 Analysis of Parallel RLC Circuits	
13.3 Power in an RLC Circuit	
14. Resonant AC Circuits	(6 hours)
14.1 Series Resonance	
14.2 Quality Factor & Selectivity in A Series Resonant Circuit	
14.3 Parallel Resonance	
14.4 Quality Factor & Selectivity in A Parallel Resonant Circuit	
15. Transformers	(4 hours)
15.1 Theory of Operation - Mutual Inductance	
15.2 Iron, Air, and Ferrite Core Transformers	
15.3 Voltage and Current Ratios	
15.4 Reflected Impedance	
15.5 Transformer Losses	
16. Filters	(6 hours)
16.1 Low Pass Filters	
16.2 High Pass Filters	
16.3 Gain, Attenuation, Decibel, Decade, and Octave	
16.4 Normalized Frequency Response Curves vs. Bode-plots	
16.5 Band Pass Filters	
16.6 Band Reject Filters (or Notch Filters)	
Total In-Class Theory Hours (including quizzes, term exams)	70 hours

Labs

1. Introduction to Multisim
2. Breadboards, Resistors and Simple Circuit Construction
3. Simple Series Circuit and Voltage Divider
4. Parallel and Series-Parallel Circuits
5. DC Network Theorems
6. DC Capacitive Circuits
7. DC Inductive Circuits
8. Introduction to AC Measurements
9. AC Measurements in a Series RC Circuit
10. Amplitude, Phase Angle and Power in a Series AC Circuit
11. Resonant and Non-Resonant RLC Circuits
12. Transformer Characteristics
13. Filters

5. Basis of Student Assessment (Weighting)

(Should be directly linked to learning outcomes.)

- (a) Assignments
- (b) Quizzes
- (c) Exams
- (d) Other (e.g. Project, Attendance, Group Work)

EVALUATION

Assignments, Quizzes and Tutorials	15%
Labs	15%
Term Exams	30%
Final Exam	40%
Total Course Mark	100%

6. Grading System

(If any changes are made to this part, then the Approved Course description must also be changed and sent through the approval process.)

(Mark with "X" in box below to show appropriate approved grading system – see last page of this template.)

- Standard Grading System (GPA)
- Competency Based Grading System

A minimum of 60% must be achieved in both the theory and lab portions to pass the course. Less than 60% in either portion will result in a failure of the entire course.

The final grading is based on 90% of theory work, and 10% of lab evaluation. Lab evaluation will be based on completing all assigned exercises and lab reports. Labs are to be completed within the assigned lab period and evaluated as satisfactory or unsatisfactory. Any unsatisfactory lab reports must be redone until a satisfactory level is achieved.

Attendance and completion of all lab material is mandatory to complete the course. Attendance at all tutorials is also compulsory.

Quizzes may be given at any time without prior notice and will be based on the current class notes, example problems and any textbook reading assigned.

7. Recommended Materials to Assist Students to Succeed Throughout the Course

8. College Supports, Services and Policies



Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ <http://camosun.ca/about/mental-health/emergency.html> or <http://camosun.ca/services/sexual-violence/get-support.html#urgent>

College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at <http://camosun.ca/>

College Policies

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at <http://camosun.ca/about/policies/>. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

A. GRADING SYSTEMS <http://www.camosun.bc.ca/policies/policies.php>

The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at <http://www.camosun.bc.ca/policies/E-1.5.pdf> for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.