



**CAMOSUN COLLEGE**  
**School**  
**Department**

**ECET 140 Circuit Fundamentals**  
**Fall 2019**

**COURSE OUTLINE**

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This course introduces students to concepts of circuit analysis in passive DC and AC circuits. Topics include: fundamental electrical quantities; resistance, capacitance and inductance; series and parallel circuits; network analysis and theorems; and introduction to filter concepts. Instruments, instrumentation and troubleshooting concepts are introduced. Complex numbers and phasor diagrams are used to analyze AC circuits.

*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.*

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**1. Instructor Information**

- (a) **Instructor**      Godfried Pimlott \_\_\_\_\_  
(b) **Office hours**      \_\_\_\_\_  
(c) **Location**      TEC 209 \_\_\_\_\_  
(d) **Phone**      250-370-4430      **Alternative:** \_\_\_\_\_  
(e) **E-mail**      pimlott@camosun.bc.ca \_\_\_\_\_  
(f) **Website**      \_\_\_\_\_

**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.)*

**3. Required Materials**

- (a) Texts

Jackson et al, ***Introduction to Electric Circuits***, 10<sup>th</sup> Ed.

- (b) Other

**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.)

**1. Introduction and Review**

- 1.1      SI Units

- 1.2 Scientific Notation
- 1.3 Engineering Notation
- 1.4 Precision versus Accuracy
- 1.5 Significant Figures, Arithmetic, and Rounding

## **2. Nature of Electricity**

- 2.1 Structure of the atom
  - 2.1.1 Bohr's model
  - 2.1.2 Bonding
  - 2.1.3 The Band Model of Solids and Conduction
- 2.2 Charge: the Coulomb; Coulomb's Law
- 2.3 Current: Conventional and electron; the Ampere
- 2.4 Potential and Potential Difference; Voltage; the Volt

## **3. Resistance**

- 3.1 Linear Resistors
- 3.2 Non-linear Resistors
- 3.3 Circuit Diagrams and Symbols
- 3.4 Ohm's Law
- 3.5 Work, Energy and Power in Resistive Circuits

## **4. Resistive Networks**

- 4.1 Series Circuits
- 4.2 Kirchhoff's Voltage Law
- 4.3 Voltage Divider Rule
- 4.4 Parallel Circuits
- 4.5 Kirchhoff's Current Law
- 4.6 Current Divider Rule
- 4.7 Series-parallel Circuits
  - 4.7.1 Analysis by Combining Resistors
  - 4.7.2 Mesh and Nodal Analysis
- 4.8 Ammeters
- 4.9 Voltmeters
- 4.10 Ohmmeters
- 4.11 Bridge Networks

## **5. Circuit Analysis**

- 5.1 Constant Current Sources
  - 5.1.1 Current Sources in Series and Parallel
- 5.2 Constant Voltage Sources
  - 5.2.1 Voltage Sources in Series and Parallel
- 5.3 Practical Sources
- 5.4 Source Conversions
- 5.5 Superposition Theorem
- 5.6 Thévenin's Theorem
- 5.7 Internal Resistance and Maximum Power Transfer

## **6. Capacitance**

- 6.1 Electric Fields
- 6.2 Capacitance

- 6.3 Dielectrics
- 6.4 Non-ideal Effects
- 6.5 Capacitors in Parallel and Series
- 6.6 Types of Capacitors
- 6.7 Capacitor Polarization

## **7. Capacitance in DC Resistive-Capacitive Circuits**

- 7.1 Charging and Discharging of Voltage and Stored Energy
- 7.2 The Time Constant
- 7.3 RC Circuit Response to Step Input
- 7.4 RC Circuit as an Integrator and Differentiator

## **8. Inductance**

- 8.1 Electromagnetic Induction
- 8.2 Faraday's Law
- 8.3 Lenz's Law
- 8.4 Self-inductance
- 8.5 Non-ideal Effects
- 8.6 Inductors in Series and Parallel
- 8.7 Types of Inductors

## **9. Inductance in DC Resistive-Inductive Circuits**

- 9.1 Rise and Fall of Current and Stored Energy
- 9.2 The Time Constant
- 9.3 RL Circuit Response to a Step Input

## **10. Introduction to Alternating Current (AC)**

- 10.1 Sine Wave Generation
- 10.2 Period and Frequency of a Sine Wave
- 10.3 Phasor Representation of a Sine Wave
- 10.4 Average Value of a Sine Wave
- 10.5 Effective (RMS) Value of a Sine Wave

## **11. Resistance, Capacitance and Inductance in AC Circuits**

- 11.1 Resistance and Sinusoidal AC
- 11.2 Capacitance and Sinusoidal AC (Capacitive Reactance)
- 11.3 Inductance and Sinusoidal AC (Inductive Reactance)
- 11.4 Analysis of AC Series Circuits (RC, RL, RLC)
- 11.5 Analysis of AC Parallel Circuits (RC, RL, RLC)
- 11.6 Analysis of AC Series-Parallel Circuits (RC, RL, RLC)

## **12. Power in AC Circuits**

- 12.1 True Power
- 12.2 Reactive Power
- 12.3 Apparent Power
- 12.4 Power Triangle
- 12.5 Power Factor

### 13. Theorems for AC Circuits

- 13.1 Source Conversion
- 13.2 Superposition
- 13.3 Thévenin's Theorem
- 13.4 Maximum Power Transfer

### 14. Resonant AC Circuits

- 14.1 Series Resonance
- 14.2 Quality Factor and Selectivity in a Series Resonant Circuit
- 14.3 Parallel Resonance
- 14.4 Quality Factor and Selectivity in a Parallel Resonant Circuit

### 15. Filters

- 15.1 Low Pass Filter
- 15.2 High Pass Filter
- 15.3 Definition of Transfer Function in the  $\omega$  Domain
- 15.4 Computation of Transfer Functions in the  $\omega$  Domain
- 15.5 Frequency Response
- 15.6 The Decibel
- 15.7 Bode Plots
- 15.8 Band Pass Filters
- 15.9 Band Reject Filters

### 16. Transformers

- 16.1 Theory of Operation and Mutual Inductance
- 16.2 The Iron Core Transformer
- 16.3 Voltage, Current and Impedance Ratios
- 16.4 Transformer Losses

## LABS:

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- 0. Word Processing and Spreadsheet Exercise
- 1. Lab Orientation, the Breadboard, Resistors, and Measurement
- 2. Series Resistive Circuits and Ohm's Law
- 3. Voltage Dividers, Potentiometers, and Control of LEDs and Motors
- 4. Parallel and Series-parallel Circuits
- 5. Thevenin's Theorem and Maximum Power Transfer
- 6. Series RC and Capacitive Bridge Circuits
- 7. DC RL Circuits
- 8. Introduction to AC Measurements
- 9. AC Measurements in an RC Circuit
- 10. Amplitude, Phase, and Power in Series AC Circuits
- 11. Resonant and Non-resonant Series and Parallel RLC Circuits
- 12. Filters
- 13. Transformers

## 5. Basis of Student Assessment (Weighting)

*(Should be directly linked to learning outcomes.)*

Labs	20%
Quizzes	10%

Term Tests (2 or 3)	30%
Final Exam	40%

## 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

## 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://camosun.ca/about/policies/index.html>

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://camosun.ca/about/policies/index.html> 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.