

# COURSE SYLLABUS



COURSE TITLE: CAD For Electronics  
CLASS SECTION: X01, X02  
TERM: 2022 Winter  
COURSE CREDITS: 2  
DELIVERY METHOD(S): In-person

Camosun College campuses are located on the traditional territories of the Lək̓ʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.  
Learn more about Camosun's [Territorial Acknowledgement](#).

For COVID-19 information please visit <https://camosun.ca/about/covid-19-updates>

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*Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.*

## INSTRUCTOR DETAILS

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NAME: John Yang  
EMAIL: yang@camosun.bc.ca  
OFFICE: TEC 268  
HOURS: To-be-determined

*As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.*

## CALENDAR DESCRIPTION

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This course introduces Altium Designer 21 (AD21 or later editions), a computer-based electronics design software for engineers/technologists to design printed circuit boards (PCB), FPGA, and embedded software, and to manage project data. Students learn how to create the electronic schematic of a circuit, how to use schematic libraries to select and design electronic components, and how to plan a printed circuit board layout. Students use these skills to create a printed circuit board from a schematic diagram.

PREREQUISITE(S): ECET 242, 260  
CO-REQUISITE(S):  
EXCLUSION(S):

## COURSE LEARNING OUTCOMES / OBJECTIVES

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- ◆ Be able to draw schematic diagrams (simple, parallel, hierarchical)
- ◆ Be able to find, select, and create schematic components (schematic library editor)
- ◆ Be able to lay out multi-layer printed circuit boards (PCB)
- ◆ Be able to find, select, and create PCB footprints (PCB library editor)
- ◆ Be able to create 3D view of a PCB
- ◆ Be able to manage the PCB project data

## REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

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- ◆ ECET 231 Course Notes (check it with your instructor)
- ◆ Altium website ([www.altium.com](http://www.altium.com))

## COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

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The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

<i>Week 1 (two hours)</i>	<i>Lab (one hour)</i>
Intro to Course Outline and Schedule Intro to Course Notes Intro to D2L layout <ul style="list-style-type: none"><li>● Course Home</li><li>● My Tools</li><li>● Content</li><li>● Assignments</li><li>● Collaborate</li></ul> Introduction to <b>Altium Designer 21</b> (AD21) Introduction to Schematic Capture Editor A simple schematic drawing Shortcut keys	Lab #1 <b>Be familiar with Altium Design Environment</b> <ul style="list-style-type: none"><li>● Altium applications</li><li>● Schematic capture editor</li><li>● Shortcut keys</li></ul>

<i>Week 2</i>	<i>Lab</i>
10-step procedure of schematic drawing How to find desired schematic components How to install proper libraries Electrical Rules setting (for schematic) Troubleshooting of schematic drawing (ERC)	Lab #2 <b>Schematic capture of a simple digit circuit</b> <ul style="list-style-type: none"> <li>• Draw the schematic</li> <li>• Verify 10-step procedure of SCH design</li> </ul>

<i>Week 3</i>	<i>Lab</i>
Introduction to PCB Layout Editor How to find desired footprints How to install proper PCB libraries A simple single-layer PCB design A simple double-layer PCB design	Lab #3-#4 (Project One) <b>PCB design of a logic probe (high/low) circuit</b> <ul style="list-style-type: none"> <li>• Schematic drawing</li> <li>• PCB layout (single signal layer)</li> <li>• PCB layout (two signal layers)</li> <li>• Verify 10-step procedure of PCB design</li> </ul>

<i>Week 4</i>	<i>Lab</i>
10-step procedure of PCB design Design Rules setting (for PCB) Troubleshooting of PCB layout (DRC) Reshape a PCB board How to pour polygon	Lab #3-#4 (continue)

<i>Week 5</i>	<i>Lab</i>
Introduction to Schematic Library Editor Three ways to create a schematic component (electronic symbol)	Lab#5-#6 <b>Schematic library editor</b> <ul style="list-style-type: none"> <li>• Manage electronic components</li> <li>• Create electronic components</li> </ul>

<i>Week 6</i>	<i>Lab</i>
Introduction to PCB Library Editor Three ways to create a PCB footprint (PCB symbol)	Lab#5-#6 (continue) <b>PCB library editor</b> <ul style="list-style-type: none"> <li>• Manager component footprints</li> <li>• Create component footprints</li> </ul>

<b><i>Week 7 (Feb 21 – Feb 25)*</i></b>	<b><i>* Holiday / Reading Break</i></b>
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<i>Week 8</i>	<i>Lab</i>
Parallel schematic drawings Hierarchy schematic drawings	Lab#7-#8 (Project Two, Part A) <b>SCH design of a four-channel data acquisition (DAQ) circuit</b> <ul style="list-style-type: none"> <li>• Parallel schematic drawing</li> <li>• Hierarchy schematic drawing</li> </ul>

<i>Week 9</i>	<i>Lab</i>
Two signal layers of PCB layout (Double side) Two signal layers of PCB layout with two internal planes (power plane, ground plane) Split power plane and ground plan	Lab#7-#8 (continue)

<i>Week 10</i>	<b>Midterm Exam</b>
<b>Midterm Exam</b>	<ul style="list-style-type: none"> <li>• Schematic drawing</li> <li>• PCB layout (single/double signal layers)</li> <li>• Create electronic components</li> <li>• Create component footprints</li> </ul>

<i>Week 11</i>	<i>Lab</i>
Four or more signal layers of PCB layout Layer stack management	Lab#9-#10 (Project Two, Part B) <b>PCB design of the four-channel data acquisition (DAQ) circuit</b> <ul style="list-style-type: none"> <li>• PCB layout (double-signal layers)</li> <li>• PCB layout (with power plane and ground plane)</li> </ul>

<i>Week 12</i>	<i>Lab</i>
Schematic template management (PCB) Board layers and Colors management Track width management Track length management Holes and vias management Solder paste/mask management	Lab#9-#10 (Continue)

<i>Week 13</i>	<i>Lab</i>
Introduction to 3D model Creating 3D component bodies Embedding a 3D STEP model  Rooms and classes management Mechanical layers management	Lab#11 <b>3-D model implementation</b> <ul style="list-style-type: none"> <li>• Create 3D bodies with Altium</li> <li>• Import 3D bodies (.step file) from other CAD programs</li> <li>• Evaluate PCB 3D modelling</li> </ul>

<i>Week 14</i>	<i>Lab</i>
PCB Panelization / Centroid file  Thermal Analysis* EMI/EMC considerations* High speed signal considerations* BGA components layout* PCB project management*  <b>Schematic capture and PCB design review</b>	Lab#12 <b>PCB Power Distribution Network (PDN) Analyzer*</b>  * When time is allowed.

<i>Week 15</i>	<b><i>Final Exam</i></b>
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Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced noticed is required. Deadlines scan be reviewed on the [CAL exams page](http://camosun.ca/services/accessible-learning/exams.html). <http://camosun.ca/services/accessible-learning/exams.html>

## EVALUATION OF LEARNING

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Attendance to all classes and satisfactory completion of all assignments and labs are **mandatory**. The lab grade, the theory grade, and the final exam must be over 50% each to pass the course. The final grade will be determined by the following components:

- ◆ Labs/Quizzes                      50%
- ◆ Midterm Exam                      20%
- ◆ Final Exam                          30%
- ◆ **Grading: in accordance with Camosun College Policy**

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the [Grade Review and Appeals](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) policy for more information. <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

## TABLE OF CONTENTS

### SECTION I – The Basics of Altium Designer 21

#### 1 ... Introduction to Altium Designer 21

- 1.1 Review of schematic circuits and printed circuit boards
- 1.2 Introduction to the environment of Altium
- 1.3 A simple schematic circuit capture – **Lab01**

#### 2 ... Schematic capture editor

- 2.1 Elements and tools of the schematic capture editor
- 2.2 10-step procedure of creating schematic captures
- 2.3 How to find desired schematic components (symbols)
- 2.4 How to install proper (schematic) libraries
- 2.5 Electrical rules setting -- for schematic captures
- 2.6 Netlist and bill of materials (BOM)
- 2.7 Project library versus general library
- 2.8 Troubleshoot schematic captures
- 2.9 A de-morgenzed logic circuit capture – **Lab02**

#### 3 ... PCB layout editor

- 3.1 Elements and tools of the PCB layout editor
- 3.2 10-step procedure of creating PCB layouts
- 3.3 PCB document wizard
- 3.4 How to find desired PCB components (footprints)
- 3.5 How to install proper (PCB) libraries
- 3.6 Import (netlist) changes versus Update PCB
- 3.7 Design rules setting -- for PCB layouts
- 3.8 Manual route versus auto route
- 3.9 Troubleshoot a PCB layout
- 3.10 Reshape a PCB board (re-size)
- 3.11 How to pour polygon
- 3.12 Fabrication outputs versus assembly outputs
- 3.13 A through-hole single-sided PCB design – [Lab03-04](#)

## **SECTION II – Library Editors**

### **4 ... Schematic Library Editor**

- 4.1 What is the schematic library editor?
- 4.2 Elements and tools of the schematic library editor
- 4.3 Three ways to create a schematic component (electrical symbol) – **Lab05**

### **5 ... PCB Library Editor**

- 5.1 What is PCB library editor?
- 5.2 Elements and tools of the PCB library editor
- 5.3 Three ways to create a PCB footprint (PCB symbol) – **Lab06**

## **SECTION III – Advanced Designs, Considerations, and Data Management**

### **6 ... PCB with multiple signal layers & multiple internal planes**

- 6.1 Parallel format of a multi-channel schematic capture
- 6.2 Hierarchical format of a multi-channel schematic capture – **Lab07-08**
- 6.3 PCB layout with two signal layers (double sided)
- 6.4 PCB layout with two signal layers and two internal planes (power/ground)
- 6.5 Split internal planes – **Lab09-10**
- 6.6 PCB layout with more than two signal layers and/or two internal planes
- 6.7 Layer stack management

### **7 ... PCB 3D Modeling**

- 7.1 3D modeling has changed electronics design forever
- 7.2 Creating 3D component bodies in a footprint library
- 7.3 Embedding a 3D STEP model in a footprint – **Lab11**
- 7.4 3D Measuring in Altium Designer

### **8 ... PCB Fabrication Documents**

- 8.1 Bill of materials (BOM)
- 8.2 Gerber/ODB++
- 8.3 NC drill setup
- 8.4 Getting the layers stack right
- 8.5 File export centroid
- 8.6 PCB Panelization
- 8.7 How to do “Embedded Board Array” (Panelize) -- procedure
- 8.8 An example from Epec Engineered Technologies

## 9 ... The advanced knowledge of PCB design

- 9.1 Schematic template management
- 9.2 Board layers and Colors management (PCB)
- 9.3 Track width management
- 9.4 Holes and vias management
- 9.5 Solder paste/mask management
- 9.6 Room & Classes management
- 9.7 Mechanical layers management
  
- 9.8 Grounding and de-coupling
- 9.9 EMI/EMC considerations
- 9.10 High speed signal considerations
- 9.11 Differential pair & length matching
- 9.12 PCB Power distribution network (PDN) analyzer – **Lab12\***
- 9.13 BGA components layout – **Lab13\***
  
- 9.14 PCB project management

## Labs

- Lab #1 **Introduction to Altium Designer**
- Lab #2 **Simple logic Circuit Schematic Capture**
- Lab #3-4 **Single-sided PCB Layout**
- Lab #5 **Schematic Library Editor – *create schematic symbols***
- Lab #6 **PCB Library Editor – *create PCB footprints***
- Lab #7-8 **Multi-sheet Schematic Design**
- Lab #9-10 **Multi-layer PCB Design**
- Lab #11 **3D PCB Design**
- Lab #12\* **PCB Power Distribution Network (PDN) Analyzer**
- Lab #13\* **BGA PCB Design** (\* *when time is allowed*)



## The Department of Electronics & Computer Engineering

- ◆ [Electronics & Computer Engineering Technology - Renewable Energy, Diploma](#)
- ◆ [Electrical Engineering Technology - Marine & Industrial, Diploma](#)

## School of Trades & Technology

<https://camosun.ca/programs-courses/school-trades-technology>

## General Information

[SOFTT@camosun.ca](mailto:SOFTT@camosun.ca)

Phone 250-370-3822

Fax 250-370-3898

[Campus Camosun College Interurban](#)

Technologies Building (TEC) 169

### Trades Info Line

250-370-3856

### Tech Info Line

250-370-4409

[tradesinfo@ca](mailto:tradesinfo@ca)

## STUDENT RESPONSIBILITY

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Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

## SUPPORTS AND SERVICES FOR STUDENTS

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Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit <http://camosun.ca/students/>.

Support Service	Website
Academic Advising	<a href="http://camosun.ca/advising">http://camosun.ca/advising</a>
Accessible Learning	<a href="http://camosun.ca/accessible-learning">http://camosun.ca/accessible-learning</a>
Counselling	<a href="http://camosun.ca/counselling">http://camosun.ca/counselling</a>
Career Services	<a href="http://camosun.ca/coop">http://camosun.ca/coop</a>
Financial Aid and Awards	<a href="http://camosun.ca/financialaid">http://camosun.ca/financialaid</a>
Help Centres (Math/English/Science)	<a href="http://camosun.ca/help-centres">http://camosun.ca/help-centres</a>
Indigenous Student Support	<a href="http://camosun.ca/indigenous">http://camosun.ca/indigenous</a>
International Student Support	<a href="http://camosun.ca/international/">http://camosun.ca/international/</a>

Support Service	Website
Learning Skills	<a href="http://camosun.ca/learningskills">http://camosun.ca/learningskills</a>
Library	<a href="http://camosun.ca/services/library/">http://camosun.ca/services/library/</a>
Office of Student Support	<a href="http://camosun.ca/oss">http://camosun.ca/oss</a>
Ombudsperson	<a href="http://camosun.ca/ombuds">http://camosun.ca/ombuds</a>
Registration	<a href="http://camosun.ca/registration">http://camosun.ca/registration</a>
Technology Support	<a href="http://camosun.ca/its">http://camosun.ca/its</a>
Writing Centre	<a href="http://camosun.ca/writing-centre">http://camosun.ca/writing-centre</a>

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

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## COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

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### Academic Accommodations for Students with Disabilities

The College is committed to providing appropriate and reasonable academic accommodations to students with disabilities (i.e. physical, depression, learning, etc). If you have a disability, the [Centre for Accessible Learning](#) (CAL) can help you document your needs, and where disability-related barriers to access in your courses exist, create an accommodation plan. By making a plan through CAL, you can ensure you have the appropriate academic accommodations you need without disclosing your diagnosis or condition to course instructors. Please visit the CAL website for contacts and to learn how to get started:

<http://camosun.ca/services/accessible-learning/>

### Academic Integrity

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.13.pdf> for policy regarding academic expectations and details for addressing and resolving matters of academic misconduct.

### Academic Progress

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.1.pdf> for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

### Course Withdrawals Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <http://camosun.ca/learn/fees/#deadlines>.

### Grading Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for further details about grading.

### Grade Review and Appeals

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

### Mandatory Attendance for First Class Meeting of Each Course

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable reason in advance, you will be removed from the course and the space offered to the next waitlisted student. For more information, please see the “Attendance” section under “Registration Policies and Procedures” (<http://camosun.ca/learn/calendar/current/procedures.html>) and the Grading Policy at <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf>.

### Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal. Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.8.pdf> to learn more about the process involved in a medical/compassionate withdrawal.

### Sexual Violence and Misconduct

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun’s Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence or misconduct occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them understand what supports are available and their options for next steps. The Office of Student Support respects a student’s right to choose what is right for them. For more information see Camosun’s Sexualized Violence and Misconduct Policy: <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.9.pdf> and [camosun.ca/sexual-violence](http://camosun.ca/sexual-violence). To contact the Office of Student Support: [oss@camosun.ca](mailto:oss@camosun.ca) or by phone: 250-370-3046 or 250-3703841

### Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College’s Student Misconduct Policy at <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf> to understand the College’s expectations of academic integrity and student behavioural conduct.

**Changes to this Syllabus:** Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.