



CAMOSUN COLLEGE
Trades and Technology
Electronics and Computer Engineering

CSNT 160
Internet of Things: Connecting and Securing Devices
Fall 2024

COURSE OUTLINE

The calendar description is available on the web @ Online.camosun.ca

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.

Instructor Information

(a) Instructor	Gurbinder Dhade
(b) Office hours	TBA
(c) Location	CBA 122B
(d) Phone	250 370 4450 Alternative:
(e) E-mail	<u>dhadeg@camosun.bc.ca</u>

Students will learn in this course how to connect and secure “Internet of Things” devices. It starts with a brief introduction to basic electronic theory, component identification, and lab equipment usage. Next IoT theory explores the methods for remotely controlling and monitoring mechanical systems in industrial, commercial and home applications. Students then move on to IoT system architecture design and security, followed by specific vulnerabilities within the devices themselves, their communication protocols, and applications they run. Students will get hands-on practice setting up and configuring various automated systems.

The student will be responsible for keeping up with the required reading and lab exercises. Notes and lab activities will be provided through D2L and related web sites.

Students who successfully complete this course will be able to:

- describe basic electronic theories and components;
- practice building simple electronic circuits and demonstrate the use of electronic test equipment;
- discuss trends, terms and concepts relating to Internet of Things devices;
- describe the concepts of industrial, commercial, and home automation/control;
- use interfacing software to configure and provision an automated environment;
- describe IoT system architectures and their security vulnerabilities;
- perform risk and vulnerability assessments on IoT devices and systems; and
- apply threat mitigation procedures to IoT devices and systems.

Course Delivery

This course will have **face to face seminars and labs** according to the Fall schedule.

Course curriculum is provided through the Cisco Skill for All website <https://skillsforall.com/> and Cisco Netacad website <https://www.netacad.com/> using the following Cisco course material:

Introduction to IoT and Digital Transformation – Netacad website
IoT Fundamentals: Connecting Things – D2L
IoT Fundamentals: IoT Security – D2L

Course Content

Week 1 – Introduction: Intro to IoT

Reading

- | | | |
|---------|---|----------------------------|
| Seminar | - Cisco Netacad overview
- Chapter 1 – Everything is Connected
- Introduction to Packet Tracer (PT) | IoT Introduction Chapter 1 |
| Lab | - PT 1.1.1.8 – Deploying and Cabling Devices
- PT 1.1.2.5 – Create a Simple Network
- PT 1.2.2.1 – Adding IoT Devices to a Smart Home
- PT 1.2.2.3 – Connect and Monitor IoT Devices | |

Week 2 – Introduction: IoT Programming and Data

- | | | |
|---------|---|----------------------------|
| Seminar | - Chapter 2 – Everything Becomes Programmable
- Python Programming | IoT Introduction Chapter 2 |
| | - Chapter 3 – Everything Generates Data
- Big Data | IoT Introduction Chapter 3 |
| Lab | - Lab 2.1.3.6 – Setting Up a Virtualized Server
- Lab 2.1.3.7 – Basic Python Programming
- Lab 2.1.3.8 – Create a Simple Game with Python | |

Week 3 – Introduction: Automation, Security, and Opportunities

- | | | |
|---------|--|----------------------------|
| Seminar | - Chapter 4 – Everything Can be Automated
- AI and Machine Learning | IoT Introduction Chapter 4 |
| | - Chapter 5 – Everything Needs to be Secured
- Security | IoT Introduction Chapter 5 |
| | - Chapter 6 – Educational/Business Opportunities
- What next? | IoT Introduction Chapter 6 |
| Lab | - PT 4.1.1.6 – Explore the Smart Home
- PT 5.1.2.6 – Configure Wireless Security
- Lab 5.1.3.6 – Discover Your Own Risky Online Behavior | |

Week 4 – IoT Fundamentals: Connecting Things: Introduction

Reading

FINAL EXAM for Introduction

Seminar	- Chapter 1 – Things and Connections - Devices, Processes, and Connections	IoT Connecting Chapter 1
	- Chapter 2 – Sensors/Actuators/Microcontrollers - Electronics, Basic Circuits	IoT Connecting Chapter 2 up to Section 2.2
Lab	- PT 1.2.2.5 – Connecting Devices to Build IoT - PT 2.2.1.4 – Simulating IoT Devices - Custom Lab – Breadboarding and Basic Lab Equipment	

Week 5 – Connecting Things: Sensors, Actuators, and Microcontrollers

Seminar	- Chapter 2 – Sensors/Actuators/Microcontrollers - Devices, Processes, and Connections	IoT Connecting Chapter 2 Section 2.2 and on
Lab	- PT 2.3.1.2 - Sensors and the PT Microcontroller - PT 3.3.1.4 - SBC Actuate	

Week 6 – Connecting Things: Software is Everywhere

Seminar	- Chapter 3 – Software is Everywhere - Programming	IoT Connecting Chapter 3
Lab	- Lab 3.2.2.3 – Setting up the PL-App w Raspberry Pi - Lab 3.2.3.8 – Basic Linux Commands - Lab 3.2.5.9 – Writing Simple Python Scripts - Lab 3.2.5.11 – Blinking an LED using Raspberry Pi	

Week 7 – Connecting Things: Networks, Fog and Cloud Computing

Seminar	- Chapter 4 – Networks, Fog & Cloud Computing - Network characteristics	IoT Connecting Chapter 4
Lab	- PT 4.2.2.5 - Build a Connected Factory Solution - PT 4.2.2.4 - Explore the Smart Home - PT 4.2.3.3 - Securing Cloud Services in the IoT	

Week 8 – Connecting Things: Digitization of the Business | IoT Applications in Business

Seminar	- Chapter 5 – Digitization IoT Apps in Business - Industrial IoT, Real World IoT	IoT Connecting Chapter 5
Lab	- PT 5.3.2.8 Smart City - PT 5.3.3.4 Smart Grid	

Week 9 – Connecting Things: Create an IoT Solution

Seminar	- Chapter 6 – Create an IoT Solution -Create an IoT Solution	IoT Connecting Chapter 6
Lab	- PT 6.3.2.3 Prototype & Test the Solution	

Week 10 – IoT Fundamentals: IoT Security: IoT Under Attack, Systems and Architectures

FINAL EXAM for Connecting Things

Seminar	- Chapter 1 – The IoT Under Attack - Security Challenges and Uses	IoT Security Chapter 1
	- Chapter 2 – IoT Systems and Architectures - IoT Models and Threat Modeling	IoT Security Chapter 2
Lab	- Lab 1.2.3.1 Set Up PL-App on a Raspberry Pi - Lab 1.2.3.2 Set up the IoT Security Lab Topology - Lab 1.2.3.3 Harden a Raspberry Pi	

Week 11 – IoT Security: The IoT Device Layer Attack Surface

Seminar	- Chapter 3 – IoT Device Layer Attack Surface - Security Challenges and Uses	IoT Security Chapter 3
Lab	- Lab 1.2.3.4 Investigate Vulnerability Assessment Tools - Lab 3.2.2.7 Compromise IoT Device Firmware	

Week 12 – IoT Security: IoT Communication Layer Attack Surface

Seminar	- Chapter 4 – IoT Communication Layer Attack - Protocol Vulnerabilities and Security	IoT Security Chapter 4
Lab	- Lab 4.1.2.3 Sniffing Bluetooth with the Raspberry Pi - Lab 4.2.2.5 Port Scanning an IoT Device - Lab 4.2.2.6 Packet Crafting to Exploit Unsecured Ports	

Week 13 – IoT Security: IoT Application Layer Attack Surface

Seminar	- Chapter 5 – IoT Application Layer Attack - Web and Cloud Vulnerabilities	IoT Security Chapter 5
Lab	- Lab 5.1.2.7 Use OpenVAS for Vulnerability Assessment - Lab 5.1.2.8 Challenge Passwords with Kali Tools - Lab 5.1.2.9 Web Application Vulnerability	

Week 14 – IoT Security: Vulnerability and Risk Assessment in an IoT System

Seminar - **Chapter 6** – Vulnerability / Risk Assessment IoT Security Chapter 6
- Assessing Vulnerabilities and Risk

Lab - Lab 6.2.3.6 Assess Risk with DREAD
- Lab 6.3.2.7 Blockchain Demo 2.0

FINAL EXAM for Securing Things

Evaluation

Evaluation for this course will be a combined total of quizzes, course finals, and lab marks. Attendance and completion of all material is mandatory to pass the course. **Late submissions will be not graded.**

Marking Criteria:

Quizzes -----	15%
Course Finals (3)	
Introduction -----	15%
Connecting -----	20%
Securing -----	20%
Completion of Lab Activities -----	30%

Quizzes will be based on current week's material from both seminar and lab content and delivered through D2L.

A Course Final will be completed at the end of each course covering all of the content in each course. There will be no overall final exam covering all of the three courses material.

Completion of Lab Activities will be based on finishing weekly Lab / Packet Tracer exercises and submission of lab reports to the D2L Dropbox by **Sunday 11:59 PM** of the corresponding week – no late labs will be graded.

Please note the following:

1. A grade of 50% or better is required in all assessment items above to be able to pass the course.
2. No late materials will be accepted past midnight of the last day of the course.
3. No opportunity will be available to write missed quizzes.
4. Attendance and completion of all lab material is mandatory to pass the course.

Required Materials

- (a) Access to CSNT 160 Camosun D2L online course materials as required
- (b) Access to Cisco Netacad site
- (c) IoT Lab Kit – to be signed out to the student

Grading System

Standard Grading System (GPA)

Competency Based Grading System

Recommended Materials or Services to Assist Students to Succeed Throughout the Course

LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College Calendar, Student Services or the College web site at <http://www.camosun.bc.ca>

STUDENT CONDUCT POLICY

There is a Student Conduct Policy. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, Registration, and on the College web site in the Policy Section.
<http://www.camosun.bc.ca/policies/policies.html>

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

The following grading system is 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