DEPARTMENT OF SCIENCE

COURSE OUTLINE – WINTER 2021

CS3120 (A3): EXPERIMENTAL ROBOTICS – 3 (3-0-3)
90 Hours over 15 Weeks

INSTRUCTOR:	Libero Ficocelli	**PHONE:**	780 539-2825
OFFICE:	C424	**E-MAIL:**	LFicocelli@gprc.ab.ca
OFFICE HOURS:	TBA		

WINTER 2021 DELIVERY:
Mixed Delivery – Remote and Onsite. This course is delivered remotely with some face-to-face/onsite components at the GPRC Grande Prairie campus.
For the remote delivery components:

- students must have a computer with a webcam and reliable internet connection. Technological support is available through helpdesk@gprc.ab.ca.
- For the onsite components: students must supply their own mask [and/or face shield] and follow GPRC Campus Access Guidelines and Expectations.

Note: GPRC reserves the right to change the course delivery.

CALENDAR DESCRIPTION:
A project-based course dealing with the design and implementation of behaviour-based robots to accomplish specific tasks. Students work in groups and are introduced to concepts in sensor technologies, sensor data processing, motion control, embedded system design, real-time programming and behaviour arbitration.

PREREQUISITE(S)/COREQUISITE: CS2290 or CS3290 or permission of the instructor

REQUIRED TEXT/RESOURCE MATERIALS:

The Robotics Primer, Maja J Mataric, MIT Press (recommended). Please order online.

Mobile Robotics for Multidisciplinary Study, Carlotta Berry, Morgan & Claypool Publishers (recommended). Please order the e-book online; print version also available.

Additional readings will be provided

COURSE OBJECTIVES:

The course will provide students an opportunity to integrate knowledge of software and hardware design in the context of building autonomous robots. Students will become extremely familiar with the difficulties of designing hardware and software which must work in the **real world**. Construction of working robotic systems will enable students to learn about numerous robot concepts, terminology and embedded systems design techniques. Students will be introduced to:

- the Arduino hardware platform and software IDE.
- numerous sensor, motor, IO and communication shields
- the use of various communication protocols
- digital and analog circuitry for interfacing with raw sensors and IO devices
- motion planning/control
- sensor data processing
- behavioral robotics

LEARNING OUTCOMES:

Students will be able to:

- work with the Arduino platform
- interface an Arduino microcontroller to numerous sensors such as encoders, buttons, photocells, IR ranging sensors, potentiometers, IR sensors, IR reflective photo-sensors, ToF sensors, sonar, color sensor, and others as available
- be able to control numerous actuators such as DC motors, servo motors, laser modules, LED, LCD, OLED displays, and relays
- implement interrupt driven software
- use I^2C, SPI and IR communications
- use behavioral robotic concepts to control robot functionality

TRANSFERABILITY:

Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.ca.

** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. **Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability**

EVALUATIONS:

35 % -- Lab Assignments/Mini-projects
20 % -- Final Project
10 % -- Log book
35 % -- Final Exam

GRADING CRITERIA:

Please note that most universities will not accept your course for transfer credit **IF** your grade is **less than C-**.

Alpha Grade	4-point Equivalent	Percentage Guidelines		Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	90-100		C+	2.3	67-69
A	4.0	85-89		C	2.0	63-66
A-	3.7	80-84		C-	1.7	60-62
B+	3.3	77-79		D+	1.3	55-59
B	3.0	73-76		D	1.0	50-54
B-	2.7	70-72		F	0.0	00-49

COURSE SCHEDULE/TENTATIVE TIMELINE:

- the Arduino platform
- actuator control
- sensor interfacing
- Arduino resources including libraries, code examples and tutorials
- data storage (flash, Sram, EEprom, SD cards)
- communication methodologies (serial, I^2C, SPI and IR)
- introduction to robotic history, robots and human culture and general terminology
- current state of robotics in society as well as potential for future adoption
- Overview of various sensor technologies
- interrupts and interrupt handling
- Robotic control architectures
- PID control
- Behavioral robotics
- Bluetooth communications

STUDENT RESPONSIBILITIES:

CLASS and LAB attendance is **mandatory**. You must clear all absences with me; failure to comply will result in a failing grade for the course!

STATEMENT ON PLAGIARISM AND CHEATING:

Cheating and plagiarism will not be tolerated and there will be penalties. For a more precise definition of plagiarism and its consequences, refer to the Student Conduct section of the College Admission Guide at http://www.gprc.ab.ca/programs/calendar/ or the College Policy on Student Misconduct: Plagiarism and Cheating at www.gprc.ab.ca/about/administration/policies/**

**Note: all Academic and Administrative policies are available on the same page.