

## Course Outline

FACULTY:	Faculty of Science and Technology		
PROGRAM(S):	243.A0 Computer Engineering Technology		
DEPARTMENT:	247 Computer Engineering Technology		
COURSE TITLE:	Introduction to PCB Design and Prototyping		
COURSE NUMBER:	247-306-VA		
COURSE SECTION(S):	00001, 00002		
PONDERATION:	2h- 2h- 2h	2h lecture, 3h lab work, 2h homework	
NUMBER OF CREDITS:		2.33	
PREREQUISITE(S):	None.		
SEMESTER/YEAR:	Semester 3, Fall 2020		
TEACHER (THEORY):	John Salik, Eng.		
	Office:	D-366	
	Tel:	514-744-7500 Ex. 7034	
	E-mail:	salikj@vaniercollege.qc.ca	
AVAILABILITY:	Office Hours:	Thursdays from 1pm to 2pm or by appointment.	
TEACHER (LAB):	John Salik, Eng.		
	Office:	D-366	
	Tel:	514-744-7500 Ex. 7034	
	E-mail:	salikj@vaniercollege.qc.ca	
AVAILABILITY:	Office Hours:	Thursdays from 1pm to 2pm or by appointment.	
<b>Introduction</b> In this course, students will use CAD tools to create schematics and PCBs to produce a fully functional prototype based on user requirements. In a team, they will plan, design and produce a project in a collaborative environment. They will fulfill the client’s requirements by following a development process that involves producing electronic prototypes and creating an initial PCB for testing. They will support the manufacturing process by producing PCB manufacturing files, a parts list and a bill of materials (BOM). They will assemble the finished system using appropriate tools and laboratory techniques with all internal and external connections made. They will then prepare for delivery, with all appropriate documentation.			
<b>Statement of Competency</b>			
<b>Competency 037L:</b> To draw electronic schematic diagrams.			
<b>Competency 037N:</b> To design printed circuits.			
<b>Competency 037P:</b> To produce a computerized system prototype.			

### **Student Personal Resources Required**

- Essential materials will be provided by the College.
- Project materials are purchased by the student for projects to a maximum value of \$150.

### **Bibliography**

- Class Notes & Slides 2020, John Salik  
To be provided through the online resource.

## Course Content and General Topic Overview

The course will be split into three fundamental sections: printed circuit board CAD, mechanical CAD, assembly & prototyping. Students will perform basic electronic assembly tasks that includes soldering as well other support techniques such as the assembly of wire harnesses, the use of heat-shrink tubing and inspection tools like a microscope. Students will demonstrate their proficiency in developing small electronic prototypes that are rugged enough for field testing (point-to point soldering, and wire-wrapping). Finally, students will produce a mechanically integrated printed circuit board that is tested and ready for industrial or retail sale.

*For each project deliverable*, students must always demonstrate their ability to produce organized work. This is to say students must produce (for each project):

1. A list of all parts purchased (pricing, manufacturer and vendor).
2. A list of all parts used (pricing, manufacturer and vendor).
3. Documentation on the product including a mechanical description of the project, a functional description of the unit and a user manual.

All work produced for a given project must demonstrate a quality and method that will allow them to work effectively with a licensed Engineer in Quebec who is bound by the Civil Code and the Engineer's Act. This includes the maintenance of financial and technical records that support the budget they are assigned.

**Tentative topics are outlined below.** Basic theory will be given in the form of presentations, video, demonstrations or a combination of these. Reading material will be assigned as required.

1. An Overview of Printed Circuit Board Design with Autodesk Eagle
2. The Eagle Schematic Capture Environment
3. The Eagle Board Layout Environment
4. Component Library Development
5. Trace Widths, Net Classes and Ground Planes
6. PCB Manufacturing: Generating GERBER Files Using a CAM Processor in Eagle
7. Producing Accurate Mechanical Models with Autodesk Inventor
8. Complex Solid Design Tools
9. Solid Visualization and Documentation
10. Assemblies
11. Sheet Metal
12. 3D Printing Models

Course Structure			
THEORY:	2 hours/week:		
LABORATORY:	3 hours/week:	Students must be present and actively participating in the laboratory activity. They must demonstrate clearly that all tasks have been independently completed.	
HOMEWORK:	2 hours/week:	Students are expected to devote at least 30 minutes in reviewing notes and 1.5h in practicing concepts learned in class or doing assignments/projects.	
ATTENDANCE			
THEORY:	Consistent attendance is required to fully benefit from the course. In the event of absence, students are responsible for obtaining and assimilating all material covered.		
LABORATORY:	Failure to complete all lab activities assigned in the designated lab class without just cause may result in a failure of the lab session and any results and/or Lab Report derived from the session. To successfully be evaluated on the course competencies, lab attendance is required.		
TESTS:	Absence will result in failure of the missed test (mark of 0). Students with a just cause for absence are encouraged to seek alternative arrangements with the instructor – beforehand if possible.		
EVALUATION			
The final mark will be weighted:	Homework 10%:	10%	Take Home Assignments.
	Tests 40%:	20%	Midterm
		20%	Final
	Projects 50%:	20%	Electronic Prototype
		15%	Mechanical Prototype
		15%	Production-Ready Design (Manufactured PCB)
The following general rules apply:			

**The following general rules apply:**

- If log books do not have at least one 500-word entry per laboratory session or if a prototype does not have 100% functionality or the final submitted device does not have at least 80% function or complete documentation is not submitted complete and in the manner requested or the student has demonstrably exceeded their budget, then student will not pass the course (a maximum final grade of 55%).
- Quizzes may be given without prior notice – there are no make-ups for quizzes.
- Students are expected to attend all their schedule classes. Absence from any lab class where specific skills are being assessed will result in a failure of that skill.
- Students are expected to conduct themselves in a professional manner at all times. This includes but is not limited to:
  - Arriving to class (theory and laboratory) on time and prepared to do the required work;
  - Conducting themselves in an appropriate manner at all times (including being respectful to the teacher, classmates, and any guests);
  - Using professional language (no cursing and/or swearing and using appropriate vocabulary);
  - Arriving to class/lab with all necessary supplies (logbook, notebook, textbook, manual, paper, writing implements, calculator, etc.);
  - Turning off all personal communication/music/video electronics (removing headphones, earphones, ear buds etc.); and
  - Having all assigned work completed.

Remember that developing professional behaviours and habits now is an important aspect of preparation for entering a professional work environment in the future.

- Students are expected to take their own notes during classes.
- Cell phones or calculators with memory for equations (for example graphing calculators) will not be allowed when writing tests.
- Reports must be typed and computer generated according to the guidelines provided by the teacher.
- When requested, Lab preparations and Lab Results/logbooks are to be handed in during the lab session. Late Lab Preparations/Lab Results may not be accepted, and a zero mark will be recorded.
  - Reports are due two weeks after they are assigned unless the instructor provides a specific due date.
  - Any assignment or project carries the standard late penalty of 15% per day late to a maximum of 45%.
  - In-class assignments will only be accepted in the class in which they are assigned.
- Students who are consistently late for class (lab and/or theory) may be refused entry.
- All grades are reported on a numeric scale from 0% to 100%. The following categories briefly describe the relative value of these grades.

range	mean	Description
90 - 100	95	Excellent, mastery of the objectives
80 - 89	85	Very Good mastery of the objectives
65 - 79	72	Good, mastery of objectives
60 - 64	62	Fair mastery of objectives
0 - 59	n/a	Poor mastery of objectives



## Academic and other Resources

If at any point in the semester, you are concerned about the course or you realise that you are having academic difficulties; your first resource should be to talk to me, your teacher. Academic difficulties include problems with the understanding of the theory, to the development of the practical skills required by the course. The earlier you look for help, the greater your chances of succeeding in the course. If I don't feel I can provide you with the help you need then I may recommend one of the College resources below.

For other problems or difficulties, you may encounter while at Vanier there are a number of Services available to help you within the college. They are there for you to use. These include:

**Student Services (C203):** Some areas where they provide services and/or information are:

- Services for students with disabilities      Counselling (personal and other problems)
  - Student Advocate Financial Aid (including aid and scholarships)
  - Health Services (Nurse on staff)      Student Employment
  - Academic and Behaviour Policies      Lockers
  - Housing      Volunteering
  - Student Services is a great resource for questions about college life and any problems you encounter while at Vanier. If they do not have the answer, they can direct you to the right place to find it.
- 
- **Tutoring and Academic Success Center - TASC (F-300):** Student-orientated centre dedicated to promoting and aiding students' development and success in academics and in society.
  - Admissions and placement tests      S.T.A.R. Program
  - English Exit Exam      English conversation and pronunciation clubs
  - English Peer Tutoring      Scholarship information
  - Vanier Native Program      Diversity support
  - TASC is the main college resource for students with learning difficulties and for students with weak English language skills.

- [Science, Technology, Engineering and Mathematics - STEM \(D-301\)](#): This Centre aims to promote student success in mathematics and science. The large interactive study space includes a hackerspace for hands-on applied projects such as robotics, and a study hub for collaborative group work. Teacher help, computers, and a large collection of math and science textbooks are equally available. We offer a number of activities, services and resources including:
  - Free drop-in peer tutoring      Drop-in help from teachers
  - Free private tutoring      Teacher-led review sessions
  - Computer access   Laptop borrowing



## **Mediation and Grades Review**

There are two committees available to the student for resolution of academic complaints.

1. The [Grades Review](#) Committee to review complaints concerning the grading of students' work.
2. The *Faculty Mediation Committee* to review academic complaints other than those dealing with student grades – see *Student Academic Complaints* below.

## **General College Academic Policies**

It is the student's responsibility to be familiar with and adhere to the [Vanier College Academic Policies](#). Your attention is drawn in particular to the following policies. A brief summary of each is included. To see the full policy, Ctrl and left click on the title of the policy.

**[Code of Conduct Policy:](#)** The policy sets forth principles, guidelines and norms of behavior expected from all individuals present at Vanier College, including students, faculty, employees, administrators, members of the Board of Directors, contractors and visitors. The Code of conduct can be found on the College's website, under *Policies* and on the Omnivox Portal.

**[Institutional Policy on the Evaluation of Student Achievement Policy:](#)** This policy explains the general principles followed at Vanier College in the evaluation of student achievement and provides a list of rights and responsibilities of students and teachers. It is the main policy guiding student evaluation.

**[Student Academic Complaints \(Policy number 7210-8\):](#)** The Vanier College Student Academic Complaints Policy and procedures puts an emphasis on mediation as the primary means to resolve complaints in the academic area. If you have a problem with a teacher and have been unable to resolve it by talking with him or her, you may wish to enlist the help of the Faculty Mediation Committee. The committee member names and contact information are available in Student Services or through the office of the Faculty Dean.

**[Cheating and Plagiarism \(Policy number 7210-31\):](#)** Any form of cheating or plagiarism will result in a grade of zero on the test or assignment and a letter from the teacher will be placed in your file. A repeated offence may lead to even more serious consequences. For more information, consult your teacher or the policy.

**[Student Misconduct in the Classroom \(Policy number 7210-19\):](#)** This policy provides guidelines for handling cases of student misbehaviour in the classroom and other instructional settings. Such cases may include conduct that is abusive to the teacher and/or other students, or disruptive to the teaching/learning process. This policy does not limit the teacher's or the College's right to take immediate action in cases of imminent danger to persons or property.

**[Student Absences for Religious Holy Days \(Policy number 7210-20\):](#)** Students whose religious obligations require them to be absent from the College on a holy day not formally recognized in the College calendar must inform their teachers, in writing, during the first week of classes, of the particular date(s) and times of the religious holy days on which they must be absent. Absences approved in this manner are considered to be excused absences. Students are responsible for material covered in the classes and labs they miss.

**[Test during the last 2 weeks of the Semester \(Policy number 7210-18\):](#)** No test, term paper or project (or combination of these) which counts for more than 30% of the final grade should be given or should be due in the last ten teaching days (20% in the case of courses with a compulsory final exam in the final exam period).

**[Course Outline Policy \(Item 4.6\):](#)** Teachers must advise students, the Department/Program Coordinator and the Faculty Dean, in writing, if changes in course content or procedures become absolutely necessary during the term. Discretionary changes to course content and/or procedures shall be agreed upon between the students and teacher, with written notification provided to the Department/Program Coordinator and Faculty Dean.