
# GNG1103C – ENGINEERING DESIGN

*Winter 2021*

January 11 to April 14

## TEACHING STAFF

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|---|---|
| **Professor** | Muslim Majeed<br>Faculty of Engineering<br>Email mmajeed@uottawa.ca<br>Phone: 613-562-5800 Ext 6163<br>Office: STEM 0018<br>Office hours: Tuesdays from 6:00 PM to 7:00 PM (By Appointment -on ZOOM) |

## HOURS AND LOCATION

| Class | Class Title | Days & Times | | Room |
|---|---|---|---|---|
| GNG 1103-C00 | ENGINEERING DESIGN (Lecture) | Tuesdays<br>Fridays | 11:30AM - 2:50PM<br>1:00PM - 2:20PM | Zoom |
| GNG 1103-C01 | ENGINEERING DESIGN (Laboratory) | Thursdays | 8:30AM - 11:20AM | Zoom |
| GNG 1103-C02 | ENGINEERING DESIGN (Laboratory) | Wednesdays | 8:30AM - 11:20PM | Zoom |
| GNG 1103-C03 | ENGINEERING DESIGN (Laboratory) | Mondays | 2:30PM - 5:20PM | Zoom |

## TEACHING METHODOLOGY

- Lectures, assignments, reflection and lifelong learning
- Weekly labs
- Engineering design project with external clients

## DETAILED COURSE PLAN (*Subject to Updates*)

| Week | Lectures | | Laboratories* | Assignments & Deliverables** | Weight (%) |
|---|---|---|---|---|---|
| 1 (Jan 11-16) | 12-Jan | 1. Course Introduction | Basic Computer tools | | |
| | 15-Jan | 2. Design case study | | | |
| 2 (Jan 17-23) | 19-Jan | 3. "Design Thinking" + **Quiz 1** | CAD | A1: Personal assessment (ITP metrics) | 2.5 |
| | 22-Jan | 4. Needs identification… | | | |
| 3 (Jan 24-30) *** | 26-Jan | 5. Client Meet 1 | Basic Training | PD A: Team formation and contract | 0.7 |
| | 29-Jan | 6. Design criteria | | | |
| 4 (Jan 31-Feb 6) | 02-Feb | 7. Team & Conflict management + **Quiz 2** | Arduino | PD B: Needs identification | 1.75 |
| | 05-Feb | 8. Modelling & Prototyping (Ideation) | | | |
| 5 (Feb 7-13) | 09-Feb | 9. Time & Project management | Project work | PD C: Design criteria | 2.8 |
| | 12-Feb | **Midterm Exam (will be discussed later)** | | | |
| (Feb 14-20) | **Reading Week** | | | | |
| 6 (Feb 21-27)*** | 23-Feb | 10. Design analysis | Project work + Client Meet 2 | A2.1 ITPM<br>PD D: Conceptual design | 0<br>1.75 |
| | 26-Feb | 11. Feedback & Iterative prototyping | | | |
| 7 (Feb 28-Mar 6) | 02-Mar | 12. User experience design + **Quiz3** | Matlab | A2.2 ITPM Report Questions<br>PD E: Project schedule & Cost | 2.5<br>2.8 |
| | 05-Mar | 13. Modeling & Prototyping (Insight) | | | |
| 8 (Mar 7-13) *** | 09-Mar | 14. Presentation skills + **Quiz 4** | Laser Cutting | PD F: Prototype 1 & Customer Feedback | 3.5 |
| | 12-Mar | 15. Modelling & Prototyping (Testing) | | | |
| 9 (Mar 14-20) | 16-Mar | 16. Client Meet 3 (5 minutes/team) | Project work | PD G: Prototype 2 & Customer Feedback | 4.2 |
| | 19-Mar | 17. Course summary & Review | | | |
| 10 (Mar 21-27) | 23-Mar | 18. Course review + **Quiz 5** | Project work | | |
| | 26-Mar | 19. Project work | | | |
| 11 (Mar 28-Apr 3) | 30-Mar | 20. Project work | Project work | PD H: Prototype 3 and Customer Feedback | 5.25 |
| | 02-Apr | 21. Final Exam Preparation | | | |
| 12 (Apr 4-10) | 05-Apr | Final presentation 1 | Design day Apr 8 Paperwork | PD I: Design Day (April 8)<br>PD J: Final presentation | 5.25<br>3.5 |
| | 09-Apr | Final presentation 2 | | | |
| 13 (Apr 11-14) | 13-Apr | Final presentation 3 | | PD K: User manual | 3.5 |
| (Apr 16-29) | | **Final Exam** | | | |
| | | | | TOTAL for Assignments & Deliverables | 40 |

***Client Meet 1 is Week 3, Client Meet 2 is Week 6, and Client Meet 3 is in Week 8
*TAs will be on location at the MakerLab, students will tune in to Zoom
**Assignments and Project Deliverables (PD) due on Sundays

# GENERAL COURSE INFORMATION

## Brief Description

This introductory course in engineering design is a hands-on course mainly focused on the design of products that solve real-word problems under teamwork environment. Topics covered in this course include the engineering design process methodology called ***Design Thinking***, prototyping, time and project management, teamwork, conflict management and cost estimation. The design principles presented in this course apply to all works and all engineering disciplines. The concepts taught in class will be reinforced by several practical activities. Students will apply their new knowledge to a practical design project involving real clients. Students will be responsible for developing concepts, creating prototypes, testing and analysis, and obtaining feedback from clients to improve the product designed. Students will present their final prototype to the public during the ***Design Day***.

## General and Specific Objectives

This course will help you to acquire and develop basic hard and soft skills necessary to design and develop products that will solve real-world problems. It will develop your skills in time and project management, teamwork, conflict management and personality assessment of yourself and others. To achieve this, the basic principles of engineering product design, time and project management, teamwork and project costing will be provided.

## Pedagogical Approach & Brightspace

The teaching approach of the course is an ordered and synchronized combination of lectures, labs, and works on team projects, homework assignments, self-reflection and lifelong learning skills. Teaching material and communication resources will be available and accessible through **Brightspace** dedicated to the course. It is strongly recommended that you familiarize yourself with Brightspace before the start of the semester. It is very important to note that any **absence** in lecture and laboratory session must be justified in timely manner to the professor by an **email notification** including **supporting documents** such as medical certificate; certificate of participation in sport competitions, etc., failing to do so, may prevent you to have the right to write your final exam. Your **attendance** to each lecture and laboratory session is **mandatory** and will be recorded. You must notify your **attendance** shortly before the end of each class using the Zoom **chat** function.

### Lectures

Lectures will require the active involvement of students who will have to be prepared to make the necessary efforts to understand the topics covered and improve the skills passed on. Lectures are designed to help students in the laboratories, homework assignments, self-reflection, lifelong learning and projects. **Your *regular attendance in lectures is highly recommended*.**

### Laboratories

This component of the course will help students to familiarize with the technologies available in our different facilities. These technologies include 3D printing, Arduino hardware and software embedded system, IOS / Android UX mobile application development, and metal and polymer processing through tools such as drills, lathes and milling machines. The laboratories will be held at the new STEM (Science, Technology, Engineering, and Mathematics) complex. **Attendance at laboratories is mandatory and evaluated**. These laboratories will deal with the following seven topics:

1. Basic computer tools
2. Computer aided design (CAD)

3. Basic training on general machining
4. Arduino
5. Course project
6. Electronic soldering and laser cutting
7. Matlab

### Projects

This component of the course is carried out by students working in teams on a central theme that will be communicated at the laboratory. It is important to have a multidisciplinary and diverse team in which members have complementary skills. You will have project managers who will coach you and work with your team to help you achieve your goals.

### Assignments

This course component will be submitted individually by each student. Submission as a team is not accepted.

## Course Learning Outcomes

Upon completion of this course, the student will:

- Be able to understand and apply the basic methodology of engineering design,
- Describe the different steps of the design thinking model and apply it to successfully design real-world products,
- Acquire soft skills in time and project management, communication, teamwork and conflict management and apply in the practice,
- Acquire practical skills in standard machining tools and software for product development and be able to perform basic cost estimation of products.
- Improve your self-reflection and lifelong learning skills

## Evaluation Methods & Distribution of Grades

The overall marking scheme, which shows how the learning outcomes of the course will be evaluated, is provided in the table below.

| ***Course Components*** | ***Weight (%)*** |
|---:|:---:|
| Lecture Quizzes | 5 |
| Individual homework assignments | 5 |
| Laboratories & Lab Quizzes | 10 |
| Project Deliverables* | 35 |
| Client Evaluation | 5 |
| Midterm Exam | 10 |
| Final Exam | 30 |
| **TOTAL** | **100** |

* Your individual mark for project deliverables is calculated as follows:

- ***Individual factor*** = *average* (your project manager mark /average of project manager marks of your team, your peer evaluation rating/average of peer evaluation rating of your team)
- **Individual Project Mark** = team mark × individual factor

In order to maximize your marks in individual assignments and project deliverables, it is strongly recommended to read the **rubric** associated to each assignment and project deliverable available in the corresponding section in **Brightspace**. Homework assignments and deliverables must be submitted on due date. A **penalty of 25%** of the total mark of the homework assignment or deliverable will be applied per day of delay**.**

**Lectures Quizzes (5 %):** Five quizzes will be given during the lectures to assess your learning outcomes and to give you an idea of the types of questions asked during the midterm and the final exams. Despite the minimal percentage of these quizzes, you must treat them with diligence because they can be a real indicator of your performance in midterm and final exam and can also help you avoid unpleasant surprises at the mid-term and final exams.

**Individual Homework Assignments (5%):** You will have two individual homework assignments. The submission of your homework assignment to the teaching assistants is done through Brightspace. Each student must individually submit the homework assignment. The following table gives you a list of the assignments, their due date and their percentage compared to the total mark of the course.

| Individual Assignment | Due Date | Percentage |
|---|---|---|
| Personality assessment & team contract | 17 Jan. | 2.5 % |
| Peer feedback & Team dynamics 1 | 7 Feb | 0 % |
| Peer feedback & Team dynamics 2 | 13 Feb | 2.5 % |
| Final Peer feedback & Team Dynamics | 14 April | 0 % |
| | **TOTAL** | **5 %** |

**Laboratories & Quizzes (10 %):** You will have a series of laboratories during the first eight week designed to train you on the safe use of important prototyping equipment as well as some computer software used for product design, word processing and project management. There will be laboratory quizzes during laboratory sessions. There will also be lab reports to submit in Brightspace before the next lab session, all of which is an integral part of the learning process. You mark for laboratory will depend on your participation and submission (7%) and your preparation (3%). The following table presents the list of laboratories and the distribution of the 10% allocated to the laboratories and their quiz.

| | | | | Percentage | | |
|---|---|---|---|---|---|---|
| **Week** | **Laboratory** | **Location** | **Due Date** | **Attended** | **Prepared** | **Deliverable** |
| 1 (Jan 11-16) | **Lab 1:** Basic computer tools + Submission | Online | Before Lab 2 | .2 | .5 | 1 |
| 2 (Jan 17-23) | **Lab 2:** CAD | Online | | .21 | .5 | .5 |
| 3 (Jan 24-30) | **Lab 3:** MatLab + Submission | Online | | .21 | .5 | .5 |
| 4 (Jan 31-Feb 6) | **Lab 4:** Arduino + Submission | Online | Before Lab 5 | .21 | .5 | .5 |
| 5 (Feb 7-13) | **Lab 5:** Project | Online | | .21 | .5 | .5 |
| 6 (Feb 21-27)* | **Lab 6:** Project specific Lab | Online | | .21 | | |
| 7 (Feb 28-Mar 6) | **Lab 7:** Basic training | Online | Before Lab 8 | .21 | .5 | .5 |
| 8 (Mar 7-13) | **Lab 8:** Soldering + Laser | Online | Before Lab 9 | .21 | .5 | .5 |
| 9 (Mar 14-20) | **Lab 9:** Project | Online | | .21 | - | - |
| 10 (Mar 21-27) | **Lab 10:** Project | Online | | .21 | - | - |
| 11 (Mar 28-Apr 3) | **Lab 11:** Project | Online | | .21 | - | - |
| 12 (Apr 4-10) | **Lab 12:** Paper work | Online | | .2 | - | - |
| | | | | 2.5 | 3.5 | 4 |
| | | | **TOTAL** | **10 %** | | |

**Project Deliverables (35 %):** Groups of students will carry out the projects. Each group will be composed of five students. Each group must be formed before the end of the second lab session. There will be several intermediate deliverables until ***Design Day, April 8, 2021***. During the Design Day, you will present the product designed by your team to external judges, client, peers and the public.

**Project:** will be announced in class

- Team: Your team members will be in the same lab sessions as you.
- Client Meet: Each team or group will meet with the client three times to clearly identify the client's needs to better define the problem to be solved and to design the product that will best satisfy the client needs.
- Project Deliverables & Due Dates: The table below lists the project deliverables, their due dates ***(Sundays)*** and the percentage of each deliverable with respect to the total mark of the course.

| Project Deliverable | Due Date | Percentage |
|---|---|---|
| PD-A: Team formation & Team contract | 24 Jan. | 0.7 % |
| PD-B: Needs identification | 31 Jan. | 1.75 % |
| PD-C: Design Criteria | 07 Feb | 2.8 % |
| PD-D: Conceptual Design | 21 Feb | 1.75 % |
| PD-E: Project Schedule & Cost | 28 Feb | 2.8 % |
| PD-F: Prototype 1 & Customer feedback | 07 Mar | 3.5 % |
| PD-G: Prototype 2 & Customer feedback | 14 Mar | 4.2 % |
| PD-H: Prototype 3 & Customer feedback | 28 Mar | 5.25 % |
| PD-I: Design Day (DD)<br>Materials submission of DD | **8 Apr.**<br>6 Apr. | 5.25 % |
| PD-J: Final presentation<br>Submission in Brightspace | 7, 12,14 Apr<br>6 Apr | 3.5 % |
| PD-K: User Manual | 14 Apr | 3.5 % |
| | **TOTAL** | **35%** |

**Client assessment (5%):** This component is the assessment made by your client about your product and your solution to the design problem

**Mid-term Exam (10 %):** The mid-term exam will cover all topics taught before the reading week. It will take place on *February 12, 2021 (subject to change)*.

**Final Exam (30 %):** The final exam will cover all topics taught during the entire term. It will take place online between *April 16 to 19 (Ottawa time) online*. Please check the university website for updates.

## Office Hours

Consultation with teaching staff will be by appointment. You simply send an email to the teaching staff you request. Contact information of the teaching staff is available on the course introduction lecture on BS. In the "subject" field of your email, always fill the subject filed of your email followed by your course code and laboratory session (example: Appointment request – **GNG1103-C01**).

## Academic Regulations

Academic regulations of the Faculty of Engineering of the University of Ottawa can be found through the following link. https://www.uottawa.ca/administration-and-governance/policies-and-regulations

Please note especially:

**Course attendance:** Your presence in class and labs is mandatory. According to the rules, you cannot write the final exam if you have not been present for **at least 80%** of classes and labs.

**Course requirements:** You must complete all course requirements - quizzes, assignments and project deliverables, mid-term exam and final exam - to receive a grade in the course. Otherwise you may receive the grade "INC" (incomplete).

**Academic fraud/plagiarism:** All work submitted in this course and counting for the grades must be the individual work of the student (exception: teamwork on the project). Any other work is considered plagiarism. Please consult the academic fraud regulations online at the following address: https://www.uottawa.ca/administration-and-governance/academic-regulation-14-other-important-information. Note that as an engineering student, you are enrolled in a program that leads to a professional engineering degree. The same standards of ethical conduct required of this profession are expected in this course.

**Online academic integrity:** By taking this course, you **agree** that you understand the importance of professional integrity in your education and future career in engineering or computer science and therefore certify that you **abide** to the academic integrity of the University of Ottawa.