Comprehensive Course Syllabus
Engineering (SCI-455)

Course Description

Engineering's curriculum is centered on the goal of problem solving. Students get hands-on experience studying problems, working on teams to design solutions and constructing their designs. Students will be introduced to this process through a variety of projects which include a styrofoam boat, an airplane, a crane, a CAD project that can then be constructed on campus 3-D printers, and a programmable robot. Long-term projects can be from any branch of engineering but must be related to one of the UN Sustainable Development Goals according to the project guidelines. Students also learn about the engineering profession by interviewing an engineer and reporting on their findings.

Instructors

Teacher	Dr. Mark Carlson	Dr. Eric Hawker
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Class schedule	BD 5-6	A/C 7-8
Office hours	ABCD 11:00-1130 or by appt.	By appt.

Text(s) / Materials

- No text required.
- Students will receive handouts and online resources via Moodle.
- Notebook of Engineering: Students are to take notes on introductory lessons. Students should also take notes when reviewing handouts and resources. Notebook may be used for the unit test.

Essential Content

Students studying science at IMSA engage in the process of scientific inquiry by:

A.1 applying the skills of observation (describe, compare, and contrast characteristics; identify parameters, precisely observe phenomena) and accurately record findings. [IL-11.A.5a; IL-11.A.5c][NSES-A]
A.2 designing and planning investigations and constructing questions which further understanding, forge connections, and deepen meaning. [IL-11.A.5b][NSES-A]
A.3 carrying out investigations that develop skills, concepts, and processes that support and enable complex thought. [IL-11.A.5c][NSES-A]
A.4 using appropriate technologies to collect, analyze and present information. [IL-11.A.5c][NSES-A]
A.5 employing scientific reasoning to evaluate the soundness and relevance of information. [IL-11.A.5e][NSES-A]
A.6 supporting judgments and constructing models based on evidence. [IL-11.A.5e][NSES-A]
A.7 sharing results by communicating orally, in writing, and through display with power, economy, and elegance. [IL-11.A.5e][NSES-A]
A.8 examining current issues in science and technology. [IL-][NSES-G]

Next Generation Science Standards

HS-ETS1-1.	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2.	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3.	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
HS-ETS1-4.	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Student Learning Objectives

The goals of this course are:

- *To develop an understanding of what engineers do.*
- *To learn about the different fields of engineering.*
- *To understand the variety of functions an engineer may perform.*
- *To examine how science and math principles naturally connect to engineering.*
- *To learn the value of working independently and as a member of a team to achieve an engineering goal.*
- *To learn technical skills such as crimping, soldering, and the use of test equipment.*

This course will require the student to integrate information, solve problems and engage in authentic inquiry to achieve these ends.

SSLs and Outcomes

I. **Developing the Tools of Thought**

A. Develop automaticity in skills, concepts, and process that support and enable complex thought.
B. Construct questions which further understanding, forge connections, and deepen meaning.
C. Precisely observe phenomena and accurately record findings.
D. Evaluate the soundness and relevance of information and reasoning.

II. **Thinking About Thinking**

A. Identify unexamined cultural, historical, and personal assumptions and misconceptions that impede and skew inquiry.

III. **Extending and Integrating Thought**

A. Use appropriate technologies as extensions of the mind.
B. Recognize, pursue, and explain substantive connections within and among areas of knowledge.
C. Recreate the beautiful conceptions that give coherence to structures of thought.

IV. **Expressing and Evaluating Constructs**

A. Construct and support judgments based on evidence.
B. Write and speak with power, economy, and elegance.
C. Identify and characterize the composing elements of dynamic and organic wholes, structures, and systems.

V. **Thinking and Acting with Others**

B. Make reasoned decisions which reflect ethical standards, and act in accordance with those decisions.

Instructional Design and Approach

This course is problem-centered in nature. Students will be given tasks/problems and will need to craft ideas to solve their task/problems. Work in this class requires students to integrate information from previous math and physics courses. Many of the tasks in the course require students to work as a member of a team. Students will learn physical concepts underlying their project designs. Students will maintain a notebook to assist in this regard. There will be a test to assess each student's knowledge of these principles.

Student Expectations

Students are expected to follow the safety, attendance, and tardy policies of the Academy. If a student is more than 5 minutes late for class, it will be recorded as an unexcused absence. In terms of academic performance, they are expected to come to class prepared to present their work, critique the work of others, and engage in classroom discourse. All IMSA materials and equipment will remain in the classroom unless given permission by the instructor. Perform only those experiments authorized by the instructor.

Ethics

Honesty is a key component of scientific work, whether on the forefront of scientific research or in an IMSA laboratory. The practices (both good and bad) that are learned in an IMSA lab greatly influence your education. Consequently any violation of the honesty policy is considered a serious offense.

Examples of Violations:

1. Falsification of data; fabricating or changing data in your notebook or formal reports. NOTE: It often happens that, in performing an experiment, "obviously" bad data is obtained. It is NOT acceptable to simply discard the suspect data; however, you should include a short note or explanation of why you are disregarding the data.
2. Plagiarism: representing another's work as your own; submitting written reports with sections directly or indirectly quoted from another source without referencing that source.

Working Together, where to draw the line:

In projects done with partners, it is expected that you will share data and observations. It is expected that you will always discuss the project and exchange ideas with your partner(s), other students, your instructors, etc. However, unless specifically told otherwise, each report is an **individual report/journal entry**. By signing your name to it, you testify that the ideas, calculations, results, discussions and conclusions are yours alone, except as referenced. Copying, borrowing, lending or sharing of the words and work of or with another, (directly or by paraphrasing) is plagiarism. Simply put, all intellectual exchanges **before** writing the report are acceptable. Unreferenced use of another's written material or joint production of a written report is not acceptable, unless you are specifically told to write a group report. Consequences of violating these rules are explained in the student/parent handbook.

Assessment Practices, Procedures, and Processes

Student grades in Engineering are based on class participation, project work, and other written work. Class participation is critical. Unexcused absences will negatively impact grades. When an assignment has been collected, it may be submitted for late credit at a 10% penalty per day. Once the teacher has returned material that has been assessed, it cannot be submitted for late credit.

Please note: Point values and totals are approximate and subject to change by instructor.

Class participation and clean-up (~30 pts distributed in the short & long term projects):

- Based on attendance, faculty and peer assessment, active participation in all classes, and in all group projects, including assigned tool bin maintenance and workspace clean-up. Unexcused absences and tardiness negatively impact participation as the student is unavailable for the interactive group work which takes place every class, frequently at the start of the period.

Project and written work (155 pts) Anticipated projects may include:

- Boat (25 pts)
- Interview an Engineer (10 pts)
- Airplane (25 pts)
- Crane (25 pts)
- Revision project (35 pts)
- CAD/3D Printer (10 pts)
- Robot (25 pts)

Final/Major Project (70 pts)

Quizzes (15 pts)

Final Exam and Notebook Check (45 pts)

Assessment Scale for Assignments

A (90 % - 100 %)	Work that exceeds expectations
B (80 % -- 89 %)	Work that meets expectations
C (70 % -- 79 %)	Work that is below expectations but still passing
D (0 % -- 69 %)	Does not meet expectations and is not passing

Grading Scale for Quarter and Semester Grades

A- (90.0 % - 92.4 %)	**A (92.5 % - 100 %)**	
B- (80.0 % - 82.4 %)	**B (82.5 % - 87.4 %)**	**B+ (87.5 % - 89.9 %)**
C- (70.0 % - 72.4 %)	**C (72.5 % - 77.4 %)**	**C+ (77.5 % - 79.9 %)**
D (0.0 % - 69.9 %)		