

# Introduction to Engineering and Design

## A. DESCRIPTION

This course is an introductory exploration of the engineering design process through a “hands-on” project approach supported by instruction of the underlying engineering concepts. Appropriate computer-based modeling software will be employed in the design process. Since proper communication of an engineer’s results is critical, there is emphasis on technical writing. The course is for either those planning to major in engineering, or those who wish to know more about the discipline.

Students who successfully complete the course will receive two credit hours of transfer credit for the course ENGR 111. This course may be applied to the IIT engineering curriculum as an elective; however, completion does not guarantee admission to IIT for a degree program of study. Credits also may be transferable to other colleges and universities.

## B. PREREQUISITE

One-year high school level physics and Algebra II

## C. ORGANIZATION

The engineering design process will be modeled by presenting a suitable engineering challenge. Through lecture, discussion, and problem-solving, students will acquire the understanding of the engineering concepts and skills necessary for all requirements of the challenge. Students will spend considerable time in project work.

## D. COURSE OBJECTIVES

- To understand what engineering is and how the work of an engineer differs from that of a scientist.
- To introduce the engineering design process through selective design challenges.
- To understand the corresponding engineering concepts needed to successfully complete the design challenges.
- To understand the role of computer-based modeling as an essential tool in the engineering design process.
- To introduce technical writing as part of the design process.
- To introduce ethnics as applied to engineering.

## E. COURSE TOPICS

There are two design challenges—given a set of constraints (1) design and construct a model rocket to achieve maximum altitude and (2) design and construct a truss-type bridge for maximum loading.

*In doing so, the course will cover the following—*

- The engineering design process
- The engineering process as compared to the scientific method
- Technical writing
- Engineering ethics

*Specific to the rocket challenge—*

- Newton’s laws of motion
- Aerodynamic torque
- General forces on a rocket
- Center of gravity
- Thrust
- Aerodynamic drag
- Center of aerodynamic pressure
- Static stability
- Dynamic stability
- RockSim v9.1 simulation software

*Specific to the bridge challenge—*

- Structural strength
- Stress and strain
- Elastic Moduli
- Non-truss rigid bodies
- Analysis of truss external forces
- Determining internal truss forces by method of sections
- Determining internal truss forces by method of joints
- Internal forces and moments in beams
- Bending stress
- Torsion
- Bending and breaking of beams
- ModelSmart3D simulation software



## F. TENTATIVE SCHEDULE

### Week 1

- The engineering design process
- Physics of rocketry
- RockSim v9.1 simulation software
- Design and construction of rocket

### Week 2

- Introduction to technical writing
- Continue physics of rocketry
- Finish construction of rocket

### Week 3

- Launch
- Unit test
- Structures and structural forces

### Week 4

- ModelSmart3D simulation software
- Continue structural forces
- Design and construction of a model bridge

### Week 5

- Continue construction
- Test bridge to maximum loading
- Engineering ethics – guest speaker
- Unit test

## G. TEXT

Teacher supplied.

## H. GRADING

This a credit course with the following graded components.

- Project work – 50%
- Two written unit tests – 40%
- Writing assignments – 20%

## I. IDEA SHOP EXPECTATIONS

In reading this syllabus, it is obvious a lot will be covered in a short period. It is expected that the students be focused and value and respect this experience.

*A few rules—*

- No texting, music, emailing, or iphone use during lectures and discussions. However, you may listen to music with headphones, while working on projects.
- No food or beverages.
- Strictly observe all safety rules. If you have a question—ask.
- Project time is meant to be spent working on the design challenges. It is not free time. If you fall behind the pace of the class, it will be difficult to get back on schedule—really difficult.

Have some fun in this course.

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**Class Hours:** Tuesdays and Thursdays, 10:00 a.m. to noon, 7/10–8/9

