MIT WOMEN'S TECHNOLOGY PROGRAM
2 WEEK PROGRAM IN MECHANICAL ENGINEERING

Sparking interest in the future study of engineering

The Women's Technology Program (WTP) inspires talented high school students, particularly those who may not have previously considered engineering, to pursue engineering in college and beyond.

WTP is a women-focused transformative two-week program at MIT for students who excel in math and science but have limited experience in mechanical engineering.

The immersive experience enables them to explore the discipline through hands-on, team-based projects. Participants brainstorm innovative solutions and build projects, all while developing crucial skills in problem-solving, teamwork, and creative thinking.

Unique in its design, WTP focuses on academic growth by encouraging students to take chances without fear of failure.

Grounded in research-based teaching methodologies, participants dive into dynamic, active learning activities. This approach transcends traditional teaching and learning, helping to build confidence in the high school participants.

By nurturing the next generation of engineers from diverse gender backgrounds, the program not only promotes equity but also enhances the engineering field with a wide range of perspectives and ideas. This diversity is crucial for driving innovation and solving complex challenges in today's world.

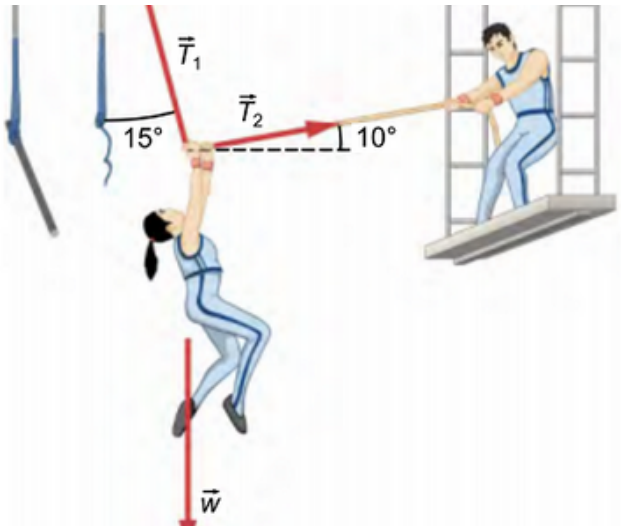
Week 1	Week 2
Monday • Physics: Forces • Drawing • Foam Cutter Build	**Monday** • Rotational Motion • Coding • Rube Goldberg
Tuesday • Materials • Energy/Momentum • Brainstorming	**Tuesday** • Rube Goldberg • Engineering showcase
Wednesday • Electronics • Shop Tour • Maker Activity	**Wednesday** • Rube Goldberg
Thursday • Motors & Gears • Static Torque • Glass Lab Tour	**Thursday** • Rube Goldberg
Friday • Rube Goldberg Prototyping • Structures • Crane Building	**Friday** • Rube Goldberg Public Demo and Movie Creation
Saturday/Sunday • Museum of Science • MIT Museum	**(Almost) Daily** • Lunch talks by local engineers

Dr. Barbara Hughey
WTP Director

Coursework

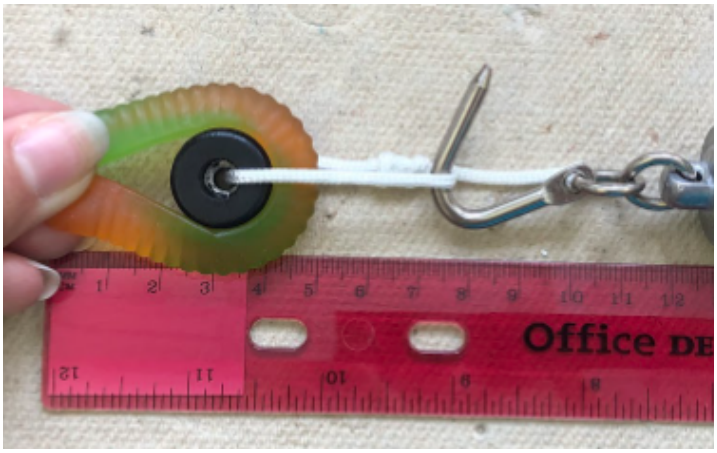
Program Overview

Students are invited to take part in their own active learning



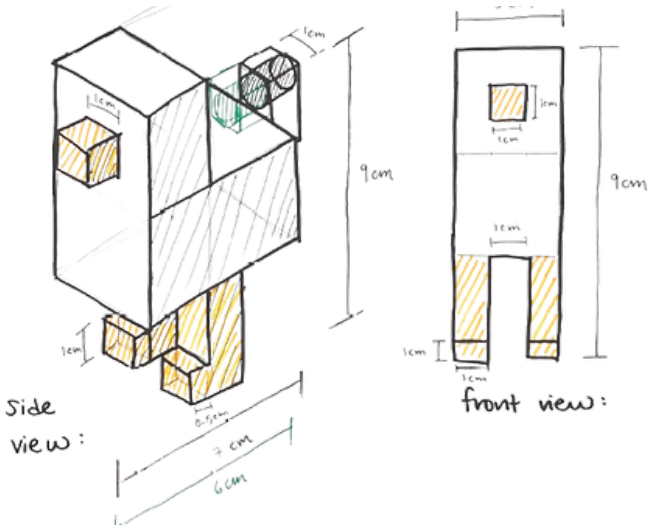
Drawing

1. Understand the purpose and value of sketching
2. Understand the purpose and value of technical drawing
3. Read and create dimensioned drawings



Forces and Free Body Diagrams

1. Become familiar with identifying and organizing relevant information in engineering problems
2. Become familiar with making assumptions and modeling real systems
3. Understand how to analyze physical systems of forces

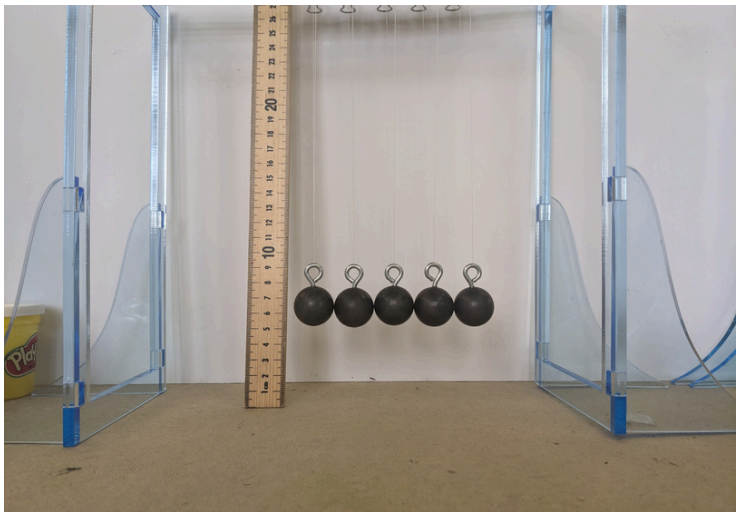


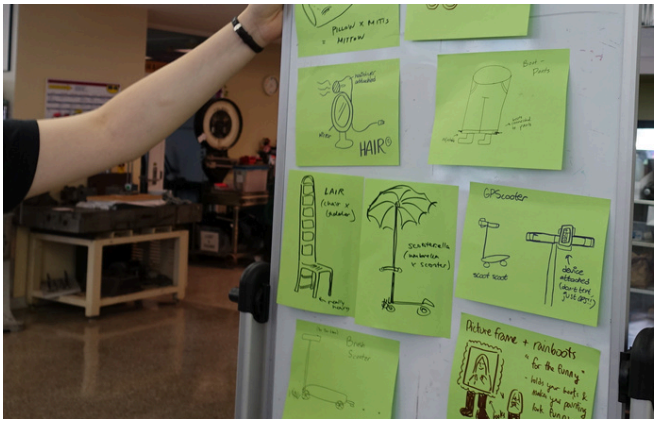
Materials

1. Understand, calculate, and estimate stresses and strains
2. Identify elastic and plastic deformation
3. Characterize a material by its stress and strain relationship

Energy and Momentum

1. Describe the relationship between mass, velocity, linear momentum, and energy
2. Analyze how mass, velocity and linear momentum, and energy change in different types of collisions
3. Design systems of objects and predict how they will behave



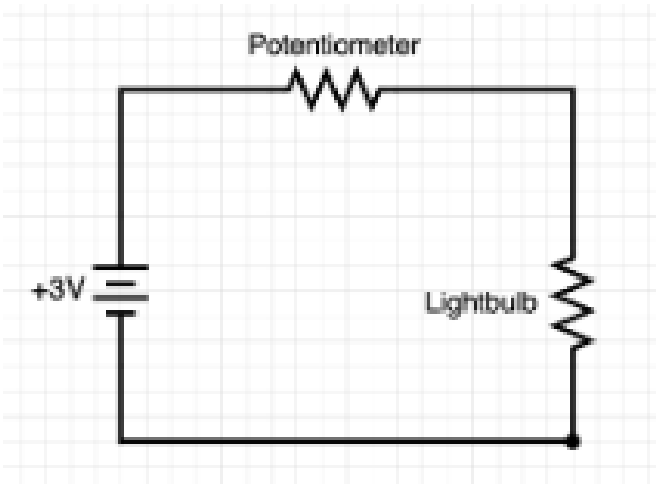


Creativity and Brainstorming

1. Enhance creativity and problem-solving skills
2. Become familiar with the engineering design process
3. Become familiar with the idea generation process

Electronics & Circuits

1. Understand the concepts of resistance and power in circuits
2. Learn about different configurations of circuits
3. Understand how to create simple circuits



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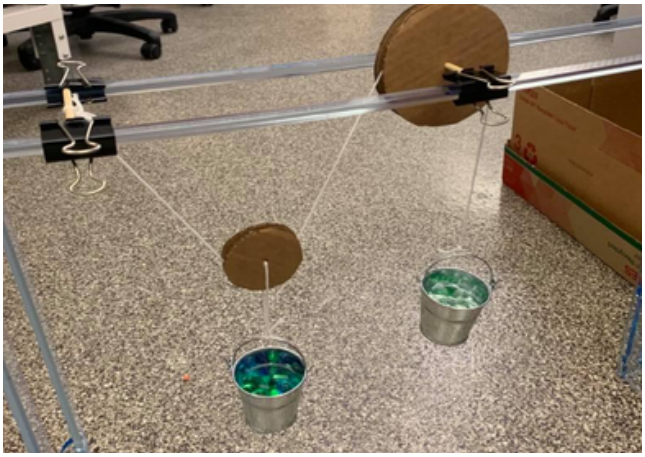
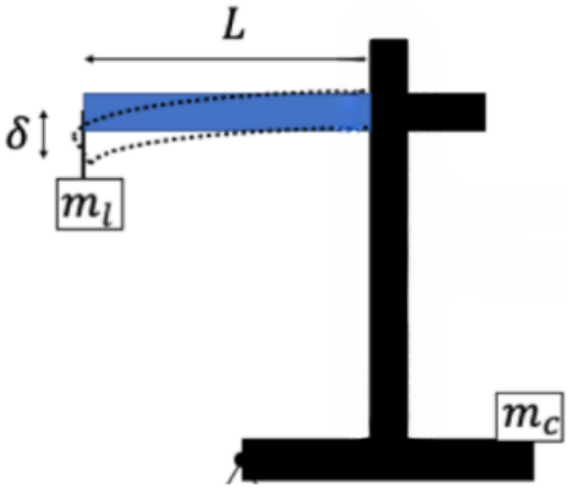
Motors and Gears

1. Learn basic principles of a DC motor
2. Select an appropriate DC motor
3. Understand gear ratios



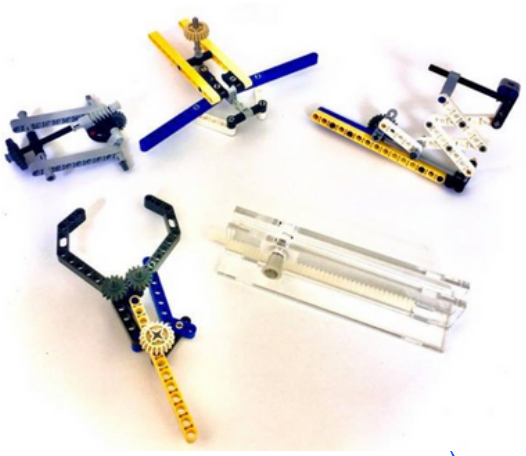
Static Torque

1. Describe the connection between forces and torques
2. Find the magnitude and direction of a torque.
3. Analyze simple static equilibrium problems using FBDs, and create similar real life systems that behave as expected



Structures

1. Determine reaction forces and moments at beam supports
2. Compare area moments of inertia between different shaped beams
3. Compete the deflection from bending of a beam



Rotational Motion

1. Identify when to use polar coordinates and use them to find angular displacements, velocities, and accelerations.
2. Use periods and frequency to describe and design rotational systems.
3. Gain intuition for moments of inertia and understanding of how a large or small moment can affect the dynamics of a design.

Coding - Applying Equations to Real Systems

1. Explore diverse applications of computation
2. Use computation to balance competing requirements
3. Use numerical computation to predict performance from equations

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 MAKE PLOTS
or d, ax in zip(d_values, axs.flatten()):
 # plot horizontal and vertical centerlines
 ax.hlines(y = 0, xmin = -R, xmax = R, linewidth =
 ax.vlines(x = 0, ymin = -R, ymax = R, linewidth =

 # plot spirographs
 x, y = spirograph(R, r, d) # calculate the x- and
 color = random_RGB()       # sample a color by ca
 ax.plot(x, y, color = color, lw = 3)

 ax.set_box_aspect(aspect = 1) # make sure the plo
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Workshops and Tours

Foam Cutter Build

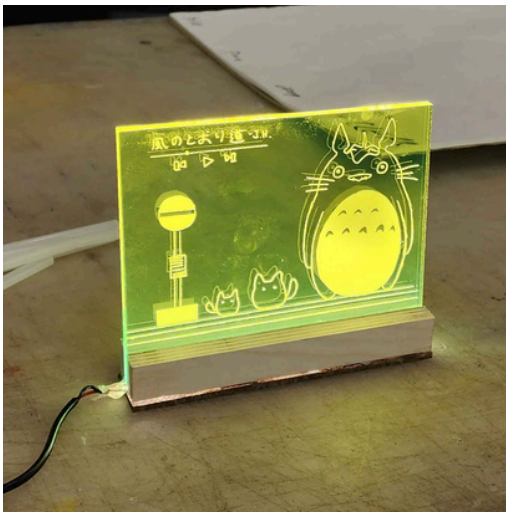
Students gain confidences in their maker skills while building a hot wire foam cutter

Shop Tour

Students receive a tour of the Pappalardo Lab and learn about the different machines and what kinds of manufacturing processes they perform.

Maker Activity

Students learn how to use band saw and disk sander and laser cutter while building a lit acryilic stand.



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Glass Lab Tour

Students receive a tour of the MIT glass lab and the Department of Material Science and Engineering Blacksmithing shop.

Crane Building

Students apply theoretical structures knowledge to physical design, practice their creativity and brainstorming skills in a group setting, and learn about the limitations of theoretical calculations in practice while building foam cranes

Engineering Showcase

Students meet local engineers and learn about their work.

WTP

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Rube Goldberg Design Challenge

In this capstone project, students apply their knowledge from coursework to build a Rube Goldberg Machine, a complex machine that performs a simple task. Students also get to apply their maker skills and gain confidence in their ability to perform hands on work in teams.

Example Schedule

Week 1

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning	Overview of Program Physics: Static Forces Make Foam Cutter	Materials Energy & Momentum	Electronics & Circuits Safety Talk with Shop Tour	Motors & Gears Static Torque	Rube Goldberg Brainstorming Structures
Lunch	Lunch Talks				
Afternoon	Forces Problem Solving Intro to Drawing	Creativity, Brainstorming, Prototyping RG Brainstorm & Prototype (Materials + Energy & Momentum)	Maker Activity RG Brainstorm & Prototype (Electronics & Circuits)	**Glass Lab & DMSE TOUR**	Cranes Activity and Pizza Dinner
Evening					

Week 2

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning	Rotational Motion Programming: Applying Equations to Real Systems.	Step Sheet Review & Start Building Building steps in pairs	Building steps in pairs Connect each pair of steps	Connect Steps, Test, Redesign, Re-test Test, Redesign, Re-test	Cleanup, mount cartoon & Step Sheets Public Demo (5 machines x 2 times each) Create Movies of RG Machines
Lunch	Lunch Talks				Watch RG Movies During Lunch then presentation of certificates
Afternoon	Brainstorm full machine, design wood structure, and create step sheets	Engineering Showcase	Subteams start connecting pairs of steps to other subteams to make complete machine	Testing & Runoff	Free Afternoon to Explore Boston & Cambridge!