Do you know a bright, curious student who sees possibilities they can create with science, technology, engineering, and math?

That student may be a perfect fit for the Beaver Works Summer Institute, a four-week virtual program that challenges high school students to tackle high-tech projects.

In 2024, Beaver Works Summer Institute (BWSI) will offer the following courses

We are determining which will be in-person or virtual and will announce in 2024:

Autonomous RACECAR Grand Prix

Program the artificial intelligence for a self-driving 1/10th scale car and race it against other teams in an autonomous Mini Grand Prix.
**Explore.. Learn.. Race!**

Autonomous Drone Racing

Take autonomy airborne using on-board sensors to process visual cues from the world around our drones. You'll program the drone to detect and avoid obstacles as well as read QR codes. Your team's code will guide the UAV through a challenging environment – where each team will have the opportunity to show off what they've learned.

E-Textile Wearable Technology

Learn about textile and apparel manufacturing and electronic prototyping while creating your own piece of wearable technology.
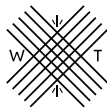
Underwater Autonomous Vehicle Challenge

Learn the challenges faced by real-world ocean engineers in designing, building and programming autonomous underwater vehicles (AUVs). The cu will autonomously navigate an underwater obstacle course, applying real-time decision making based on feedback from onboard sensors.

Autonomous Cognitive Assistant*

CogWorks uses project-based learning to immerse students in exciting applications of modern machine learning and data science. The central ethos to this course is that impressive projects can be completed without depending on "mystery boxes". All lectures are paired with detailed Python-based exercises that

incorporate both applied mathematics and basic algorithms. Student teams complete capstone projects they help select, using tools like git and VSCode to collaborate together.

Quantum Software

BWSI and MITRE are preparing the next generation of scientists and engineers to take advantage of the opportunities that the quantum revolution will bring. The course starts with the fundamentals of quantum information, takes students through the concepts underlying quantum computation with hands-on coding exercises, and concludes with the challenge of implementing a quantum algorithm as a software program so it can be tested, analyzed, and run.

Embedded Security and Hardware Hacking

This course by MITRE aims to start the education of the next generation of security engineers — teaching fundamental computer engineering in addition to cryptography, cybersecurity, and system security. Topics covered include microcontrollers and device architecture, low-level programming, protocol design, cryptography, software security, and hardware security. A hands-on approach gets students working with hardware during lab exercises. Students will also work in teams to design and build a secure system in an attack and defense style exercise, targeting other team's designs once theirs is completed.

Medlytics: Data Science for Health & Medicine*

In Medlytics, short for medical analytics, students learn to apply machine learning approaches to real medical problems: predicting hypothyroidism in patients, using physiological signals to classify sleep states, and spotting cancer from x-ray images. Using these problems, we can motivate and demonstrate a wide range of machine learning approaches, including decision trees, support vector machines, and convolutional neural networks, applying these skills to solve a team-selected challenges.

Cyber Operations

Cyber Operations students will learn how to protect access, users, data, or network assets while denying the same to oppositional forces in the digital domain. Students are introduced to topics in a crawl-walk-run manner through labs and projects. Cyber Ops is taught through a fusion of lecturers from MIT Lincoln Laboratory as well as special guest lecturers from industry to contribute real experiences. Cyber Ops concludes with a capstone event where students must plan, research, execute, and present analysis on forensic artifacts or penetration-test.

Serious Game Design and Development with AI

SGAI introduces students to game design and artificial intelligence programming their own modifications to a game. Known as "Serious Games" this provides a way to better understand various real-world situations such as disease spread, self-driving cars and more! Artificial intelligence is used to investigate how a computer will handle the moral dilemmas that will happen and compare to human decisions in the complex environments modeled.

Unmanned Air System Synthetic Aperture Radar

Don't just fly a drone – turn it into a high-tech sensor! Experience complex systems engineering in a new way. Students will build a fully functioning radar imaging system including everything from drones and RF hardware to data processing. At the end of this course, students will have built a complex system to be proud of and gained first-hand experience in the world of engineering.

Microelectronics and Hardware Development

This course for 2024 will introduce students to the fundamentals of hardware system design and show how hardware developers approach problems and think like engineers. Students with no prior experience in hardware are encouraged to participate.
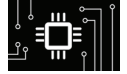
Remote Sensing for Disaster Response

This course covers remote sensing, image processing, network science, and deep learning for emergency management applications using Python to process different sources of imagery and data sources in response to disaster situations. The final project is a simulated hurricane scenario that takes place over several days, where the students must predict storm impacts, make evacuation decisions, analyze post-storm aerial imagery, and develop supply routes, all in a 1-hour press conference documenting their response. The class teaches programming, data science, and teamwork skills in the critically important domain of emergency management.
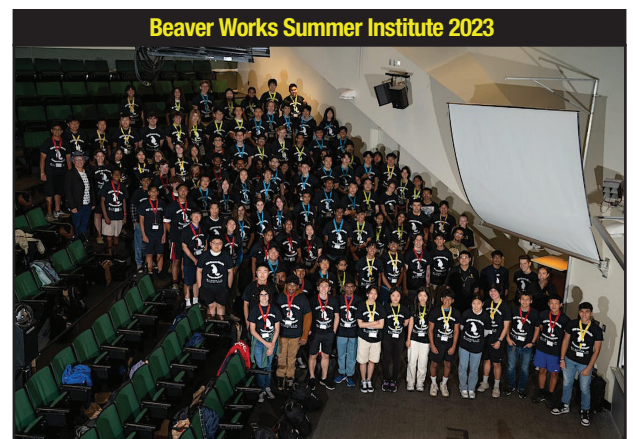
Basics of ASIC

BWSI and MITRE will offer this course on open source semiconductor design and fabrication of Application Specific Integrated Circuits (ASICs). This course will give students a fundamental and working knowledge of the building blocks of today's electronic world — knowledge that will benefit the student no matter what they decide to pursue academically. Students will receive hands-on experience on how to design and arrange semiconductors on a nanometer scale to perform a specific function.

* Tentative

Beaver Works Summer Institute 2023

BWSI Class of 2023
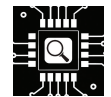
Students are eligible for the 2024 summer program if:

- They are attending high school in US or US citizen abroad
- They have demonstrated technical ability (evidenced by recommendations from school officials, test scores, coursework, grades, and extracurricular activities)
- They have completed the lessons in the online tutorial for their desired project
- Online tutorials starts February 2024 (prerequisite in order to apply to the July program)
- BWSI runs July 8 – August 4 2024

To get more information and to apply, visit:
https://beaverworks.ll.mit.edu/CMS/bw/BWSI
or email: bwsi-admin@mit.edu

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