THE CODING SCHOOL

Training the diverse STEM leaders, innovators, and builders of tomorrow

2024 - 25 ACADEMIC COURSE CATALOG

ABOUT

THE CODING SCHOOL

The Coding School is an international non-profit that specializes in K-16 education in the emerging technologies of classical coding (codeConnects), quantum computing (Qubit by Qubit) and machine learning (TRAIN). Whether held virtually or in-person, our programs are always taught with live instruction from experts in their fields. We offer two (year-long) academic courses, summer camps, summer research, internship programs, and teacher professional development.

www.the-cs.org

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WHY CHOOSE US?

We've taught over 50,000 students across all 50 states and in over 130 countries

100% of partner schools say our courses were a valuable learning experience

96% of students feel more confident in their STEM skills after taking our courses

QUBIT X QUBIT

Qubit by Qubit is an initiative of The Coding School. In partnership with leading quantum experts and sponsored by Google Quantum AI we're bringing quantum computing out of the lab and into classrooms around the world through age-appropriate, engaging, and innovative programs.
To learn more, please visit:
https://www.qubitbyqubit.org

Google Quantum AI

TRAIN

TRAIN is a program of The Coding School, a first-of-its kind initiative, sponsored by the Department of Defense (DoD), dedicated to making artificial intelligence (AI) and machine learning (ML) more accessible to K-12 students.

To learn more, please visit:
https://the-cs.org/train

Department of Defense
DoDSTEM
Science · Technology · Engineering · Mathematics

Thanks to our sponsors, our two, year-long courses are FREE to all students at a partnering high school

About Our Courses

COURSE OVERVIEW

TCS offers two, year-long academic courses: *Introduction to Artificial Intelligence* and *Introduction to Quantum Computing*. Our courses are two-semester, for-credit, introductory-level courses taught virtually with live instruction and are designed to be accessible for high school students grades 9-12. For both courses, schools can opt to offer either semester 1 only or semesters 1 & 2. Our courses are taught by experts in their fields with teaching assistants from leading universities.

September 2024 - April 2025
Semester 1: Sept - Dec 2024 **Semester 2:** Jan - Apr 2025

COURSE REQUIREMENTS

The courses consist of weekly lectures, labs, and homework, requiring approximately 3-5 hours of work per week.

- **Lecture** = 1.5 hours/week. Schools typically split recordings into two 45 min. class periods
- **Lab** (small group) session = 1 hour/week typically offered Tuesday - Friday 9am-10pm EST and Saturdays at various times
- **Homework** = 45 min. to 1.5 hours/week

Prerequisites:

- *Introduction to Artificial Intelligence* = **NONE**
- *Introduction to Quantum Computing* = **Geometry**

COURSE DESCRIPTIONS

The ***Introduction to Artificial Intelligence*** course will cover concepts from basic linear algebra to Python coding, to data manipulation to "Deep Learning," a subfield of ML inspired by the structure and function of the brain.

The ***Introduction to Quantum Computing*** course will cover concepts from Python coding basics to the "weird" physics properties of quantum mechanics. By the end of this course, students will be able to code quantum gates and circuits, understand quantum algorithms, and even run code on a real quantum computer.

Both courses will feature national lab tours and career path panels making them excellent courses for ICAP (Individual Career Academic Plan).

COURSE IMPLEMENTATION

Bring this course to your school

Our partner schools have successfully offered our year long courses in several ways, such as:

Independent Study

- If your school has an independent study or STEM Capstone model already in place, your students can enroll in our courses as their independent study course.

Elective Course

- Similar to home economics, choir or sports, you can add our courses as an elective course at your school and allow your students to expand on their STEM knowledge.

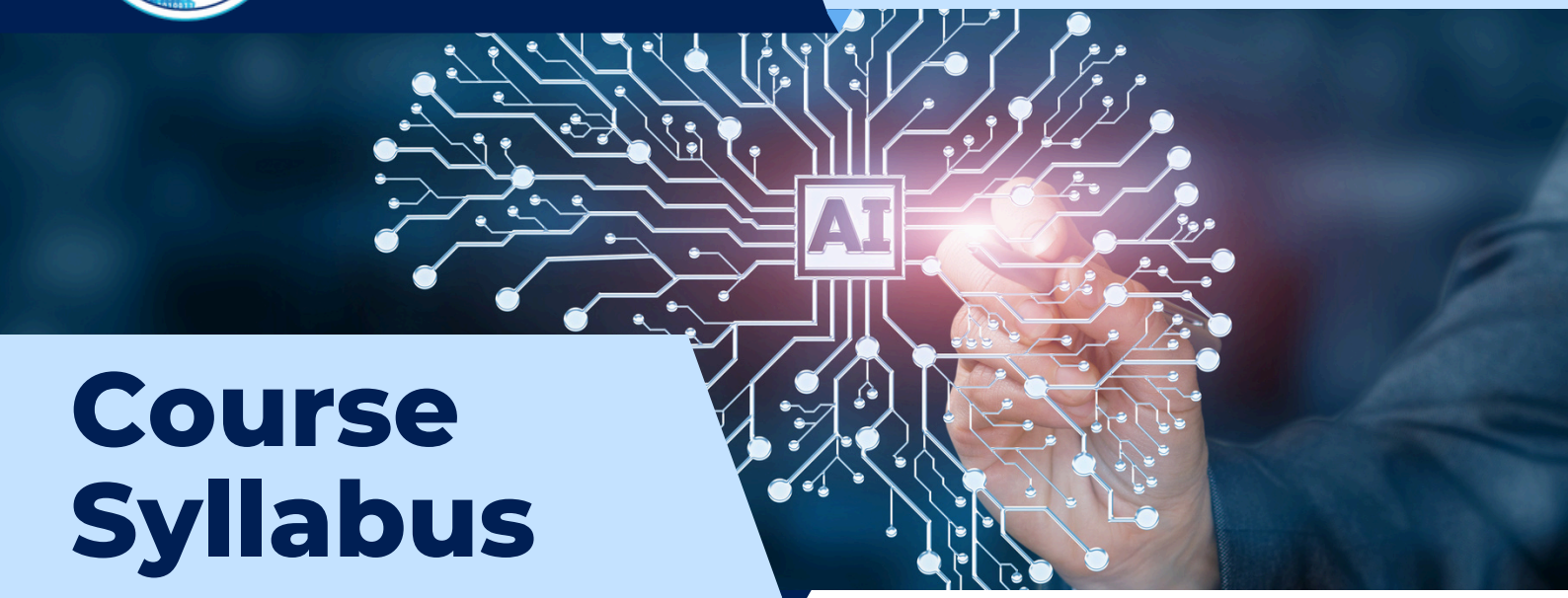
Course Catalog

- **Add our courses to your course catalog** as a computer science, math or science course.
- Dedicate a specific period during the school day with a teacher/advisor from your school to provide additional support and/or hands-on activities for the course.
  - Most schools choose to split the recorded lecture into two 45 min. class periods each week, go over weekly homework assignments as well as offer additional related hands on activities in the remaining weekly class periods, and have students participate independently in a lab section.
  - If a school has more than 20 students enrolled in the course, TCS will consider offering a lab section during the school's specified class period so that all students can participate in the live lab session together during the school day.

All TCS Courses are Nationally Accredited By:

WASC ACCREDITING COMMISSION FOR SCHOOLS

We offer University of California (UC) A-G approved courses



Course Syllabus

Introduction to Artificial Intelligence

SEMESTER 1:

Focused on building a strong understanding of the core principles and techniques used in data science and machine learning.

- Computer science and Python fundamentals
- Data analysis and visualization
- Linear regression
- The machine learning process
- Supervised machine learning models

SEMESTER 2

Focused on building upon Semester 1's foundation with advanced topics and practical applications of artificial intelligence. Units covered in semester two include:

- Computer vision
- Natural language processing
- Training a Neural Network
- Bias in AI
- Capstone Projects

For both courses, students may enroll in either Semester 1 or both Semesters 1 and 2

Course Syllabus

Introduction to Quantum Computing

SEMESTER 1

Focused on the foundational knowledge and skills necessary for understanding quantum computing, including math, programming, and physics concepts required to do so. Example topics include:

- Foundational topics in quantum mechanics, including qubits, superposition, and entanglement
- Classical Computing & Computing Logic
- Introduction to programming in Python and Cirq, Google's quantum programming language

SEMESTER 2

Focused on building upon Semester 1's foundation with explorations of near-term quantum computing, advanced topics, and practical applications of quantum computing. Example topics include:

- Math for Quantum Computing: Vectors, Matrices, Probability, Complex Numbers
- The Qubit and Bloch Sphere
- Gates, Measurements and Quantum Circuits
- Quantum algorithms and protocols: Quantum Key Distribution and Grover's algorithm
- Classical vs Quantum Algorithms
- Experimental Metrics, Implementation, and Quantum Hardware
- Capstone projects