

LINC 78D: PHYSICAL COMPUTING FUNDAMENTALS

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2021
Units:	2
Hours:	2 lecture per week (24 total per quarter)
Advisory:	Basic computer skills and knowledge of Macintosh or Windows operating systems; familiarity with web browsers, email, downloading, and uploading.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Description

This introductory makerspace-oriented course covers the foundational components of physical computing, specifically as it relates to makerspace projects and activities. Participants will build and use a basic computer by connecting circuits, creating inputs and outputs, writing code, and programming physical devices to interact with users. Computational and design thinking practices will be emphasized throughout. Participants will gain a fundamental knowledge of the form and functions of computers, as well as the ways in which computers can solve simple and complex problems. Practical skills include model construction, circuitry, algorithm design, troubleshooting, debugging, and engineering for design.

Course Objectives

The student will be able to:

1. Build a fully functioning computer, determining how key components work together to form a complete system.
2. Understand and explain basic circuitry and the function of different electrical components.
3. Identify the functions of inputs and outputs by building basic series circuits.
4. Connect parallel circuits and develop circuit diagrams.
5. Use computational thinking methods to write code and develop algorithms.
6. Apply coding concepts and computational thinking to create a program that simulates a common device.
7. Develop interactive projects that combine programming with physical computing elements such as lights and sound.
8. Use design thinking fundamentals to develop a physical computing device to solve a real world problem.

Course Content

1. Build a computer
 - a. Engineering diagrams
 - b. Case construction
 - c. Key components
 - d. Connectors
 - e. Screens
2. Circuitry and electrical components
 - a. Open vs. closed circuits
 - b. Electrical current
 - c. Circuit building
 - d. Breadboards and jumper wires
 - e. Buttons
3. Inputs and outputs
 - a. Electrical flow and voltage
 - b. Functions of inputs and outputs
 - c. Switches vs. buttons
 - d. Polarity and diodes
 - e. Audio output
4. Parallel circuits
 - a. Series vs. parallel circuits
 - b. Drawing circuit diagrams
 - c. Troubleshooting circuit issues
 - d. Stacking functions
5. Computational thinking
 - a. Decomposition
 - b. Pattern recognition
 - c. Abstraction
 - d. Algorithm design
 - e. Sequences and loops
6. Simulate a common device
 - a. Decomposing device mechanics
 - b. Cause and effect
 - c. Events
 - d. Conditionals
 - e. Testing and debugging programs
7. Program interactive projects
 - a. Hardware and software interface
 - b. Project design and mapping
 - c. Variables to store and modify data
 - d. Combining events, loops, and conditionals
8. Device development
 - a. Design thinking process
 - b. Empathy and user centered design
 - c. Prototyping
 - d. Iterative engineering cycle
 - e. Product testing and revision

Lab Content

Not applicable.

Special Facilities and/or Equipment

1. When offered on campus: Lecture room equipped with computer projector system, whiteboard, and internet connectivity. Computer laboratories with internet connectivity and computers or internet enabled devices running standard operating systems (e.g., iOS, MacOS, Windows, Android, Linux)
2. When taught online via Canvas students must have current email accounts and/or ongoing access to computers with email and web browsing capability

Method(s) of Evaluation

Designing and developing a physical computing plan and product or project
Presenting the product or project to peers, capturing feedback, and using it to revise the product or project
Making constructive contributions to class discussions and peer review feedback

Method(s) of Instruction

Writing notes, listening, and participating in lecture presentation
Observing an instructor-led demonstration and/or actively practicing the demonstrated skills
Presenting and communicating their ideas in discussion and/or participating in peer reviews

Representative Text(s) and Other Materials

Scherz, Paul, and Simon Monk. [Practical Electronics for Inventors, 4th ed.](#) 2016.

Krauss, Jane, and Kiki Prottzman. [Computational Thinking and Coding for Every Student: The Teacher's Getting-started Guide, 1st ed.](#) 2017.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Writing assignments include a major course project and multiple developmental projects, online discussion response, and critical analysis of peer's educational projects.
2. Outside assignments include conducting project development, planning, reading, and developing the project through an iterative process.
3. When taught online these methods may take the form of video, audio, animation and webpage presentations. Writing assignments are completed online.

Discipline(s)

Instructional Design/Technology