

Fundamentals of Bitcoin & Cryptocurrency Syllabus

» Course Overview

In this course, students will learn all about bitcoin, including its history, development, and context within the modern global economy. Students will learn the basic cryptographic principles that underlie bitcoin, and gain confidence by demonstrating strong security principles in storing and transacting bitcoin. Key principles such as mining, wallets, and hashing will be introduced. And finally, they will be familiarized with the nascent industry of digital currencies and how they function.

» Course Outline by Module

Module 1	What is Bitcoin?	Module 6	Transacting Bitcoin
Module 2	Cryptography for Beginners	Module 7	Bitcoin Security
Module 3	Public and Private Keys	Module 8	Bitcoin and Money
Module 4	Nodes, Wallets, and Addresses	Module 9	Altcoins and Regulations
Module 5	Bitcoin Mining	Module 10	Bitcoin: the Past and the Future

» Module Overview and Learning Objectives

| Module 1. What is Bitcoin?

This module will provide a basic introduction to bitcoin, a digital currency that was invented in 2008 by Satoshi Nakamoto. Since its humble beginnings, known only to a few programmers who communicated online, it has grown to a global phenomenon, with steady adoption by users and merchants, along with a growing value (though with many wild price swings along the way). This module will introduce students to the basics of bitcoin, describing what it is, some details on its history, theories on why it has value, and how to find information about the bitcoin price and network. We will also review some important warnings and cautions about using bitcoin.

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Learning Objectives: In this module, students will:

- List four definitions of bitcoin and describe what each of them means
- Identify drivers of the value of bitcoin
- Examine the historical price of bitcoin and label drivers of major price movements
- Compare bitcoin with other methods of payment
- Find the current price of bitcoin and convert bitcoins to US dollars and vice versa
- Describe the divisibility of bitcoin and how this enables micropayments
- Recognize the risks of using bitcoin as a currency and as an extremely speculative investment

| Module 2. Cryptography for Beginners

Encryption, ciphers, hashing, protocols... it all sounds like something out of a spy movie. However, these topics are key components of a field of computer science known as cryptography. This module begins assuming the student is not familiar with any of these topics and explains each of them in detail with many examples. Students then will learn how cryptography allows bitcoin to work, and how relying on cryptography allowed bitcoin to succeed where previous attempts at creating a digital currency failed.

Learning Objectives: In this module, students will:

- Describe encryption, decryption, and ciphers
- Define hash function, algorithm, and one-way function
- Demonstrate how to get a hash function from a text string input
- Describe the 3 main properties of a hash function
- Review exponents and evaluate the importance of mathematics in cryptography
- Discuss shortcomings of previous attempts at creating a digital currency and why they failed
- Describe how bitcoin addresses the double spend problem

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| Module 3. Public and Private Keys

This module will introduce public key cryptography and describe its importance to the inner workings of bitcoin. Students will learn how a private key controls the ownership of bitcoin. They will also demonstrate the use of a digital signature and compare it to a physical signature. The module also explains multi-signature or 'multi-sig' and how it is used in bitcoin. Students will also become familiar with best practices for securing private keys. Finally, students will be introduced to some potential career paths within the bitcoin space.

Learning Objectives: In this module, students will:

- Define a cryptographic public key and cryptographic private key
- Describe how a private and public key pair control ownership of bitcoin
- Evaluate methods and best practices for securing private keys
- Demonstrate the use of a digital signature
- Define multi-sig and explain how this is used to control bitcoin and other cryptocurrencies
- Identify future career opportunities and pathways in bitcoin

| Module 4. Nodes, Wallets, and Addresses

This module will discuss some key components of bitcoin. First, it will start with a bitcoin node, which is simply any person or system that participates in the bitcoin network. Next, the module will discuss bitcoin wallets and addresses, how they are created, and how they are used. Students will evaluate the difference between digital and physical wallets, and demonstrate how to open a bitcoin wallet.

Learning Objectives: In this module, students will:

- Define a bitcoin node
- Describe the four functions of nodes in the bitcoin network
- Define a bitcoin address and explain the difference between an address and a wallet
- Compare a digital wallet with a physical wallet

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- Categorize the five wallet platforms
- Contrast hardware wallets and software wallets
- Demonstrate how to open a bitcoin wallet
- Select a commercial bitcoin wallet provider to evaluate and describe its key characteristics

| Module 5. Bitcoin Mining

This module will discuss the ins and outs of bitcoin mining: what it is, how it works, and who is doing it. As early proponents compared bitcoin to “digital gold,” it naturally followed that the process of creating of new bitcoin, like the process of finding gold, should be called mining. Students will learn the elegantly simple solution of bitcoin mining and how it incentivizes people to contribute to the bitcoin network. Students will also discuss important societal issues such as the high energy use and carbon emissions of bitcoin mining.

Learning Objectives: In this module, students will:

- Define bitcoin mining, proof of work, and other key terms related to mining
- Describe the characteristics of the mathematical puzzle that miners must solve and verify to win a mining round
- Describe the history and development of bitcoin mining, including the increase in hashing power of the system
- Evaluate the characteristics of how to make bitcoin mining profitable
- Examine the incentives of miners and nodes to support the bitcoin network
- Discuss the pros and cons of the high energy usage required in bitcoin mining

| Module 6. Transacting Bitcoin

Do you envision a world where you can buy a coffee with bitcoin (or some other cryptocurrency)? High transaction costs have made this scenario less feasible, though solutions are coming! This module dives into the nuts and bolts of how to use bitcoin to purchase things. Students will learn how to transfer, receive, and spend bitcoin. The module also evaluates transactions costs for bitcoin, other cryptocurrencies, and other payment methods.

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Learning Objectives: In this module, students will:

- Describe the steps to completing a bitcoin transaction (either receiving money or paying using bitcoin)
- Demonstrate how to transfer, receive, and spend bitcoin
- Identify transaction inputs and transaction outputs
- Explain transaction costs for both buyers and sellers, and compare them across payment methods
- Contrast the irreversibility of bitcoin transactions with other electronic payment networks
- Compare the pros and cons of being a bitcoin merchant
- Describe the Lightning Network and how it is able to reduce transaction costs

| Module 7. Bitcoin Security

This module dives into security and discusses the problems and vulnerabilities of the bitcoin network. It will compare the security of the bitcoin network with other financial institutions. Students will learn what a 51% attack is and how it could affect bitcoin's price and credibility. Students will also learn about how best to secure their own wallets and bitcoin holdings.

Learning Objectives: In this module, students will:

- Compare the security of holding value in bitcoin wallets to holding dollars in a bank or in the stock market
- Evaluate the security of the bitcoin network
- Describe a 51% attack
- Examine the vulnerability of the bitcoin network to quantum computing developments
- Define pseudonymity, anonymity, and privacy in the context of bitcoin transactions
- Identify best practices of securing personal wallets and bitcoin holdings

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| Module 8. Bitcoin and Money

This module provides a basic introduction to the economic concept of money. The module will define and describe the three traditional characteristics of money, as well as the seven properties of a strong currency. It will also discuss the two sides of inflation and deflation, in addition to touching on some historical and current examples of hyperinflation. Next, we'll examine historical types of money, and this will include a research assignment on a historical monetary unit (there are lots to choose from!). Finally, the module will conclude with a discussion of money and trust.

Learning Objectives: In this module, students will:

- Describe the three principle characteristics of money
- Define monetary system, inflation, and deflation
- Evaluate give historical examples of hyperinflation
- Examine the historical types of money
- List the properties of a strong currency and evaluate Bitcoin's strength based on these properties
- Discuss the principle of trust associated with various forms of money
- Research a historical monetary unit, describing and evaluating how it was used as currency

| Module 9. Altcoins and Regulations

Bitcoin is just the first of hundreds of similar cryptocurrencies! This module will discuss the other major cryptocurrency projects and how they compare to bitcoin. Students will be introduced to Ethereum and examine its impact and potential. Finally, the module will introduce how regulation in the U.S. and other countries may affect bitcoin and other cryptocurrencies.

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Learning Objectives: In this module, students will:

- Define altcoin and explain features of bitcoin that can be altered
- Contrast features of bitcoin with other major altcoins such as Litecoin, Dash, and Ripple
- Define cryptocurrency market capitalization, demonstrate how it is calculated, and look up its current value
- Evaluate the altcoin Ethereum, describing its features and smart contracts
- Describe Initial Coin Offering (ICO) and venture capital and compare how they are used to raise money for new projects
- Examine proposed or existing regulations and discuss how government actions may impact bitcoin and altcoins
- Choose an altcoin or token and describe its purpose and features

| Module 10. Bitcoin: the Past and the Future

Are bitcoin and cryptocurrencies the future of money? A big bubble? An interesting idea, but ultimately not that important? This module will take a look at the latest topics trends and issues of bitcoin. Students will learn how and where to continue learning about issues surrounding bitcoin and cryptocurrencies. As part of this module, students will choose a topic and research the situation and both sides of an issue. The module will conclude with a discussion of the potential of bitcoin and blockchain technology.

Learning Objectives: In this module, students will:

- List key issues that affect bitcoin's price and network
- Define a fork and describe the reasons behind past forks in the bitcoin network
- Differentiate between a hard fork and a soft fork
- Evaluate the block size debate and identify how the block size affects transaction fees and costs
- List locations for credible information and updates on bitcoin developments including twitter, reddit, podcasts, and credible news outlets
- Summarize the potential of bitcoin and blockchain technologies to redefine transfer of value and monetary systems
- Choose a recent or current issue in cryptocurrencies and describe and evaluate the arguments made by both sides