

Elements of Blockchain Application Development in Ethereum

Course Outline

In-Class Hours: four November Saturdays, 10AM – 5PM & Tuesday, Nov. 28, 5:30PM – 7PM

Students will be introduced to Blockchain programming and application development through Ethereum, with hands-on active learning style classes. Students will complete individual assignments as well as a group project aimed at solving a real-world problem. Projects will be presented at the end of the course before a panel of judges, and selected projects will receive support for bringing their project to market.

Course Learning Outcomes

Students will be introduced to (or review) elements of Blockchain technology and Smart Contracts as they apply to Ethereum. An introduction to the Ethereum tool-chain, including wallets, compilers, network clients will be provided. Students will learn how to connect with the main Ethereum network, as well as how set up a private network in order to send transactions to one another. Students will be introduced to the Solidity programming language for the Ethereum platform, as well as application deployment, complete with user interface. Students will learn how to use advanced deployment management middleware for facilitating deployments of complex Smart Contracts. Federated technologies are presented, in order to provide context within a greater decentralized technology ecosystem.

Pre-requisites: A programming course

Student Preparation for Class and Class Participation: Expectations

Class preparation. Students are expected to prepare for each class according to the instructions indicated in the class-by-class syllabus.

Class Participation (contribution). It is expected that students attend all sessions of this intensive course. Class discussion focuses around that week's assignment. Students have an opportunity to ask questions to the lecturer, to share their own experiences, and to discuss different approaches to the problem.

Class-by-Class Syllabus

DATE/WEEK	TOPIC(S) / ASSIGNED WORK DUE
November 4 (1)	<p><u>Introduction to Ethereum</u></p> <p>In this introductory lecture we review the applied cryptography principles that underlie Blockchain and distributed ledger technologies in order to be able to understand, categorize, and analyze their functionality. Hashing, shared-key cryptography, and several distributed, trustless, consensus algorithms are presented. The Ethereum Network is presented as a Turing-complete platform for token-value transfer and Smart Contract application development. Students learn how to synchronize and transact with the Main Ethereum network, as well as how to run a private test network.</p> <ul style="list-style-type: none">▪ Review of Blockchain and Cryptographic Fundamentals▪ Components of the Ethereum ecosystem▪ Setting up environment and tools▪ Running a private network▪ Basic interactions with the blockchain
November 11 (2)	<p><u>Smart Contracts</u></p> <p>Students are introduced to Smart Contract development on the Ethereum platform, as well as the main features and abstractions of the Solidity Smart Contract development language. Tools and processes for compiling and deploying Smart Contracts on the Ethereum network are demonstrated. Basic techniques for interacting with Smart Contracts are presented including the creation of basic user interfaces.</p> <ul style="list-style-type: none">• Smart Contracts using Solidity• Deploying Smart Contracts• Interacting with Smart Contracts• User Interfaces for Distributed Applications <p><u>Assignment:</u> Assignment 1 handed out</p> <p><u>Project:</u> Project handed out</p>
November 18 (3)	<p><u>Advanced Topics</u></p> <p>Advanced Smart Contract concepts are presented including a variety of Design Patterns and emerging standards are discussed. Then, advanced tools for building and deploying complex projects are demonstrated. Related technologies for extending our applications are presented. Finally, important security pitfalls are taught, along with the history of critical security incidents in the past.</p>

DATE/WEEK	TOPIC(S) / ASSIGNED WORK DUE
	<ul style="list-style-type: none"> • Advanced Solidity Programming • Federated Technologies • Design Patterns • Security Pitfalls <p><u>Assignment:</u> Assignment 1 due Assignment 2 handed out</p>
November 25 (4)	<p><u>Course Wrap Up & Student Presentations</u> As a capstone, building upon the Inverted classroom model students are given a chance to demonstrate what they have learned throughout the immersive, experiential learning experienced in this course. Students will take the lead to share what they have learned through their project efforts with their peers. Students will create a presentation and deliver in front of the instructor and their peers. So-called Initial Coin Offerings are discussed vis-a-vis the ERC-20 token standard.</p> <p><u>Assignment:</u></p> <ul style="list-style-type: none"> ▪ Assignment 2 due <p><u>Project:</u></p> <ul style="list-style-type: none"> ▪ Project due
November 28 5:30 – 7 PM	<p><u>Blockchain Mixer</u> There will be a student/industry mixer sponsored by Schulich Career Services. Members of Schulich student community as well as blockchain professionals in large consulting, financial services, and enterprise software companies will be invited, as well as those from other industries. Each project group will present a pitch-deck to all present, and their presentations will be judged by some of these blockchain professionals as well as the BlockchainLab co-directors.</p>

Written Assignments/Projects and Exam[s]: Descriptions

Assignments. Each assignment requires the student to answer a set of questions closely related to the course material or to conduct experiments. All of the information students need to complete an assignment is included in the course material and in prior lectures. Assignments must be submitted at the beginning of class on the due date.

Project. In the group project, students will apply the material learned in the course in a comprehensive manner. Students will implement a novel Blockchain application and create a demo and pitch deck before the end of the course.

Acknowledgement of Student Performance

This is not a for-credit or for-certificate course. However, there are deliverables and an expectation that the student ably complete the deliverables. Each student who deserves it will receive an acknowledgement of satisfactory completion of the course in the form of a letter signed by BlockchainLab co-directors. Students whose efforts were clearly lacking will not receive this letter.