**SGUS Blockchain Talent Programme**

**Blockchain (Intermediate)**

**Course Outline**

This course is designed for participants to learn intermediate-level concepts in blockchain and join the ranks of the blockchain professionals in the financial services industry. At the end of the 120-hour course, participants will learn how to issue an Initial Coin Offering (ICO) for DeFi and Non-Fungible-Tokens (NFT), apply Design Thinking in blockchain projects, create and set up a Permissioned Blockchain for Enterprise projects using tools and frameworks such as Reactjs, Nodejs, Hyperledger Fabric, Openethereum, SmartMesh Spectrum,CrunchDB and IPFS.

The 120 hours of total time is divided into 60 hours of F2F lecture, through Zoom, and 60 hours of a group project.

# Face-to-Face Lectures

The 60 hours of F2F lecture is outlined as follows.

* Topic 1: Forks, Hard & Soft
* Understand the concepts of hard fork and soft fork
* Topic 2: Consensus Beyond Proof of Work
* Describe different consensus mechanisms
* Topic 3: Initial Coin Offerings (ICOs) with DeFi and NFT
* Understand DeFi’s development History
* Describe Major DeFi Frameworks
* Use opensource github repos to fork uniswap
* Mint a Debt NFT using ERC721 on Spectrum Blockchain
* Topic 4: Enterprise Blockchains
* Describe the enterprise level blockchain solutions
* Be able to deploy a permissoned Blockchain using Openethereum
* Introduction to Hyperledger Fabric
* Experience how to compose a Hyperledger Fabric network
* Experience Docker and Docker Compose
* Experience Chain Code
* Experience CouchDB and other HyperLedger Tools
* Topic 5: Architecting a Blockchain Solution
* Describe Blockchain Application Design Thinking
* Experience Nodejs
* Experience Reactjs
* Experience Reactjs Web3 Interaction
* Experience IPFS

# Course Material & Discussion Channel

<https://github.com/onebit256>

<https://app.slack.com/client/T01DJ9FA0BZ/learning-slack>

<https://t.me/joinchat/IQzIDeLQ9mrsk3Lq>

# Course Project

The 60 hours of Group Project is tentatively planned as follows.

* Please form groups of 2 to 3 persons from your own batch per group.
* You may choose to work on one of the following BC projects, or create a topic on your own.
  + At the conclusion of the recent SmartMesh SUSS Blockchain Challenge (BC) in summer of 2020, several projects were developed at the Concept level for BC Phase 1.
  + Some of the groups’ project concept will be given an opportunity to present to you, for your consideration to work on for your Blockchain Intermediate Course project.
* Through the project participation, you will apply the knowledge from this BCI course, delve deeper into blockchain related business models, experience blockchain technology including token minting on a blockchain and cross-chain architectures, and Decentralized Application (DAPP) implementation.

The BCI projects will be evaluated according to the following criteria:

1. Documentation (PPT or Word). No more than 12 PPT slides or 6 word-document pages.
   1. Title (Project Name, Vision, Mission)
   2. An introduction (What are the problems? Why is worth looking into it? What are the existing techniques/business modes used to solve it so far, and the effectiveness of those techniques/business modes?)
   3. Proposed Solution is to be implemented as a Web App. List major functions of the ideal (commercial) Product, and Benefits of each function.
   4. Approach and assumptions (Blockchain technology chosen, Token Economy, Target customers)
   5. Define targeted Minimum Viable Product (MVP) functions, which is a scaled-down version of the Ideal Commercial Product, with functions which can be implemented before day 16 or 17 of this course.
   6. Evaluation your solution against the LASIC principles (Low margin, Asset light, Scalable, Innovative, Compliance easy)
2. Code Review: Evaluated based on MVP Demo quality of the code:
   1. Prefer projects to be implemented based on MVC model
   2. Prefer projects to be implemented using the framework taught in the course: Nodejs, Reactjs, Web3, Hyperledger, Mongodb, SQL, IPFS e.t.c.
3. Functionality of Application: Evaluated based on the MVP of the project:
   1. Prefer projects to run on a server (production mode is better) versus only running on a localhost.
   2. Test Cases and Results
   3. Use Docker and Docker compose for deployment will earn extra credit
4. MVP Live Demo
   1. Demo states and functions of the demonstrated MVP
   2. Degree of completion of the demonstrated MVP, compared to that of the targeted MVP, (gap).

**Project Milestones**

* Deliverable-1 - Documentation.
  + Documentation (PPT or Word) No more than 12 PPT slides or 6 word-document pages.
  + First Draft due by Friday 05 March at 23:59 (midnight), so that the teachers can give you comments.
* Deliverable-2 - Code Review, and Deliverable-3 - Functionality of Application
  + The instructors will hold mentoring sessions in which you can present your current progress and get in-person feedback.
  + You will not be evaluated for what you present at a mentoring session.
  + Mentoring sessions consist of 30 minute slots, and will be held after class to go over the Documentation from 12:45 to 13:45 on the dates: 05, 08, 09, 11, and 12 of March. Additional days may be added if needed.
* Deliverable-4 Live Demo
  + Presented in Class on Day 16 and 17 = Tuesday 23 and Wed 24 March 2021

# Course Time-Table and Agenda

***All F2F Days are scheduled at 3.5 hours; 09:00 - 12:30; 15 mins Break), with the exception of Day 18 which is only 1 hour.***

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| **Day 1 – Tue 16 February 2021** |
| **BCI Lecture :** Course Introduction & Evaluation |
| **BCI Lecture :** Blockchain Technology trends  - Blockchain Technology History  - Blockchain Technology Trends  - DeFi, Governance, Private (permissioned) blockchains, Cross-Chain Solutions, Sharding |
| **BCI Lecture :** Typical Components of a Enterprise Blockchain Solution  - A Typical Blockchain Application Diagram  - A Typical Web Application Diagram  - Difference  - What is Software Architecture?  - Solutions |
| **BCI Lecture :** Developer Roadmap  - Frontend Path  - Backend Path  - Devop Path |

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| **Day 2 – Thu 18 February 2021** |
| **BCI Lecture :** Introduction to Hard forks and Soft forks in Blockchains  - What are Hard and Soft Forks  - Major Ethereum Forks  - Ethereum Improvement Proposals (EIP) Explanation  - Soft Fork: EIP Demo |
| **BCI Demo :** Do a hard fork using Openethereum  - What is Open Ethereum  - Chain Specifications  - Permissioning  - Hard Fork Code Demo |

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| **Day 3 – Thu 25 February 2021** |
| **BCI Lecture :** Course Project Guidelines  **BCI Lecture:** Optional: Can consider, as your project concept: SUSS-SmartMesh Blockchain Challenge Projects |

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| **Day 4 – Mon 1 March 2021** |
| **BCI Lecture :** Proof of Work consensus (POW)  - What is Consensus  - Byzantine General's Problem  - The Enlightenment of BGP and POW |
| **BCI Lecture :** Proof of Stake consensus **(**POS)  - What is POS?  - POS Mechanism  - POW VS POS  - Ethereum 2.0 |
| **BCI Lecture :** Proof of Authority **(**POA) Permissioning Demo  - What is POA?  - POA Permissioning Layers  - POA VS POW  - Code Demo |

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| **Day 5 – Tue 02 March 2021** |
| **BCI Lecture :** Introdution to Docker  - Docker Overview  - Docker Compose overview |
| **BCI Lecture :** Introdution to Nodejs and Expressjs |

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| **Day 6 – Thu 04 March 2021** |
| **BCI Lecture :** Introduction to Nodejs and Expressjs (2) |

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| **Day 7 – Fri 05 March 2021** |
| **BCI Lecture :** Spectrum Consensus |
| **BCI Lecture :** Spectrum and Atmosphere Cross-Chain Solution |
| **BCI Lecture :** Photon Layer2 Off-Chain State-Channel for Spectrum |
| **BCI Lecture :** SmartMesh NFT |

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| **Day 8 – Mon 08 March 2021** |
| **BCI Lecture :** Introduction to Reactjs |
| **BCI Demo :** Reactjs Class Component |
| **BCI Demo :** ReactjsProps and State |

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| **Day 9 – Tue 09 March 2021** |
| **BCI Demo :** Reactjs Functional Component |
| **BCI Demo :** ReactjsContext |
| **BCI Demo :** Reactjs Hooks |

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| **Day 10 – Thu 11 March 2021** |
| **BCI Lecture :** Dive into Web3js |
| **BCI Demo:** Reactjs Web3 Interaction |
| **BCI Lecture :** IPFS |
| **BCI Demo:** Webpack, Webserver and Production |

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| **Day 11 – Fri 12 March 2021** |
| **BCI Lecture :** ICO and DeFi |
| **BCI Lecture :** Fork Uniswap on Spectrum  - Introduction to Uniswap App  - Overview of Uniswap’s Contracts  - Liqudity Pool  - Uniswap Fork Process  - Uniswap Smart Contracts Deployment  - Uniswap Frontend |

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| **Day 12 – Tue 16 March 2021** |
| **BCI Lecture :**  Opensea and Ethereum Request for Comments (ERC) 721  - What is ERC721  - Code Demo: mint a new token and transfer assets  - Code Demo: How to use opensea js |

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| **Day 13 – Wen 17 March 2021** |
| **BCI Lecture :** Introduction to Hyperledger Fabric  - What is Hyperledger Fabric  - The Infrastructure Component  - Component Explanation  - The Architecture  - Architecture Explanation  - The Transaction Process  - Process Explanation |
| **BCI Lecture :** Dive into Hyperledger Network(1)  - Network Composing Process  - The Important Files |

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| **Day 14 – Thu 18 March 2021** |
| **BCI Lecture :** Dive into Hyperledger Network(2)  - Network Composing Process  - The Important Files |
| **BCI Demo :** Hyperledger Chain Code Development(1) |

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| **Day 15 – Mon 22 March 2021** |
| **BCI Demo :** Hyperledger Chain Code Development(2)  - Fabcar Demo  - Deployment |
| **BCI Demo :** Introduction to CrunchDB  - Insertion, Update, Delete, Set |
| **BCI Lecture :** HyperLedger Tools |

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| **Day 16 – Tue 23 March 2021** |
| **BCI Lecture :** Project Presentation and Demo by each BCI Group – 1/2 |

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| **Day 17 -- Wed 24 March 2021** |
| **BCI Lecture :** Project Presentation and Demo by each BCI Group – 2/2 |

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| **Day 18 – Thu 25 March 2021**  **(1 hour; 09:00 – 10:00)** |
| **BCI Lecture :** Wrap-Up |

# Trainers’ Profiles

**Bingyang LI**

* SmartMesh Chief Education and Training Officer
* Oumi Blockchain CTO
* Blockchain Early Investor

**Peter YAN**

* MeshBox CEO
* SmartMesh Advisor
* Ph.D Electrical Engineering, Washington University in St. Louis
* SUSS Fellow
* Former Senior Staff Engineer, America Wireless Access Labs Huawei Technologies;
* Former Principle-Scientist, Enterprise Switching Business-Unit Broadcom;
* Former Systems Architect, Business Development and Strategy Group Freescale Semiconductor.

**Henry WANG Qiheng**

* Founder of Smartmesh and SmartMesh CEO
* MeshBox Advisor
* Masters in Computer Science, Washington University in St. Louis
* President of the International Blockchain Application Federation
* Cofounder of SmartMesh-SUSS Blockchain Living Lab
* SUSS Fellow
* Extensive background in blockchain、inclusive communications and inclusive finance.