CENTRAL UNIVERSITY OF KERALA
DEPARTMENT OF COMPUTER SCIENCE
M.Sc. COMPUTER SCIENCE – PROGRAMME STRUCTURE

ELECTIVES					
COURSE CODE	**COURSE TITLE**	**CONTACT HRS/WEEK**			**CREDITS**
		LEC	**LAB**	**TUT**	
CSC5018	Block Chain	2	2	1	4

Lec = Lecture, Tut = Tutorial, Lab = Practical

This is a theoretical, participatory, experimental and **employability based skill development course**.

Course Objective:
   The objective of the course is to provide theoretical and practical aspects of block chain.

By completing this course, students will obtain the following course/learning outcomes:
1. Knowledge gained:
    (i)   State of art methods for developing block chain
    (ii)   Equipping design principles of bitcoin and ethereum
2. Skill gained:
    (iii) Investigating the need and necessity of block chain various applications
3. Competency gained:
    (iv)   Development of prototypes for various applications using block chain technology.

Prerequisites: Nil

Grading:
          Lab implementation   – 10%
          Participatory based group Project   – 10%
          Assignment/Quiz/presentation   – 10%
          Lab Test   – 10%
          Final Exam   – 60%

CSC5018 – Block Chain

Module 1
Introduction: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs. Private Blockchain, Understanding Cryptocurrency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain.

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

Module 2
Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Module 3
Permissioned Blockchain: Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned blockchain-Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Enterprise application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade –Trade Finance Network, Supply Chain Financing, Identity on Blockchain.

Module 4
Blockchain Application Development: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda.

Text Books/References:

1. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
2. Josh Thompsons, "Blockchain: The Blockchain for Beginners-Guide to Blockchain Technology and Leveraging Blockchain Programming", CreateSpace Independent Publishing Platform, 2017
3. Daniel Drescher, "Blockchain Basics", Apress; 1st Edition, 2017.
4. Anshul Kaushik, "Blockchain and Crypto Currencies", Khanna Publishing House, Delhi, 1st Edition, 2019
5. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, 2nd Edition, 2018.
6. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing, 2018.
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Packt Publishing, 2019.
8. Rogen Wattenhofer, "Blockchain Science: Distributed Ledger Technologies", Inverted Forest Publishing, 2019.