RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

CSE- Data Science/Data Science, VIII-Semester

803 (A) Block chain Technologies

UNIT I - Introduction: Overview of Block chain, Public Ledgers, Bit coin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain; Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic crypto currency.

UNIT II - Understanding Block chain with Crypto currency: Bit coin and Block chain: Creation of coins, Payments and double spending, Bit coin Scripts, Bit coin P2P Network, Transaction in Bit coin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bit coin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hash Cash PoW, Bit coin 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.

UNIT III - Understanding Block chain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

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

UNIT V - Block chain 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.

References:

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming”
3. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5.Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing
6. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd, Venkatraman Ramakrishna, “Hands-On Block Chain with Hyper ledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018

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803 (B) Time-Series Analysis

Unit I - INTRODUCTION OF TIMESERIES ANALYSIS: Introduction to TimeSeries and Forecasting, Different types of data, Internal structures of timeseries. Models for time series analysis, Autocorrelation and Partialautocorrelation. Examples of Time series Nature and uses of forecasting,
Forecasting Process, Data for forecasting, Resources for forecasting.

Unit II - STATISTICS BACKGROUND FOR FORECASTING: Graphical Displays,Time Series Plots, Plotting Smoothed Data, Numerical Description of TimeSeries Data, Use of Data Transformations and Adjustments, GeneralApproach to Time Series Modeling and Forecasting, Evaluating andMonitoring Forecasting Model Performance.

Unit III - TIME SERIES REGRESSION MODEL: Introduction Least SquaresEstimation in Linear Regression Models, Statistical Inference in LinearRegression, Prediction of New Observations, Model Adequacy Checking,Variable Selection Methods in Regression, Generalized and Weighted LeastSquares, Regression Models for General Time Series Data, ExponentialSmoothing, First order and Second order.

Unit IV - AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA)MODELS: Autoregressive Moving Average (ARMA) Models – Stationarityand Invertibility of ARMA Models - Checking for Stationarity usingVariogram- Detecting Nonstationarity - Autoregressive Integrated MovingAverage (ARIMA) Models - Forecasting using ARIMA - Seasonal Data -Seasonal ARIMA Models Forecasting using Seasonal ARIMA ModelsIntroduction - Finding the "BEST" Model -Example: Internet Users DataModel Selection Criteria - Impulse Response Function to Study theDifferences in Models Comparing Impulse Response Functions forCompeting Models .

Unit V - MULTIVARIATE TIME SERIES MODELS AND FORECASTING: Multivariate Time Series Models and Forecasting, Multivariate StationaryProcess, Vector ARIMA Models, Vector AR (VAR) Models, NeuralNetworks and Forecasting Spectral Analysis, Bayesian Methods inForecasting.

TEXTBOOKS:

1. **Introduction To Time Series Analysis AndForecasting**, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen.
2. **Master Time Series Data Processing, Visualization, And Modeling Using Python** Dr. Avishek Pal Dr. Pks Prakash.

Time Series Analysis Lab

1. Time Series Data Cleaning
2. Loading and Handling Times series data
3. Preprocessing Techniques
4. How to Check Stationarity of a Time Series.
5. How to make a Time Series Stationary?
6. Estimating & Eliminating Trend.
   - Aggregation
   - Smoothing
   - Polynomial Fitting
7. Eliminating Trend and Seasonality
   - Differencing
   - Decomposition

a) Moving Average time analysis data.
b) Smoothing the Time analysis Data.
c) Check out the Time series Linear and non-linear trends.
d) Create a modelling.

8. Modelling time series
   - Moving average
   - Exponential smoothing
   - ARIMA
9. Seasonal autoregressive integrated moving average model (SARIMA)

10. Dependence Techniques
    - Multivariate Analysis of Variance and Covariance
    - Canonical Correlation Analysis
    - Structural Equation Modeling
11. Inter-Dependence Techniques
12. Factor Analysis
13. Cluster Analysis

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CD 803 (C) Internet of Things

Unit I -IoT definition, Characteristics, IoT conceptual and architectural framework, Physical and logical design of IoT, IoT enablers, Modern day IoT applications, M2M communications, IoT vs M2M, IoT vs WoT, IoT reference architecture, IoT Network configurations, IoT LAN, IoT WAN, IoT Node, IoT Gateway, IoT Proxy, IPv4 vs IPV6

Unit II - Sensor, Basic components and challenges of a sensor node, Sensor features, Sensor resolution; Sensor classes: Analog, Digital, Scalar, Vector Sensors; Sensor Types, bias, drift, Hysteresis error, quantization error; Actuator; Actuator types: Hydraulic, Pneumatic, electrical, thermal/magnetic, mechanical actuators, soft actuators

Unit III - Basics of IoT Networking, IoT Components, Functional components of IoT, IoT service oriented architecture, IoT challenges, 6LowPAN, IEEE 802.15.4, ZigBee and its types, RFID Features, RFID working principle and applications, NFC (Near Field communication), Bluetooth, Wireless Sensor Networks and its Applications

Unit IV -MQTT, MQTT methods and components, MQTT communication, topics and applications, SMQTT, CoAP, CoAP message types, CoAP Request-Response model, XMPP, AMQP features and components, AMQP frame types

Unit V -IoT Platforms, Arduino, Raspberry Pi Board, Other IoT Platforms; Data Analytics for IoT, Cloud for IoT, Cloud storage models & communication APIs, IoT case studies

References:

1. Vijay Madisetti, Arshdeep Bahga, "Ïnternet of Things, A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach",
ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use
Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand Internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Analyze data from various sources in real-time and take necessary actions in an intelligent fashion
4. Remotely monitor data and control devices
5. Develop real life IoT based projects

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803(D) Quantum Computing

COURSE OBJECTIVES:

Course Objectives: The objective of this course is to impart necessary knowledge to the learner so that he/she can develop and implement algorithm and write programs using these algorithm

Unit I Motivation for studying Quantum Computing , Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing Overview of major concepts in Quantum Computing: Qubits and multi-qubits states, Braket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement

Unit II Math Foundation for Quantum Computing: Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors

Unit III Building Blocks for Quantum Program: Architecture of a Quantum Computing platform, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates. Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc.

Unit IV Programming model for a Quantum Computing Program: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits. Basic techniques exploited by quantum algorithms, Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks

Unit V Major Algorithms: Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch -Jozsa Algorithm OSS Toolkits for implementing Quantum program: IBM quantum experience, Microsoft Q, RigettiPyQuil (QPU/QVM)

References:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.

2. David McMahon, "Quantum Computing Explained", Wiley

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand major concepts in Quantum Computing
2. Explain the working of a Quantum Computing program, its architecture and program model
3. Develop quantum logic gate circuits
4. Develop quantum algorithm
5. Program quantum algorithm on major toolkits.