

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

CSE-Internet of Things and Cyber Security Including Block Chain Technology, VI-Semester

IS 601-Data Analytics in IoT and Blockchain

UNIT I: Structured and unstructured Data, Overview of Data Analytics, Types of data analytics: Descriptive Data Analytics, Measure of Central Tendency, Measurement of Dispersion, Predictive, Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT II: Applications of Probability Distribution, Sampling and Sampling Distribution, Hypothesis Testing, Z-test, T-test, Skewness and Kurtosis, Data Normalization, Two sample testing and ANOVA.

UNIT III: Predictive Data Analytics: Univariate and Multivariate Exploration of Data, Classification and Regression, K-means Clustering, Linear regression, KNN, Logistic regression, Decision trees, Random Forest, ANN

UNIT IV: Overview of the Data Analyst Ecosystem, Different Types of File Formats, Data Pipelines, Foundations of Big Data, Data Visualization: Tools for data analytics, Histogram, Box Plots, Correlation, Heatmap, Python libraries for data handling, Numpy, Matplotlib, Pandas, Seaborn.

UNIT V: Case Study in IoT, Industrial IoT, Medical IoT, Blockchain, Cryptocurrency, etc.

Suggested Books:

Text Books/References:

1. Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly Publisher Media
2. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher
3. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media.
4. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
5. Jake VanderPlas, Python Data Science Handbook, Shroff Publisher Publisher /O'Reilly Publisher Media
6. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O'Reilly Publisher Media.

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IS 602- Internet and Web Technology

After completion of the course students will be able to

1. Describe the concepts of WWW including browser and HTTP protocol.
2. List the various HTML tags and use them to develop the user friendly web pages.
3. Define the CSS with its types and use them to provide the styles to the web pages at various levels.
4. Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
5. Use the JavaScript to develop the dynamic web pages.
6. Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
7. Develop the modern Web applications using the client and server side technologies and the web design fundamentals.

UNIT 01

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers, Features of Web 2.0 Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Web site, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation.

UNIT 02

HTML : Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5

UNIT 03

Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3
JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and Javascript, Events and buttons

UNIT 04

XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP

UNIT 05

PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs

Reference Books:

1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
2. Web Technologies, Black Book, dreamtech Press
3. HTML 5, Black Book, dreamtech Press
4. Web Design, Joel Sklar, Cengage Learning
5. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill
6. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson

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Departmental Elective IS- 603(A) Cyber Security

UNIT 1

Introduction of Cyber Crime, Challenges of cyber crime, Classifications of Cybercrimes: EMail Spoofing, Spamming, Internet Time Theft, Salami attack/Salami Technique,

UNIT 2

Web jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, cyber terrorism, Virtual Crime, Perception of cyber criminals: hackers, insurgents and extremist group etc. Web servers were hacking, session hijacking.

UNIT 3

Cyber Crime and Criminal justice: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment and E-mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackle Cyber Crime and Trends.

UNIT 4

The Indian Evidence Act of 1872 v. Information Technology Act, 2000: Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages.

UNIT 5

Tools and Methods in Cybercrime: Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spyware, virus and worms, Trojan Horses, Backdoors, DoS and DDoS Attacks, Buffer and Overflow, Attack on Wireless Networks, Phishing : Method of Phishing, Phishing Techniques.

Suggested Books:

1. Principles of Cyber crime, Jonathan Clough Cambridge University Press
2. John R. Vacca, Computer Forensics:Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005
3. Cyber Law Simplified, VivekSood, Pub: TMH.
4. Cyber Security by Nina Godbole, SunitBelapure Pub: Wiley-India
5. Information Warfare: Corporate attack and defense in digital world, William Hutchinson, Mathew Warren, Elsevier.
6. Cyber Laws and IT Protection, Harish Chander, Pub:PHI.

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CSE-Internet of Things and Cyber Security Including Block Chain Technology, VI-Semester

Departmental Elective IS- 603(B) Bitcoin and Crypto currency Technologies

Unit I: Introduction to Crypto and Cryptocurrencies: Cryptographic building blocks ("primitives") and reason about their security. Constructing Simple Cryptocurrencies, Decentralization in Bitcoin, Bitcoin's consensus mechanism and its security. Technical methods and clever incentive engineering. Mechanics of Bitcoin: Components of the Bitcoin protocol, transactions, script, blocks, and the peer-to-peer network, Different ways of storing Bitcoin keys, Security measures, and various types of services that allow trade and transact with bitcoins.

Unit II: Bitcoin Mining Who are the miners, Introduction to mining, Operations of mining and miners, Business model for miners, their have on the environment. Bitcoin and Anonymity: Concept of Bitcoin anonymity, improving Bitcoin's anonymity and privacy, Bitcoin's role in Silk Road and other hidden marketplaces.

Unit III: Community, Politics, and Regulation, Bitcoin and cryptocurrency technology touches the world of people, Community, politics within Bitcoin and the way that Bitcoin interacts with politics, and law enforcement and regulation issues.

Unit IV: Alternative Mining Puzzles: Issues and problems with mining, energy consumption aspect, Requirement of specialized hardware, how mining can be re-designed in alternative cryptocurrencies.

Unit V: Bitcoin as a Platform: Bitcoin potential to support applications other than currency. Properties of Bitcoin that makes this possible, Alternative cryptocurrencies, The Future of Bitcoin, The use of Bitcoin technology for decentralizing property, markets.

Books:

Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and cryptocurrency technologies: a comprehensive introduction*. Princeton University Press.

Schar, F., & Berentsen, A. (2020). *Bitcoin, Blockchain, and Cryptoassets: A Comprehensive Introduction*. MIT press.

Cole Ruiz, *Bitcoin and Cryptocurrency Technologies*, 2022

Cliff Davison, *Bitcoin and Cryptocurrency Technologies*, 2022

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CSE-Internet of Things and Cyber Security Including Block Chain Technology, VI-Semester

Departmental Elective IS- 603(C) Industry Use Cases using Blockchain

Unit I: Introduction to Blockchain – I (Basics, History, Architecture, Conceptualization), Basic Crypto Primitives, Distributed Consensus, Consensus in Bitcoin – I (The Basics, PoW and Beyond, The Miners), Permissioned Blockchain (Basics, Consensus)

Unit II: Permissioned Blockchain (RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance), Blockchain for Enterprise - Overview, Blockchain Components and Concepts, Hyperledger Fabric – Transaction Flow, Hyperledger Fabric Details, Fabric – Membership and Identity Management, Hyperledger Fabric Network Setup, Fabric Demo on IBM Blockchain Cloud

Unit III: Hyperledger Composer – Application Development, Hyperledger Composer – Network Administration, Blockchain Use Cases, Blockchain in Financial Service (Payments and Secure Trading, Compliance and Mortgage, Financial Trade), Revolutionizing Global Trade, Blockchain in Supply Chain

Unit IV: Blockchain in Other Industries, Blockchain in Government (Advantages, Use Cases, Digital Identity), Blockchain in Government (Hyperledger Indy, Tax Payments and Land Registry Records), Blockchain Security (Overview, Membership and Access control in Fabric, Privacy in Fabric)

Unit V: Blockchain Security (Fabric SideDB), Research Aspects (Consensus Scalability, Bitcoin-NG, Collective Signing, Byzcoin), Research Aspects (Algorand, Cross Fault Tolerance, Secured Multi-Party Computation), Blockchain for Science (Blockchain for Big Data, Blockchain and AI), Comparing Ecosystems – Ethereum

Books

Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos

Blockchain by Melanie Swa, O'Reilly

Hyperledger Fabric - <https://www.hyperledger.org/projects/fabric>

Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits

<https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>

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Open Elective IS 604(A) Cognitive IoT

Course Objectives:

- To emphasis the students from shifting their mindset from theoretical to practical multidisciplinary skills through installing the know-how of actual practice in industry field
- Impart the knowledge to log the sensor data and to perform further data analytics
- Make the students to apply Internet of Things (IoT) data for business solution in various domain in secured manner

Syllabus:

Unit I:Cognitive IoT – Introduction Cognitive IoT, Need for Cognitive IoT, Current and Future trends of IoT, Cognitive computing and applications. Data Analytics for IoT Regression, Data Analytics for IoT ANN Classification, Data Analytics for IoT Modern DNN's.

Unit II:Cloud and Edge Computing in IoT, Decentralized Computing, Cloud computing, Cloudlets and fog computing, Cloud and edge computing for large scale IoT applications.

Unit III:Introduction to GPU: Introduction to GPU's Parallel programming for GPU, Parallel programming in CUDA, CNN Inference in GPU, CNN Training in GPU.

Unit IV:FPGA for Internet of Things: Benefits of FPGA, Interfacing FPGAs with IoT-based edge devices, IoT-FPGA based applications, Microsemi's SmartFusion2 SoC FPGA. Big data, Digital twin, Cloud Computing, Sensors, Communications, Analytical software, Edge Devices.

Unit V:Security in Cognitive IoT, Security Issues in IoT, A hardware assisted approach for security, Architectural level overview for providing security, Security threats. Recent Trends

Text Books:

Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange and Stefan Meissner, Enabling things to talk –Designing IoT solutions with the IoT Architecture Reference Model, 1st edition, Springer Open, 2016

Matin, Mohammad Abdul, ed. Towards Cognitive IoT Networks, 1st edition, Springer, International Publishing, 2020.

Reference Books

Arshdeep Bahga and Vijay Madisetti, Cloud Computing: A Hands-on Approach, 1st edition, CreateSpace Independent Publishing Platform, 2013.

John Mutumba Bilay, Peter Gutsche, Mandy Krimmel and Volker Stiehl, SAP Cloud Platform Integration: The Comprehensive Guide, 2nd edition, Rheinwerk publishing.2019.

Mahalle, Parikshit Narendra, and Poonam N. Railkar, Identity management for internet of things, 1st edition , River Publishers, 2015.

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Open Elective IS 604(B) Theory of Computation

COURSE OBJECTIVE

- To understand computability, decidability, and complexity through problem solving.
- To analyse and design abstract model of computation & formal languages
- To understand and conduct mathematical proofs for computation and algorithms.

Unit-I

Introduction of Automata Theory: Examples of automata machines, Finite Automata as a language acceptor and translator, Moore machines and mealy machines, composite machine, Conversion from Mealy to Moore and vice versa.

Unit-II

Types of Finite Automata: Non Deterministic Finite Automata (NFA), Deterministic finite automata machines, conversion of NFA to DFA, minimization of automata machines, regular expression, Arden's theorem. Meaning of union, intersection, concatenation and closure, 2 way DFA.

Unit-III

Grammars: Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, killing null and unit productions. Chomsky normal form and Greibach normal form.

Unit-IV

Push down Automata: example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petrinet model.

Unit-V

Turing Machine: Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable languages, undecidable languages, Halting problem of Turing machine & the post correspondence problem.

RECOMMENDED BOOKS

- Introduction to Automata Theory Language & Computation, Hopcroft & Ullman, Narosa Publication.
- Element of the Theory Computation, Lewis & Christors, Pearson.
- Theory of Computation, Chandrasekhar & Mishra, PHI.
- Theory of Computation, Wood, Harper & Row.
- Introduction to Computing Theory, Daniel I-A Cohen, Wiley.

COURSE OUTCOMES

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

CO1. explain the basic concepts of switching and finite automata theory & languages.

CO2. relate practical problems to languages, automata, computability and complexity.

CO3. construct abstract models of computing and check their power to recognize the languages.

CO4. analyse the grammar, its types, simplification and normal form.

CO5. interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.

CO6. develop an overview of how automata theory, languages and computation are applicable in engineering application.

LIST OF EXPERIMENTS

1. Design a Program for creating machine that accepts three consecutive one.
2. Design a Program for creating machine that accepts the string always ending with 101.
3. Design a Program for Mode 3 Machine
4. Design a program for accepting decimal number divisible by 2.
5. Design a program for creating a machine which accepts string having equal no. of 1's and 0's.
6. Design a program for creating a machine which count number of 1's and 0's in a given string.
7. Design a Program to find 2's complement of a given binary number.
8. Design a Program which will increment the given binary number by 1.
9. Design a Program to convert NDFA to DFA.
10. Design a Program to create PDA machine that accept the well-formed parenthesis.
11. Design a PDA to accept WCW_R where w is any string and W_R is reverse of that string and C is a Special symbol.
12. Design a Turing machine that's accepts the following language $a^n b^n c^n$ where $n > 0$.

COURSE OUTCOMES

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

CO1: judge various computational models.

CO2: construct abstract models of computing.

CO3: justify the power of abstract models in computing to recognize the languages.

CO4: demonstrate analytical thinking and intuition for problem solving in the related areas.

CO5: discuss the limitations of computation in problemsolving.

CO6: follow set of rules for syntax verification.

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Open Elective IS 604(C) Wireless Sensor Networks

Unit I: Overview of Wireless Sensor Networks: Network Characteristics, Network Applications, Network Design Objectives, Network Design Challenges, Technological Background: MEMS Technology , Wireless Communication Technology , Hardware and Software Platforms, Wireless Sensor Network Standards, Introduction, Network Architectures for Wireless Sensor Networks, Classifications of Wireless Sensor Networks, Protocol Stack for Wireless Sensor Networks.

Unit II: Fundamental MAC Protocols, MAC Design for Wireless Sensor Networks, MAC Protocols for Wireless Sensor Networks: Contention-Based Protocols, Contention-Free Protocols, Hybrid Protocols. Introduction, Fundamentals and Challenges, Taxonomy of Routing and Data Dissemination Protocols, Overview of Routing and Data Dissemination Protocols: Location-Aided Protocols, Layered and In-Network ProcessingBased Protocols, Data-Centric Protocols, Multipath-Based Protocols, Mobility-Based Protocols, QoS Based Protocols, Heterogeneity-Based Protocols.

Unit III: Wireless Sensor Network Architectures and Overview of Node Clustering Structures, Query Processing in Wireless Sensor Networks, Data Aggregation in Wireless Sensor Networks, Node Localization: Concepts and Challenges of Node Localization Technologies, Ranging Techniques for Wireless Sensor Networks, Wireless Localization Algorithms, Wireless Sensor Node Localization.

Unit IV: Need for Energy Efficiency and Power Control in Wireless Sensor Networks, Passive Power Conservation Mechanisms: Physical-Layer Power Conservation Mechanisms, MAC Layer Power Conservation Mechanisms, Higher Layer Power Conservation Mechanisms, and Active Power Conservation Mechanisms: MAC Layer Mechanisms, Network Layer Mechanisms, Transport Layer Mechanisms.

Unit V: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security.

Reference Books:

1. Wireless Sensor Networks A Networking Perspective, Jun Zheng & Abbas Jamalipour, a John Wiley & sons, Inc., publication.
2. Wireless sensor networks Technology, Protocols, and Applications, Kazemsohraby, danielminoli, taiebznati, A, John Wiley & sons, Inc., publication .
3. Fundamentals of Wireless sensor networks theory and practice, WaltenegusDargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication.