JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in CSE (CYBER SECURITY)
III & IV YEAR COURSE STRUCTURE & TENTATIVE SYLLABUS (R18)

Applicable From 2020-21 Admitted Batch

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Design and Analysis of Algorithms	3	0	0	3
2		Cryptography and Network Security	3	0	0	3
3		Database Management Systems	3	0	0	3
4		Formal Languages and Automata Theory	3	0	0	3
5		Professional Elective - I	3	0	0	3
6		Professional Elective - II	3	0	0	3
7		Cryptography and Network Security Lab	0	0	3	1.5
8		Database Management Systems Lab	0	0	3	1.5
9		Advanced Communication Skills Lab	0	0	2	1
10		Intellectual Property Rights	3	0	0	0
		Total Credits	**21**	**0**	**8**	**22**

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Cyber Security	3	1	0	4
2		Cyber Crime Investigation & Digital Forensics	3	1	0	4
3		Software Engineering	3	1	0	4
4		Professional Elective – III	3	0	0	3
5		Open Elective - I	3	0	0	3
6		Cyber Security Lab	0	0	3	1.5
7		Cyber Crime Investigation & Digital Forensics Lab	0	0	3	1.5
8		Professional Elective – III Lab	0	0	2	1
9		Environmental Science	3	0	0	0
		Total Credits	**18**	**3**	**8**	**22**

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Vulnerability Assessment & Penetration Testing	3	0	0	3
2		Network Management Systems and Operations	2	0	0	2
3		Professional Elective - IV	3	0	0	3
4		Professional Elective - V	3	0	0	3
5		Open Elective - II	3	0	0	3
6		Vulnerability Assessment & Penetration Testing lab	0	0	2	1
7		Industrial Oriented Mini Project / Summer Internship	0	0	0	2*
8		Seminar	0	0	2	1
9		Project Stage - I	0	0	6	3
		Total Credits	**14**	**0**	**10**	**21**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Organizational Behaviour	3	0	0	3
2		Professional Elective - VI	3	0	0	3
3		Open Elective - III	3	0	0	3
4		Project Stage - II	0	0	14	7
		Total Credits	**9**	**0**	**14**	**16**

***Note:** Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

MC - Environmental Science – Should be Registered by Lateral Entry Students Only.
MC – Satisfactory/Unsatisfactory.

Professional Elective - I

	Compiler Design
	Artificial Intelligence
	Data warehousing and Data Mining
	Ad-hoc & Sensor Networks
	Cloud Computing

Professional Elective - II

	Ethical Hacking
	Data Science
	Distributed Systems
	Cyber Laws
	IoT Security

Professional Elective - III

	Mobile Application Security
	Machine Learning
	DevOps
	Mobile Application Development
	Blockchain Technology

 # Courses in PE - III and PE - III Lab must be in 1-1 correspondence.

Professional Elective - IV

	Edge Analytics
	Web & Database Security
	Computer Security & Audit Assurance
	Social Media Security
	Deep Learning

Professional Elective - V

	Quantum Computing
	Data Analytics for Fraud Detection
	5G Technologies
	Security Incident & Response Management (SOC)
	Authentication Techniques

Professional Elective – VI

	Quantum Cryptography
	IoT Cloud Processing and Analytics
	Cloud Security
	Digital Watermarking and Steganography
	Data Privacy

VULNERABILITY ASSESSMENT AND PENETRATION TESTING

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

- Knowledge in information security.
- Knowledge on Web Application.

Course Objectives:

1. Introduce Vulnerability Assessment and Penetration Testing.
2. To be familiar with the Penetration Testing and Tools.
3. To get an exposure to Metasploit exploitation tool, Linux exploit and Windows exploit.
4. To gain knowledge on Web Application Security Vulnerabilities, Vulnerability analysis and Malware analysis.

Course Outcomes:

1. Understand social engineering attacks
2. Learn to handle the vulnerabilities of a Web application.
3. Perform penetration testing
4. Analyze the malware type and impact.

UNIT - I

Introduction Ethics of Ethical Hacking: Why you need to understand your enemy's tactics, recognizing the gray areas in security, Vulnerability Assessment and Penetration Testing. Penetration Testing and Tools: Social Engineering Attacks: How a social engineering attack works, conducting a social engineering attack, common attacks used in penetration testing, preparing yourself for face-to-face attacks, defending against social engineering attacks.

UNIT - II

Physical Penetration Attacks: Why a physical penetration is important, conducting a physical penetration, Common ways into a building, Defending against physical penetrations. Insider Attacks: Conducting an insider attack, Defending against insider attacks. Metasploit: The Big Picture, Getting Metasploit, Using the Metasploit Console to Launch Exploits, Exploiting Client-Side Vulnerabilities with Metasploit, Penetration Testing with Metasploit's Meterpreter, Automating and Scripting Metasploit, Going Further with Metasploit.

UNIT - III

Managing a Penetration Test: planning a penetration test, structuring a penetration test, execution of a penetration test, information sharing during a penetration test, reporting the results of a Penetration Test. Basic Linux Exploits: Stack Operations, Buffer Overflows, Local Buffer Overflow Exploits, Exploit Development Process. Windows Exploits: Compiling and Debugging Windows Programs, Writing Windows Exploits, Understanding Structured Exception Handling (SEH), Understanding Windows Memory Protections (XPSP3, Vista, 7 and Server 2008), Bypassing Windows Memory Protections.

UNIT - IV

Web Application Security Vulnerabilities: Overview of top web application security vulnerabilities, Injection vulnerabilities, cross-Site scripting vulnerabilities, the rest of the OWASP Top Ten SQL Injection vulnerabilities, Cross-site scripting vulnerabilities. Vulnerability Analysis: Passive Analysis, Source Code Analysis, Binary Analysis.

UNIT - V

Client-Side Browser Exploits: Why client-side vulnerabilities are interesting, Internet explorer security concepts, history of client- side exploits and latest trends, finding new browser-based vulnerabilities heap spray to exploit, protecting yourself from client-side exploit. Malware Analysis: Collecting Malware and Initial Analysis: Malware, Latest Trends in Honeynet Technology, Catching Malware: Setting the Trap, Initial Analysis of Malware.

TEXT BOOKS:

1. Gray Hat Hacking - The Ethical Hackers Handbook, Allen Harper, Stephen Sims, Michael Baucom, 3rd Edition, Tata Mc Graw-Hill.
2. The Web Application Hacker's Handbook-Discovering and Exploiting Security flaws, Dafydd Suttard, Marcus pinto, 1st Edition, Wiley Publishing.

REFERENCE BOOKS:

1. Penetration Testing: Hands-on Introduction to Hacking", Georgia Weidman, 1st Edition, No Starch Press.
2. The Pen Tester Blueprint-Starting a Career as an Ethical Hacker ", L. Wylie, Kim Crawly, 1st Edition, Wiley Publications.

NETWORK MANAGEMENT SYSTEMS AND OPERATIONS

B.Tech. IV Year I Sem.

L	T	P	C
2	0	0	2

Course Objectives:

1. To maintain optimal network performance and availability, and to ensure continuous uptime.
2. Monitor the network for problems that require special attention.

Course Outcomes:

1. Understand the basic network elements and their services.
2. To able to familiarize with different network faults and their correction techniques.
3. Understand various measures of network performance.

UNIT - I

The Network Management Challenge: Introduction, The Internet and Network Management, Internet Structure, Managing an Entity, Internal and External policies, The state of Network Management, Network Management in the Gartner Model, Benefits of Automation, The Lack of Industry Response, Impact on Business, Distributed Systems and new abstractions.

A Review of Network Elements and Services: Introduction, Network Devices and Network Services, Network Elements and Element Management, Effect of physical organization on Management, Examples of Network Elements and Services, Basic Ethernet Switch, VLAN Switch, Access Point for a Wireless LAN,

Cable Modem System, DSL Modem System and DSLAM, CSU/DSU used in Wide Area Digital Circuits, Channel Bank, IP Router, Firewall, DNS Server, DHCP Server, Web Server, HTTP Load Balancer.

UNIT - II

The Network Management Problem: Introduction, What is Network Management?, The scope of Network Management, variety and multi-vendor environments, element and network management systems, scale and complexity, types of networks, classification of devices, FCAPS: The Industry Standard Definition, The motivation for automation, Why Automation has not occurred, Organization of management Software.

Configuration and Operation: Introduction, Intuition for configuration, configuration and protocol layering, dependencies among configuration parameters, seeking a more precise definition of configuration, configuration and temporal consequences, configuration and global consistency, global state and practical systems, configuration and default values, partial state, automatic update and recovery, Interface paradigm and incremental configuration, commit and rollback during configuration, automated rollback and timeout, snapshot, configuration, and partial state, separation of setup and activation.

UNIT - III

Fault detection and correction: Introduction, Network Faults, Trouble Reports, Symptoms, And Causes, Troubleshooting And Diagnostics, Monitoring, Baselines, Items That Can Be Monitored, Alarms, Logs, And Polling, Identifying The Cause Of A Fault, Human Failure And Network Faults, Protocol Layering And Faults, Hidden Faults And Automatic Correction, Anomaly Detection And Event Correlation, Fault Prevention.

Performance Assessment and Optimization: Introduction, aspects of performance, Items that can be measured, measures of network performance, application and endpoint sensitivity, degraded service, variance in traffic and congestion, congestion, delay and utilization, local and end-to-end measurements, passive observation Vs. active probing, bottlenecks and future planning, capacity Planning, planning the capacity of a switch, planning the capacity of a router, planning the capacity of an Internet connection, measuring peak and average traffic on a link, estimated peak utilization and 95th percentile, relationship between average and peak utilization, consequences for management and

the 50/80 Rule, capacity planning for a complex topology, a capacity planning process, route changes and traffic engineering, failure scenarios and availability.

UNIT - IV

Security: Introduction, The illusion of a secure network, security as a process, security terminology and concepts, management goals related to security, Risk Assessment, Security policies, acceptable use policy, basic technologies used for security, management issues and security, Security architecture: Perimeter Vs. Resources, element coordination and firewall unification, resource limits and denial of service, management of authentication, access control and user authentication, management of wireless networks, security of the network, role-based access control, audit trails and security logging, key management.

Management tools and technologies: Introduction, the principle of most recent change, the evolution of Management tools, management tools as applications, using a separate network for management, types of management tools, physical layer testing tools, reach ability and connectivity tools (ping), packet analysis tools, discovery tools, device interrogation interfaces and tools, event monitoring tools, triggers, Urgency Levels, And Granularity, events, Urgency Levels and traffic, performance monitoring tools, flow analysis tools, routing and traffic engineering tools, Configuration tools, Security Enforcement tools, Network Planning tools, Integration of Management tools, NOCs and Remote Monitoring, Remote CLI Access, Remote Aggregation Of Management Traffic.

UNIT-V

Network Management Tools: Zabbix Labs, Nagios, Google Cloud network, Automation with Terraform.

TEXT BOOKS:

1. Automated Network Management Systems, D. Comer, Prentice Hall, 2006, ISBN No. 0132393085.
2. Nagios Core Administration Cookbook - Second Edition, Tom Ryder, 2016, Packt publishing, ISBN: 781785889332.
3. Terraform: Up and Running, Yevgeniy Brikman, 2017, O'Reilly Media, Inc., ISBN: 9781491977088.

REFERENCE BOOK:

1. Applied Network Security Monitoring, Chris Sanders, Jason Smith, Syngress publications.

EDGE ANALYTICS (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites

- A basic knowledge of "Python Programming"

Course Objectives:

- The aim of the course is to introduce the fundamentals of Edge Analytics
- The course gives an overview of – Architectures, Components, Communication Protocols and tools used for Edge Analytics

Course Outcomes:

1. Understand the concepts of Edge Analytics, both in theory and in practical application
2. Demonstrate a comprehensive understanding of different tools used at edge analytics
3. Formulate, Design and Implement the solutions for real world edge analytics

UNIT - I

Introduction to Edge Analytics. What is edge analytics, Applying and comparing architectures, Key benefits of edge analytics, Edge analytics architectures, Using edge analytics in the real world.

UNIT - II

Basic edge analytics components, Connecting a sensor to the ESP-12F microcontroller, KOM-MICS smart factory platform, Communications protocols used in edge analytics, Wi-Fi communication for edge analytics, Bluetooth for edge analytics communication, Cellular technologies for edge analytics communication, Long-distance communication using LoRa and Signfox for edge analytics.

UNIT - III

Working with Microsoft Azure IoT Hub, Cloud Service providers, Microsoft Azure, Exploring the Azure portal, Azure ioT Hub, Using the Raspberry Pi with Azure IoT edge, Connecting our Raspberry Pi edge device, adding a simulated temperature sensor to our edge device.

UNIT - IV

Using Micropython for Edge Analytics, Understanding Micropython, Exploring the hardware that runs MicroPython, Using MicroPython for an edge analytics application, Using edge intelligence with microcontrollers, Azure Machine Learning designer, Azure IoT edge custom vision.

UNIT - V

Designing a Smart Doorbell with Visual Recognition setting up the environment, Writing the edge code, creating the Node-RED dashboard, Types of attacks against our edge analytics applications, Protecting our edge analytics applications.

TEXT BOOK:

1. Hands-On Edge Analytics with Azure IoT: Design and develop IoT applications with edge analytical solutions including Azure IoT Edge by Colin Dow.

REFERENCE BOOKS:

1. Learn Edge Analytics - Fundamentals of Edge Analytics: Automated analytics at source using Microsoft Azure by Ashish Mahajan.

WEB & DATABASE SECURITY (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Give an Overview of information security
2. Give an overview of Access control of relational databases

Course Outcomes: Students should be able to

1. Understand the Web architecture and applications.
2. Understand client side and server-side programming.
3. Understand how common mistakes can be bypassed and exploit the application.
4. Identify common application vulnerabilities.

UNIT - I

The Web Security, The Web Security Problem, Risk Analysis and Best Practices
Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification

UNIT - II

The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications

UNIT - III

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems

UNIT - IV

Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities and

UNIT - V

Future Trends Privacy in Database Publishing: A Bayesian Perspective, Privacy-enhanced Location-based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment

TEXT BOOKS:

1. Web Security, Privacy and Commerce Simson GArfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia.

REFERENCE BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, O'reilly.
2. Jonathan LeBlanc Tim Messerschmidt, Identity and Data Security for Web Development - Best Practices, O'reilly.
3. McDonald Malcolm, Web Security For Developers, No Starch Press, US.

COMPUTER SECURITY & AUDIT ASSURANCE (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. State the basic concepts in information systems security, including security technology and principles, software security and trusted systems, and IT security management.
2. Explain concepts related to various cryptographic tools.

Course Outcomes:

1. State the requirements and mechanisms for identification and authentication.
2. Explain and compare the various access control policies and models as well as the assurance of these models.
3. Understand various standard practices and policies in conducting audits.
4. Understand and analyze the significance of Network Security and Control, Internet Banking Risks and Control.

UNIT - I

System Audit and Assurance – Characteristics of Assurance services, Types of Assurances services, Certified Information system auditor, Benefits of Audits for Organization, COBIT.

UNIT - II

Internal Control and Information system Audit - Internal Control, Detective control, Corrective Control, Computer Assisted Audit Tools and Techniques.

UNIT - III

Conducting Audit – Standard practices, policies, Audit planning, Risk Assessment, Information gathering techniques, Vulnerabilities, System security testing, conducting Audits for Banks.

UNIT - IV

Network Security and Control, Internet Banking Risks and Control, Operating System Risks and Control, Operational Control Overview.

UNIT - V

Business Continuity and Disaster Recovery Planning Control – Data backup/storage, Developing appropriate Disaster recovering strategy, Business Impact analysis.

TEXT BOOK:

1. Information System Audit and Assurance; D. P. Dube, Ved Prakash Gulati; Tata McGraw- Hill Education, 01 Jan 2005.

REFERENCE BOOKS:

1. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson education
2. Martin Weiss and Michael G. Solomon, Auditing IT Infrastructures For Compliance (Information Systems Security & Assurance)**,** Jones and Bartlett Publishers, Inc.

SOCIAL MEDIA SECURITY (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: Give introduction about the social networks, its use, the need of security in social data.

Course Outcomes:

1. Learn about browser's risks.
2. Learn about Social Networking, Understand the risks while using social media. Guidelines for social networking.
3. Understand how to secure different web browsers.
4. Understand how an e-mail works, learn threats involved using an email communication, safety measures while using e-mail.

UNIT – I

Introduction to Social Media, Understanding Social Media, Different Types and Classifications, The Value of Social Media, Cutting Edge Versus Bleeding Edge, The Problems That Come With Social Media, Is Security Really an Issue? Taking the Good With the Bad.

UNIT - II

Dark side Cybercrime, Social Engineering, Hacked accounts, cyberstalking, cyberbullying, predators, phishing, hackers.

UNIT – III

Being bold versus being overlooked Good social media campaigns, Bad social media campaigns, Sometimes it's better to be overlooked, Social media hoaxes, The human factor, Content management, Promotion of social media.

UNIT - IV

Risks of Social media Introduction Public embarrassment, Once it's out there, it's out there False information, Information leakage, Retention and archiving, Loss of data and equipment.

UNIT – V

Policies and Privacy Blocking users controlling app privacy, Location awareness, Security Fake accounts passwords, privacy and information sharing.

TEXT BOOKS:

1. Interdisciplinary Impact Analysis of Privacy in Social Networks, Recognizing Your Digital Friends, Encryption for Peer-to-Peer Social Networks Crowd sourcing and Ethics, Authors: Altshuler Y, EloviciY, Cremers A.B, Aharony N, Pentland A. (Eds.).
2. Social media security https://www.sciencedirect.com/science/article/pii/B97815974998660000

REFERENCE BOOKS:

1. Michael Cross, Social Media Security Leveraging Social Networking While Mitigating Risk.
2. Online Social Networks Security, Brij B. Gupta, Somya Ranjan Sahoo, Principles, Algorithm, Applications, and Perspectives, CRC press.

DEEP LEARNING (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: Students will be able:

1. To understand complexity of Deep Learning algorithms and their limitations
2. To be capable of performing experiments in Deep Learning using real-world data.

Course Outcomes:

1. Implement deep learning algorithms, understand neural networks and traverse the layers of data
2. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
3. Understand applications of Deep Learning to Computer Vision
4. Understand and analyze Applications of Deep Learning to NLP

UNIT - I

Introduction: Feed forward Neural networks, Gradient descent and the back-propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT - II

Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT- III

Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

UNIT -IV

Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity

UNIT -V

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCE BOOKS:

1. Bishop, C,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G., H., and Van Loan, C. F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

QUANTUM COMPUTING (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the fundamentals of quantum computing
2. The problem-solving approach using finite dimensional mathematics

Course Outcomes:

1. Understand basics of quantum computing
2. Understand physical implementation of Qubit
3. Understand Quantum algorithms and their implementation
4. Understand the Impact of Quantum Computing on Cryptography

UNIT - I

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. **Complex Numbers:** Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers.

UNIT - II

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

UNIT - III

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. **Quantum Hardware:** Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

UNIT - IV

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

UNIT - V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve. **The Impact of Quantum Computing on Cryptography:** Asymmetric Cryptography, Specific Algorithms, Specific Applications.

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

DATA ANALYTICS FOR FRAUD DETECTION (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Discuss the overall process of how data analytics is applied.
2. Discuss how data analytics can be used to better address and identify risks.
3. Help mitigate risks from fraud and waste for our clients and organizations.

Course Outcomes

1. Formulate reasons for using data analysis to detect fraud.
2. Explain characteristics and components of the data and assess its completeness.
3. Identify known fraud symptoms and use digital analysis to identify unknown fraud symptoms.
4. Automate the detection process.
5. Verify results and understand how to prosecute fraud.

UNIT - I

Introduction: Defining Fraud, Anomalies versus, Fraud, Types of Fraud, Assess the Risk of Fraud, Fraud Detection, Recognizing Fraud, Data Mining versus Data Analysis and Analytics, Data Analytical Software, Anomalies versus Fraud within Data, Fraudulent Data Inclusions and Deletions.

UNIT - II

The Data Analysis Cycle, Evaluation and Analysis, Obtaining Data Files, Performing the Audit, File Format Types, Preparation for Data Analysis, Arranging and Organizing Data, Statistics and Sampling, Descriptive Statistics, Inferential Statistics.

UNIT - III

Data Analytical Tests: Benford's Law, Number Duplication Test, Z-Score, Relative Size Factor Test, Same-Same-Same Test, Same-Same-Different Test.

UNIT - IV

Advanced Data Analytical Tests, Correlation, Trend Analysis, GEL-1 and GEL-2, Skimming and Cash Larceny, Billing schemes: and Data Familiarization, Benford's Law Tests, Relative Size Factor Test, Match Employee Address to Supplier data.

UNIT - V

Payroll Fraud, Expense Reimbursement Schemes, Register disbursement schemes.

TEXT BOOK:

1. Fraud and Fraud Detection: A Data Analytics Approach by Sunder Gee, Wiley.

REFERENCE BOOKS:

1. Blokdyk Gerardus, Data analysis techniques for fraud detection, Createspace Independent Publishing Platform.
2. Leonard W. Vona, Fraud Data Analytics Methodology: The Fraud Scenario Approach to Uncovering Fraud in Core Business Systems, Wiley.

5G TECHNOLOGIES (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: Knowledge on the concepts of 5G and 5G technology drivers. Understand 5G network architecture, components, features and their benefits.

Course Outcomes:

1. Understand 5G and 5G Broadband Wireless Communications.
2. Understand 5G wireless Propagation Channels.
3. Understand the significance of transmission and Design Techniques for 5G.
4. Analyze Device-to-device (D2D) and machine-to-machine (M2M) type communications.
5. Learn Massive MIMO propagation channel models.

UNIT - I:

Overview of 5G Broadband Wireless Communications: Evolution of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G.

UNIT - II:

The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems.,3GPP standards for 5G

UNIT - III:

Transmission and Design Techniques for 5G: Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques – orthogonal frequency division multiple accesses (OFDMA), generalized frequency division multiple accesses (GFDMA), non-orthogonal multiple accesses (NOMA).

UNIT - IV:

Device-to-device (D2D) and machine-to-machine (M2M) type communications – Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multi-hop and multi-operator D2D communications.

UNIT V:

Millimeter-wave Communications – spectrum regulations, deployment scenarios, beam-forming, physical layer techniques, interference and mobility management, Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, Pilot Contamination, Spatial Modulation (SM).

TEXT BOOKS:

1. Martin Sauter “From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband”, Wiley-Blackwell.
2. Afif Osseiran, Jose. F. Monserrat, Patrick Marsch, “Fundamentals of 5G Mobile Networks”, Cambridge University Press.

REFERENCE BOOKS:

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, John Wiley & Sons.
2. Amitabha Ghosh and Rapeepat Ratasuk “Essentials of LTE and LTE-A”, Cambridge University Press.
3. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos, “New Directions in Wireless Communication Systems from Mobile to 5G”, CRC Press.
4. Theodore S. Rappaport, Robert W. Heath, Robert C. Danials, James N. Murdock “Millimeter Wave Wireless Communications”, Prentice Hall Communications.

SECURITY INCIDENT AND RESPONSE MANAGEMENT (SOC) (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

- Knowledge in information security and applied cryptography.
- Knowledge in Operating Systems.

Course Objectives:

1. Introduce preparation of inevitable incident and incident detection and characterization.
2. To get an exposure to live data collection, Forensic duplication.
3. To gain knowledge on data analysis including Windows and Mac OS Systems.

Course Outcomes:

1. Learn how to handle the incident response management.
2. Perform live data collection and forensic duplication.
3. Identify network evidence.
4. Analyze data to carry out investigation.

UNIT - I

Introduction: Preparing for the Inevitable incident: Real world incident, IR management incident handbook, Pre-incident preparation, Preparing the Organization for Incident Response, Preparing the IR team, Preparing the Infrastructure for Incident Response. Incident Detection and Characterization: Getting the investigation started on the right foot, collecting initial facts, Maintenance of Case Notes, Understanding Investigative Priorities. Discovering the scope of incident: Examining initial data, Gathering and reviewing preliminary evidence, determining a course of action, Customer data loss scenario, Automated clearing fraud scenario.

UNIT - II

Data Collection: Live Data Collection: When to perform live response, Selecting a live response tool, what to collect, collection best practices, Live data collection on Microsoft Windows Systems, Live Data Collection on Unix-Based Systems. Forensic Duplication: Forensic Image Formats, Traditional duplication, Live system duplication, Duplication of Enterprise Assets.

UNIT - III

Network Evidence: The case for network monitoring, Types for network monitoring, Setting Up a Network Monitoring System, Network Data, Analysis, Collect Logs Generated from Network Events. Enterprise Services: Network Infrastructure Services, Enterprise Management Applications, Web servers, Database Servers

UNIT - IV

Data Analysis: Analysis Methodology: Define Objectives, Know your data, Access your data, Analyse your data, Evaluate Results. Investigating Windows Systems: NTFS and File System analysis, Prefetch, Event logs, Scheduled Tasks, The Windows Registry, Other Artifacts of Interactive Sessions, Memory Forensics, Alternative Persistence Mechanisms.

UNIT - V

Investigating Mac OS X Systems: HFS+ and File System Analysis, Core Operating systems data. Investigating Applications: What is Application Data?, Where is application data stored?, General Investigation methods, Web Browser, Email Clients, Instant Message Clients.

TEXT BOOKS:

1. “Incident Response and Computer Forensics”, Jason T. Luttgens, Mathew Pepe and Kevin Mandia, 3rd Edition, Tata McGraw-Hill Education.
2. “Cyber Security Incident Response-How to Contain, Eradicate, and Recover from Incidents”, Eric. C. Thompson, Apress.

REFERENCE BOOKS:

1. “The Computer Incident Response Planning Handbook: Executable Plans for Protecting Information at Risk”, N.K. McCarthy, Tata McGraw-Hill.

AUTHENTICATION TECHNIQUES (Professional Elective – V)

B.Tech. IV Year I Sem.

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Course Objectives: Knowledge on concept of authentication types, protocols, physical identification and various authentication algorithms.

Course Outcomes

1. Understand different types of authentication techniques
2. Understand text based and voice-based authentication techniques
3. Understand significance of authentication algorithms and its standards
4. Apply various authentication protocols in multi-server environment and their representation

UNIT - I:
Definition of Authentication, Identification/verification, Stages and steps of authentication, Authentication Entity : User, Device and Application; Authentication attributes: Source, Location, Path, Time duration etc.; Authentication Types : Direct / Indirect, One Way / Mutual, On demand/ Periodic/ Dynamic/Continuous authentication, Assisted/Automatic; 3 Factors of authentication; Passwords, Generation of passwords of varied length and of mixed type, OTP, passwords generation using entity identity credentials; Secure capture, processing, storage, verification and retrieval of passwords;

UNIT - II:
Physical identification using smart cards, remote control device, proximity sensors, surveillance camera, authentication in Card present / Card Not Present transactions as ATM/ PoS Device, mobile phone, wearable deviceand IoT device-based authentication; single sign- on; Symmetric Key Generation, Key Establishment, Key Agreement Protocols;

UNIT - III:
Biometrics – photo, face, iris, retinal, handwriting, signature, fingerprint, palm print, hand geometry, voice – Text based and text independent voice authentication, style of talking, walking, writing, keystrokes, gait etc. multi-modal biometrics.

UNIT - IV:
Matching algorithms, Patterns analysis, errors, performance measures, ROC Curve; Authentication Standards – International, UIDAI Standard. Kerberos, X.509 Authentication Service, Public Key Infrastructure, Scanners and Software; Web Authentication Methods: Http based, Token Based, OAuthand API.

UNIT - V:
User authentication protocols in multi-server environment, BAN Logic, Representation of authentication protocols using BAN Logic, Random Oracle Model, Scyther Tools, Proverif tool, Chebyshev Chaotic Map, Fuzzy Extractor, Fuzzy Extractor Map, Bloom Filter, LU Decomposition based User Authentication, Blockchain based authentication.

TEXT BOOKS:
Protocols for Authentication and Key Establishment, Colin Boyd and Anish Mathuria, springer, 2021
Guide to Biometrics, Ruud M.Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, Springer 2009.

REFERENCE BOOKS:

1. Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard Eugene Woods, 2nd Edition, Tata McGraw-Hill Education 2010.
2. Biometric System and Data Analysis: Design, Evaluation, and data Mining, Ted Dunstone and Neil Yager, Springer.
3. Biometrics Technologies and verification Systems, John Vacca, Elsevier Inc., 2007.
4. Pattern Classification, Richard O. Duda, David G.Stork,Peter E. Hart, Wiley 2007.