 **GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**School of Engineering and Technology**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

**(Internet of Things)**

**CONTENTS**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Particulars** | **Page No.** |
| 1 | IV Year - I Semester Course Structure | 2 |
| 2 | IV Year - II Semester Course Structure | 3 |
| 3 | Professional Electives Course Structure | 4 |
| 4 | IV Year - I Semester Syllabus | 5 |
| 5 | Professional Electives Syllabus | 11 |

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**School of Engineering and Technology**

**IV B.Tech. CSE (Internet of Things)**

**COURSE STRUCTURE**

(Applicable for the batch admitted from 2020-21 & 2021-22)

**R18 / R21 REGULATION**

**IV Year I Semester**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl.No** | **Course Code** | **Title of the Course** | **L** | **T** | **P** | **Credits** |
| 1 | 18PC0CI07 | IoT Cloud Processing and Analytics | 3 | 0 | 0 | 3 |
| 2 | 18PC0CI08 | IoT Security | 3 | 0 | 0 | 3 |
| 3 | OEC | **Open Elective - III** | 3 | 0 | 0 | 3 |
| 4 | PEC | **Professional Elective - IV** | 3 | 0 | 0 | 3 |
| 5 | PEC | **Professional Elective - V** | 3 | 0 | 0 | 3 |
| 6 | 18PC0CI09 | IoT Security & Cloud Computing Lab | 0 | 0 | 2 | 1 |
| 7 |  | Project - I | 0 | 0 | 6 | 3 |
| 8 |  | Summer Internship | - | - | - | 2 |
| **Total Credits** | | | | | | **21** |

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**School of Engineering and Technology**

**IV B.Tech. CSE (Internet of Things)**

**COURSE STRUCTURE**

(Applicable for the batch admitted from 2020-21 & 2021-22)

**R18 / R21 REGULATION**

**IV Year II Semester**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl.No** | **Course Code** | **Title of the Course** | **L** | **T** | **P** | **Credits** |
| 1 |  | Organizational Behaviour | 3 | 0 | 0 | 3 |
| 2 | OEC | **Open Elective - IV** | 3 | 0 | 0 | 3 |
| 3 | PEC | **Professional Elective - VI** | 3 | 0 | 0 | 3 |
| 4 |  | Seminar & Technical Writing | 1 | 0 | 0 | 1 |
| 5 |  | Project - II | 0 | 0 | 14 | 7 |
| **Total Credits** | | | | | | **17** |

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**School of Engineering and Technology**

**B. Tech. Information Technology**

**PROFESSIONAL ELECTIVES**

(Applicable for the batch admitted from 2020-21 & 2021-22)

**R18 / R21 REGULATION**

**Professional Elective - IV**

1. Wireless Networks
2. Software Testing
3. Augmented Reality & Virtual Reality

**Professional Elective - V**

1. IoT Automation
2. Digital Forensics
3. Ad Hoc and Sensor Networks

**Professional Elective - VI**

1. Block Chain Technology
2. 5G & IoT Technologies
3. Edge Computing

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**IOT CLOUD PROCESSING AND ANALYTICS**

**COURSE OBJECTIVES**

Knowledge on IoT networking connectivity protocols and IoT Analytics for the cloud processing.

**COURSE OUTCOMES**

At the end of the course, students will be able to:

CO1:Implement the architectural components and protocols for application development.

CO2: Identify data analytics and data visualization tools as per the problem characteristics.

CO3: Collect, store and analyze IoT data.

CO4: Analyze the data science for IOT.

CO5: Organize the data for analytics.

**SYLLABUS**

**UNIT - I**

IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.

**UNIT - II**

IoT Analytics for the Cloud: Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage.

**UNIT - III**

Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.

**UNIT - IV**

Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias - variance tradeoff, Use cases for deep learning with IoT data.

**UNIT - V**

Strategies to Organize Data for Analytics: Linked Analytical Datasets, Managing data lakes, data retention strategy.

**TEXT BOOKS**

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands on Approach, Universities Press, 2015.
2. Kevin, Townsend, Carles, Cufí, Akiba and Robert Davidson, "Getting Started with Bluetooth Low Energy” O'Reilly.

**REFERENCE BOOKS**

1. Madhur Bhargava, IoT Projects with Bluetooth Low Energy, Packt Publishing, August 2017.
2. Robin Heydon, Bluetooth Low Energy: The Developer's Handbook, Pearson, October 2012
3. Kumar Saurabh, Cloud Computing, Wiley India, 1st Edition, 2016.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**IOT SECURITY**

**COURSE OBJECTIVES**

1. Understand the fundamentals, various attacks and importance of security aspects in IoT.
2. Understand the techniques, protocols and some idea on security towards Gaming models.
3. Understand the operations of Bitcoin block chain, crypto-currency application of block chain technology.
4. Understand the essential components of IoT.
5. Understand security and privacy challenges of IoT.

**COURSE OUTCOMES**

CO1: Incorporate the best practices learnt to identify the attacks and mitigate the same.

CO2: Adopt the right security techniques and protocols during the design of IoT products.

CO3: Assimilate and apply the skills learnt on ciphers and block chains when appropriate.

CO4: Describe the essential components of IoT.

CO5: Find appropriate security/privacy solutions for IoT.

# SYLLABUS

# UNIT - I

Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data, Block ciphers, Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity, Modeling faults and adversaries, Difference among IoT devices, computers, and embedded devices.

# UNIT - II

IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT. IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions, Consensus algorithms and their scalability problems, Accelerometer, photoresistor, buttons.

# UNIT - III

Security engineering for IoT development Hardware Security, Merkle trees and Elliptic curves digital signatures, verifiable random functions, Zero-knowledge systems motor, LED, vibrator. IoT security lifecycle, Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), blockchain, the challenges, and solutions, analog signal vs. digital signal.

# UNIT - IV

Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT, Device/User Authentication in IoT IoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication.

# UNIT - V

Introduction to Authentication Techniques Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency, Data Trustworthiness in IoT Secure IoT Higher Layers, Distributed consensus, Smart Contract Languages and verification challenges data analytics in IoT - simple data analyzing methods.

# TEXT BOOKS

1. B. Russell and D. Van Duren, Practical Internet of Things Security, Packt Publishing, 2016.
2. FeiHU, Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, CRC Press, 2016.
3. Narayanan et al., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.

# REFERENCE BOOKS

1. A. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O’Reilly, 2014.
2. T. Alpcan and T. Basar, Network Security: A Decision and Game-theoretic Approach, Cambridge University Press, 2011.
3. Security and the IoT ecosystem, KPMG International, 2015.
4. Internet of Things: IoT Governance, Privacy and Security Issues” by European Research Cluster.
5. Ollie Whitehouse, Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond, NCC Group, 2014
6. Josh Thompson, Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**0 0 2 1**

**IOT SECURITY & CLOUD COMPUTING LAB**

**PREREQUISITES**

Fundamentals of Computer Networks, Wireless Sensor Network, Web Technology, Information Security.

**COURSE OBJECTIVES**

1. To learn about how to integrate the security aspect into their IoT design taking into consideration all the threats that can possibly happen.
2. To develop web applications in cloud.
3. To learn the design and development process involved in creating a cloud-based application.

**COURSE OUTCOMES**

CO1: Understand the vision of IoT from a global context for secure and smart city.

CO2: Use of Devices, Gateways and Data Management in IoT. Its security building state of the art architecture in IoT with security deployment.

CO3: Configure various virtualization tools such as Virtual Box, VMware workstation.

CO4: Design and deploy a web application in a PaaS environment.

**LIST OF EXPERIMENTS: (IOT SECURITY LAB)**

1. Introduction to Open Source Hardware & its Application.
   1. Arduino
   2. Raspberry Pi
2. Develop Applications using Arduino and Raspberry Pi
3. Exploring Open Source tools for Security and Privacy issues in IoT.
4. Implement Eclipse IoT Project with Emphasis on Security related issues.
5. Explore the working of AWS IoT Device Defender.

**REFERENCE BOOKS**

1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013.
3. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-1- 4493-9357-1.

**SUPPLEMENTARY RESOURCES**

1. <https://github.com/connectIOT/iottoolkit>
2. <https://www.arduino.cc/>
3. <http://www.zettajs.org/>
4. Contiki (Open source IoT operating system)
5. Arduino (open source IoT project)
6. IoT Toolkit (smart object API gateway service reference implementation)
7. Zetta (Based on Node.js, Zetta can create IoT servers that link to various devices and sensors)

**LIST OF EXPERIMENTS: (CLOUD COMPUTING LAB)**

1. Install Virtualbox/Vmware Workstation with different flavors of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
6. Install Hadoop single node cluster and run simple applications like word count.

**E-RESOURCES**

1. <https://www.iitk.ac.in/nt/faq/vbox.htm>
2. [https://www.google.com/urlsa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjqrNG0z](https://www.google.com/urlsa%3Dt%26rct%3Dj%26q%3D%26esrc%3Ds%26source%3Dweb%26cd%3D%26ved%3D2ahUKEwjqrNG0z)a73AhXZt1YBHZ21DWEQFnoECAMQAQ&url=http%3A%2F%2Fwww.cs.columbia.edu%2F~sedwards%2Fclasses%2F2015%2F1102-fall%2Flinuxvm.pdf&us g=AOvVaw3xZPuF5xVgk- AQnBRsTtHz
3. <https://www.cloudsimtutorials.online/cloudsim/>
4. <https://edwardsamuel.wordpress.com/2014/10/25/tutorial-creating-openstack-instance-in-> trystack/
5. <https://www.edureka.co/blog/install-hadoop-single-node-hadoop-cluster>

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

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**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**WIRELESS NETWORKS**

**(PROFESSIONAL ELECTIVE - IV)**

**PREREQUISITE**

Wireless Sensor Networks.

**COURSE OBJECTIVES**

1. To study the fundamentals of wireless Ad-Hoc Networks.
2. To study the operation and performance of various Ad Hoc wireless network protocols.
3. To study the architecture and protocols of Wireless sensor networks.

**COURSE OUTCOMES**

At the end of the course, students will be able to:

CO1: Understand the basis of Ad-hoc wireless networks.

CO2: Design, operation and the performance of MAC layer protocols of Ad Hoc wireless networks.

CO3: Design, operation and the performance of routing protocol of Ad Hoc wireless network.

CO4: Design, operation and the performance of transport layer protocol of Ad Hoc wireless networks.

CO5: Distinguish between protocols used in Adhoc wireless networks and wireless sensor networks.

**SYLLABUS**

**UNIT - I**

Wireless LANs and PANs: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

Ad-Hoc Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks.

**UNIT - II**

MAC Protocols: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention-Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

**UNIT - III**

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power- Aware Routing Protocols.

**UNIT - IV**

Transport Layer Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

**UNIT - V**

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

**TEXT BOOKS**

1. Ad Hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad-hoc and Sensor Networks: Protocols, Performance and Control, Jagannathan Sarangapani, CRC Press.

**REFERENCE BOOKS**

1. Ad-Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh, 1st Ed. Pearson Education.
2. Wireless Sensor Networks, C.S.Raghavendra, Krishna M. Sivalingam, 2004, Springer.

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**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**SOFTWARE TESTING**

**(PROFESSIONAL ELECTIVE - IV)**

**COURSE PREREQUISITES**

A course on Software Engineering.

**COURSE OBJECTIVES**

This course is intended to understand the software testing techniques such as flow graphs and path testing, transaction flows testing, data flow testing, domain testing and logic base testing.

**COURSE OUTCOMES**

By the end of the course, students will be able to

CO1: Understand the purpose of testing and different types of testing techniques.

CO2: Apply the process of testing and various methodologies in testing for developed software.

CO3: Design and conduct a software test process for a software testing project.

CO4: Use software testing methods and modern software testing tools for their testing projects.

CO5: Write test cases for given software to test it before delivery to the customer

**SYLLABUS**

**UNIT I**

**Introduction:** Purpose of testing, Dichotromies, Model for testing, consequences of bugs, taxonomy of bugs.

**Flow graphs and path testing:** Basics concepts of path testing, predicates, path predicates and achievable paths, paths sensitizing, path instrumentation, application of path testing.

**UNIT II**

**Transaction flow testing:** Transaction flows, transaction flow testing techniques.

**Data flow testing:** Basics of data flow testing, Strategies in data flow testing, Applications of data flow testing.

**UNIT III**

**Domain testing:** Domains and paths. Nice and ugly domains, Domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

**UNIT IV**

**Paths**, **path products and regular Expressions:** Path products and path expression, Reduction Procedure, Applications, regular expressions and flow anomaly detection.

**Logic based testing:** Overview, decision tables, path expressions, kv charts specifications.

**UNIT V**

**State, State graphs and transaction testing:** State graphs, good and bad state graphs, State testing, testability tips.

**Graphs matrices and application:** Motivational Overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools

**TEXT BOOKS**

1. Software Testing techniques, Baris Beizer, 2nd Edition, Dreamtech, 2009.
2. Software Testing: Principles and Practices, Srinivasan D and Gopalaswamy R, Pearson Education, 2008.
3. Software Testing Tools, Dr.K.V.K.K.Prasad, Dreamtech.

**REFERENCE BOOKS**

1. The craft of software testing, Brian Marick, Pearson Education.
2. Software Testing Techniques, SPD(Oreille).
3. Software Testing in the Real World, Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing, Meyers, John Wiley.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**AUGMENTED REALITY AND VIRTUAL REALITY**

**(PROFESSIONAL ELECTIVE - IV)**

**COURSE OBJECTIVES**

1. The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices.
2. To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

**COURSE OUTCOMES**

CO1: Describe how AR systems work and list the applications of AR.

CO2: Understand and analyze the hardware requirement of AR.

CO3: Describe how VR systems work and list the applications of VR.

CO4: Understand the design and implementation of the hardware that enables VR systems to be built.

**SYLLABUS**

**UNIT - I**

Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

**UNIT - II**

AR Devices & Components: AR Components - Scene Generator, Tracking system, monitoring system, display, Game scene. AR Devices - Optical See-Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems.

**UNIT - III**

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality

**UNIT - IV**

Representing the Virtual World: Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR, Case Study: GHOST (General Haptics Open Software Toolkit) software development toolkit.

**UNIT - V**

Visual Perception & Rendering: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information, Visual Rendering - Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates.

**TEXT BOOKS**

1. Allan Fowler, AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178.
2. Augmented Reality: Principles & Practice, Schmalstieg / Hollerer, Pearson Education India, First Edition (12 October 2016), ISBN-10: 9332578494.

**REFERENCE BOOKS**

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics). Morgan Kaufmann Publishers, San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig,William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.
4. Designing for Mixed Reality, Kharis O'Connell, O'Reilly Media, Inc., 2016, ISBN: 9781491962381.
5. Sanni Siltanen, Theory and applications of marker-based augmented reality. Julkaisija-Utgivare Publisher. 2012. ISBN 978-951-38-7449-0.
6. Gerard Jounghyun Kim, Designing Virtual Systems: The Structured Approach, 2005.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**IOT AUTOMATION**

**(PROFESSIONAL ELECTIVE - V)**

**COURSE OBJECTIVES**

1. While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.
2. Students acquire the upcoming Industrial IoT: Roadmap to the Connected World Course offers important insights on overcoming the challenges and thrive in this exciting space.

**COURSE OUTCOMES**

CO1: Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security.

CO2: Explore IoT technologies, architectures, standards, and regulation.

CO3: Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices.

CO4: Examine technological developments that will likely shape the industrial landscape in the future.

CO5: Develop and implement own IoT technologies, solutions, and applications.

**SYLLABUS**

**UNIT - I**

Introduction & Architecture: What is IIoT and the connected world? the difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT. Fundamentals of Control System, introductions, components, closed loop & open loop system.

**UNIT - II**

IIOT Components: Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basic Sensors - Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11). Digital switch, Electro Mechanical switches.

**UNIT - III**

Communication Technologies of IIoT: Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID Industry standards communication technology (LoRAWAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network communication.

**UNIT - IV**

Visualization and Data Types of IIoT: Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud database, Cloud computing, Fog or Edge computing.

Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

**UNIT - V**

Retrieving Data: Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M). Control & Supervisory Level of Automation: Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA).

**TEXT BOOKS**

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham, Springer Publication.
2. Industrial Internet of Things: Cyber manufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, Springer Publication.
3. Industrial IoT Challenges, Design Principles, Applications, and Security, Ismail Butun.

**REFERENCE BOOK**

1. Jerker Delsing, IoT Automation: Arrowhead Framework, CRC Press.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**DIGITAL FORENSICS**

**(PROFESSIONAL ELECTIVE - V)**

**PRE-REQUISITES**

Cybercrime and Information Warfare, Computer Networks.

**COURSE OBJECTIVES**

1. Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

**COURSE OUTCOMES**

On completion of the course the student should be able to

CO1: Understand relevant legislation and codes of ethics.

CO2: Computer forensics and digital detective and various processes, policies and procedures.

CO3: E-discovery, guidelines and standards, E-evidence, tools and environment.

CO4: Email and web forensics and network forensics.

**SYLLABU**

**UNIT - I**

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.

Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

**UNIT - II**

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

**UNIT - III**

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

**UNIT - IV**

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case.

Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

**UNIT - V**

Mobile Forensics: mobile forensics techniques, mobile forensics tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

**TEXT BOOK**

1. John Sammons, The Basics of Digital Forensics, Elsevier John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.

**REFERENCE BOOKS**

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) I Sem L T P C**

**3 0 0 3**

**AD HOC AND SENSOR NETWORKS**

**(PROFESSIONAL ELECTIVE - V)**

**COURSE PREREQUISITES**

A course on Computer Networks and Mobile Computing.

**COURSE OBJECTIVES**

This course is intended to describe the concepts of sensor networks, MAC and transport protocols for ad hoc networks, security of sensor networks, applications of ad hoc and sensor networks.

**COURSE OUTCOMES**

By the end of the course, students will be able to

CO1: Analyze the various sensor networks and the unique set of design challenges.

CO2: Identify the various data transmission methods of sensor networks.

CO3: Examine the purpose of TCP and its layers over Ad Hoc protocol.

CO4: Determine the process of data retrieval in sensor networks.

CO5: Understand the security aspects in Ad Hoc networks.

**SYLLABUS**

**UNIT - I**

Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs. Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topology-based routing algorithms-Proactive: DSDV, WRP; Reactive: DSR, AODV, TORA; Hybrid: ZRP; Position-based routing algorithms -Location Services-DREAM, Quorum-based, GLS; Forwarding Strategies: Greedy Packet, Restricted Directional Flooding - DREAM, LAR; Other routing algorithms - QoS Routing, CEDAR.

**UNIT - II**

Data Transmission - Broadcast Storm Problem, Rebroadcasting Schemes - Simple-flooding, Probability-based Methods, Area-based Methods, Neighbour Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCEDAR and Geocasting: Data -transmission Oriented - LBM; Route Creation Oriented - GeoTORA, MGR.

**UNIT - III**

TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Adhoc, Basics of Wireless, Sensors and Applications: The Mica mote, Sensing and communication range, Design issues, energy consumption, Clustering of sensors, Applications.

**UNIT - IV**

Data Retrieval in Sensor Networks - Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

**UNIT - V**

Security - Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

**TEXT BOOKS**

1. Ad Hoc and Sensor Networks: Theory and Applications, Carlos de Morais Corderio, Dharma Prakash Agrawal, World Scientific Publications, March 2006.
2. Wireless Sensor Networks: An Information Processing Approach (The Morgan Kaufmann Series in Networking), Feng Zhao, Leonidas Guibas, Elsevier.

**REFERENCE BOOKS**

1. Advanced Technologies in Ad Hoc and Sensor Networks, Xue Wang, Li Cui, [Zhongwen Guo](https://www.amazon.in/s/ref=dp_byline_sr_ebooks_3?ie=UTF8&field-author=Zhongwen+Guo&text=Zhongwen+Guo&sort=relevancerank&search-alias=digital-text), Springer.
2. Security in Ad-hoc and Sensor Networks, Claude Castelluccia, Hannes Hartenstein, Springer.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) II Sem L T P C**

**3 0 0 3**

**BLOCK CHAIN TECHNOLOGY**

**(PROFESSIONAL ELECTIVE - VI)**

**COURSE PREREQUISITES**

A course on Data Structures.

**COURSE OBJECTIVES**

This course is intended to Introduce block chain technology and Crypto currency.

**COURSE OUTCOMES**

By the end of the course, students will be able to

CO1: Learn about research advances related to one of the most popular technological areas today.

CO2: Block chain technology landscape

CO3: Applications and implementation strategies

CO4: State-of-the-art, open research challenges, and future directions

**SYLLABUS**

**UNIT - I**

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Crypto currency works, Crowd funding.

**UNIT - II**

Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment.

**UNIT - III**

Block chain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

**UNIT - IV**

Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency.

**UNIT - V**

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

**TEXT BOOK**

1. Blockchain Blue print for Economy, Melanie Swan.

**REFERENCE BOOK**

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st Edition, Daniel Drescher.

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

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**IV Year B.Tech. CSE (IOT) II Sem L T P C**

**3 0 0 3**

**5G & IOT TECHNOLOGIES**

**(PROFESSIONAL ELECTIVE - VI)**

**COURSE OBJECTIVES**

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IoT Devices.

**COURSE OUTCOMES**

CO1: Understand the application areas of IoT.

CO2: Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.

CO3: Understand building blocks of Internet of Things and characteristics.

CO4: Understand IoT and M2M.

**SYLLABUS**

**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, IEEE 802.15.4

**UNIT - III**

Introduction to Internet of Things - Definition and Characteristics of IoT, Physical Design of IoT - IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs - Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

**UNIT - IV**

IoT and M2M - Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER

**UNIT - V**

IoT Physical Devices and Endpoints - Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming - Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

**TEXT BOOKS**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

**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.

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**(AUTONOMOUS)**

**IV Year B.Tech. CSE (IOT) II Sem L T P C**

**3 0 0 3**

**EDGE COMPUTING**

**(PROFESSIONAL ELECTIVE - VI)**

**COURSE OBJECTIVES**

Knowledge on how edge computing and Internet of Things (IoT) can be used as a way to meet application demands in intelligent IoT systems.

**COURSE OUTCOMES**

CO1: Understand use of the IoT architecture with its entities and protocols, from the IoT devices.

CO2: Security and privacy issues related to the area of edge computing and IoT.

CO3: Understand the RaspberryPi architecture and its components.

CO4: Work with RaspberryPi components and evaluate its performance.

**SYLLABUS**

**UNIT - I**

IoT and Edge Computing Definition and Use Cases: Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

**UNIT - II**

IoT Architecture and Core IoT Modules - A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples - Example use case and deployment, Case study - Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

**UNIT - III**

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

**UNIT - IV**

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols - Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

**UNIT - V**

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

**TEXT BOOKS**

1. IoT and Edge Computing for Architects, Second Edition, Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806.
2. Raspberry Pi Cookbook, 3rd Edition, Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

**REFERENCE BOOKS**

1. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya, Satish Narayana Srirama, Wiley publication, 2019, ISBN: 9781119524984.
2. David Jensen, Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE.