AICTE MODEL CURRICULUM

FOR

POST GRADUATE DEGREE COURSE

M.TECH

in

COMPUTER NETWORKS & INFORMATION SECURITY

[W.E.F. 2021-22]

DEPARTMENT OF

COMPUTER SCIENCE AND SYSTEMS ENGINEERING

AU COLLEGE OF ENGINEERING (AUTONOMOUS)

ANDHRA UNIVERSITY

VISAKHAPATNAM-530 003

ANDHRA UNIVERSITY: : VISAKHAPATNAM

M.Tech.

Computer Networks& Information Security

Course Structure and Scheme of Valuation w.e.f. 2021-22

I-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS11	Mathematical Foundations For Cryptography	3	-	70	30	100	3
MTCNIS12	TCP/IP	3	-	70	30	100	3
MTCNIS13	Elective-I	3	-	70	30	100	3
MTCNIS14	Elective-II	3	-	70	30	100	3
MTCST15	Research Methodology &IPR	3	-	70	30	100	2
MTCST16	Organizational Behavior (Audit Course)	3	-	70	30	100	0
MTCNIS17	TCP/IP Lab		3	50	50	100	2
MTCNIS18	Network Simulation & IoT Lab		3	50	50	100	2
Total		**18**	**6**	**520**	**280**	**800**	**18**

Elective-I: Virtual Private Networks/Machine Learning/Unix Network Programming
Elective II: Cloud Computing/ Distributed Operating Systems /IoT

II-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS21	Mobile-Adhoc Networks	3	-	70	30	100	3
MTCNIS22	Computer Security	3	-	70	30	100	3
MTCNIS23	Elective-III 3	3	-	70	30	100	3
MTCNIS24	Elective-IV	3	-	70	30	100	3
MTCST25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTCNIS26	Wireless Networks Lab	-	3	50	50	100	2
MTCNIS27	Application Security Lab	-	3	50	50	100	2
MTCNIS28	Mini Project With Seminar	-	3	-	100	100	2
Total		**15**	**9**	**450**	**350**	**800**	**18**

Elective III: Web Application Security/Android-IoS Security/IoT Security
Elective IV: Digital Forensics/Sensor Networks/Intrusion Detection System(IDS)

III-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 31	Elective-V	3	-	70	30	100	3
MTCNIS 32	Open Elective	3	-	70	30	100	3
MTCNIS33	Dissertation-I / Industrial project		-	100	-	100	10
Total		**6**	**-**	**240**	**60**	**300**	**16**

Elective V: Malware Analysis/Block chain Technologies/Software Defined Networks

Open Elective: Business Anlytics /4G-5G Mobile Communication Networks/ Operation Research

IV-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS41	Dissertation- II	-	-	100	-	100	16
Total		**-**	**-**	**100**	**-**	**100**	**16**

M.Tech CNIS

Programme Education Objectives (PEO)

PEO1: To drive the students to achieve excellence in research and professional career.
PEO 2: To promote creative thinking and innovative mindset for solving societal problems.
PEO3: To help exhibit adaptive and agile skills in the core area of Information Security& Networks to meet the technical and managerial challenges.
PEO4: To demonstrate interpersonal skills, professional ethics to work in a team to make a positive impact on society and sustenance.

Programme Specific Outcomes (PSO)

PSO 1: Ability to understand the design and implementation of Computer Networks and Information Security algorithms and infrastructure.
PSO 2: Ability to apply standard practices related to Networks and Security Technologies and follow professional ethics.
PSO 3: Ability to apply mathematical and algorithmic models and handle projects involving hardware and software related to Networks and Security and follow agile methods.
PSO 4: Ability to propose research and applicability of innovative ideas related to Networks and Security and be able to write reports.

Programme Outcomes (PO)

PO1: To acquire essential knowledge of relevant mathematics and algorithms basics.
PO2: To understand, model and find solutions for engineering problems to help achieve sustainable development.
PO3: To be able to design systems, components and products useful to enhance quality of human life while using internet and related devices.
PO4: To be able to apply knowledge in Computer Engineering to solve research problems and publish in high impact journals/conferences.
PO5: To be able to use open-source networking and security tools and networking equipment.
PO6: To be able to understand societal, health, cultural, safety and legal issues in context of network and security domain.
PO7: To be able to understand the impact of network and security technology-based solutions in a global, economic, environmental and societal context.
PO8: To understand professional and ethical responsibility.
PO9: To excel as an individual and as a team member in achieving a common goal.
PO10: To communicate effectively with research and academic communities in both written and oral formats.
PO11: To acquire knowledge of contemporary issues in QOS, cyber-attacks, preventive measures, and data safety.
PO12: To gain appropriate skills and be a continuous learner for professional and career advancement.

MTCNIS11	MATHEMATICAL FOUNDATIONS FOR CRYPTOGRAPHY	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

In this course, we will be introduced to basic mathematical principles and functions that form the foundation for cryptographic and cryptanalysis methods. These principles and functions will be helpful in understanding symmetric and asymmetric cryptographic methods examined in our course. It is recommended that you have a basic knowledge of computer science and basic math skills such as algebra and probability.

To make the student learn different encryption techniques along with hash functions, MAC, digital signatures, and their use in various protocols for network security and system security.

- To understand basics of Cryptography and mathematical foundations.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity, and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

Course Outcomes:

After successful completion of the course, the learners would be able to

- Provide security of the data over the network.
- Do research in the emerging areas of cryptography and network security.
- Implement various networking protocols.
- Protect any network from the threats in the world.
- Apply numerical methods and Mathematical Foundations to solve the complex engineering Problems.

MTCNIS12	TCP/IP	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits:3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- The objective of a TCP/IP course is to provide a comprehensive understanding of the TCP/IP protocol suite, including its architecture, protocols, and services.
- The course should cover topics such as IP addressing, subnetting, routing, TCP and UDP protocols, domain names, network security, and network troubleshooting.
- The goal is to equip students with the knowledge and skills necessary to design, implement, and manage TCP/IP-based networks.

Course Outcomes:

By the end of this course, students will gain the following knowledge and skills:

- Understanding of Networking Fundamentals: Students will gain an understanding of basic networking concepts, such as the OSI & TCP/IP models,
- Details of Network layer protocols (such as IP, ARP, RARP, ICMP etc.,)
- Knowledge of TCP/IP Protocols: Students will develop an understanding of the core concepts of the TCP and IP protocols, including data segmentation, flow control, congestion control and error detection.
- IP Routing Skills: Students will learn how to configure and implement IP routing, including the use of static and dynamic routing protocols (such as BOOTP, DHCP).
- TCP Connection Management Skills: Students will gain experience in managing TCP connections, including the three-way handshake and flow control.
- Knowledge of Application Protocols: Students will develop an understanding of commonly used application protocols that run over TCP/IP, such as HTTP, SNMP, FTP, IP Multicasting, MPLS and DNS.
- A good understanding of the other advanced protocols such as FINGER protocol, MOBILE IP, WHOIS protocol, TCPDUMP, GOPHER, VERONICA etc.,

MTCNIS13	ELECTIVE-I VIRTUAL PRIVATE NETWORK	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits:3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To Learn About the Different Layers, Encapsulation, Addressing, Routing of Tcp/Ip Model.
- To Learn About Virtual Private Network, Its Components, Workflow, Tunneling, Architecture, Advantages and Disadvantages and Different Protocols
- To Learn About Secure Sockets Layer (Ssl), Its Protocols, Its Security, Secure Socket Shell (Ssh) And About Light Weight Vpn
- To Learn About Internet Protocol Security (Ip Sec), Authentication Header and Their Architecture, Protocols, Modes, Security.
- To Learn About Vpn Applications in Business and Industry

Course Outcomes:

- Gain Knowledge About Process Layer, Transport Layer, Internet Layer, Link Layer, Physical Layer, Data Encapsulation, Ip, User Datagram Protocol, Internet Control Message Protocol, Network Addressing Protocol, Non-Internet Facing Ip, 128 Bit Length Addressing, Static and Dynamic Routing.
- Gain Knowledge About Vpn, Device Level and Network Level Components Of Vpn, Steps For All Kinds Of Vpn Configurations, Process By Which Vpn Packets Reach Their Intended Destinations, And Different Protocols Like Ip-In-Ip Tunnels, Point To Point Tunneling, Generic Routing Encapsulation, Secure Shell, Layer 2 Tunneling Etc.
- Gain Knowledge About Secure Socket Level (Ssl), Its Protocols Like Record, Handshake, Change-Cipher, Alert, Encryption and Decryption Algorithms For Security.
- Gain Knowledge About Secure Socket Shell, Sshv1, Sshv2, Lightweight Vpn.
- Gain Knowledge About Building Vpn Using Ssh
- Gain Knowledge About Internet Protocol Security, Authentication Header, Group of Protocols to Set Up Encrypted Connection Between Devices, Authentication Header Protocol, Encapsulating Security Protocol, Security Assistant, Transport Mode And Tunnel Mode.
- Gain Knowledge to Establish Vpn In Business And Industry Establishments.

MTCNIS13	ELECTIVE-I MACHINE LEARNING	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

Machine Learning course will

- Develop an appreciation for what is involved in learning from data.
- Study a wide variety of learning algorithms.
- Demonstrate how to apply a variety of learning algorithms to data.
- Demonstrate how to perform evaluation of learning algorithms and model selection.

Course Outcomes:

After the completion of the course, student will be able to

- Understand the distribution and diversity of Data.
- Extract features useful for building predictive models.
- Gain knowledge on Supervised and unsupervised Learning techniques.
- Analyze Statistical learning techniques and Logistic Regression
- Select appropriate Support Vector Machines and Perceptron Algorithm
- Compare the performance of different learning models.

MTCNIS13	ELECTIVE-I UNIX NETWORK PROGRAMMING	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To understand inter process and inter-system communication.
- To understand socket programming in its entirety.
- To understand usage of TCP/UDP / Raw sockets.
- To understand how to build network applications.

Course Outcomes:

- To write socket API based programs.
- To design and implement client-server applications using TCP and UDP sockets.
- To analyse network programs.

MTCNIS14	ELECTIVE-II CLOUD COMPUTING	
Instruction: 3Periods/week,	Time: 3 Hours	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course objectives:

- To import fundamental concepts in cloud computing.
- To understand the concept of Virtualization and cloud data storage.
- To learn cloud Application Development and cloud Governance.
- To gain competence in Map Reduce and Hadoop Overview.

Course Outcomes:

- Identify the architecture and infrastructure of cloud computing.
- Develop applications for cloud computing.
- Design and implement a novel cloud computing application.

MTCNIS14	ELECTIVE-II DISTRIBUTED OPERATING SYSTEMS	
Instruction: 3Periods/week,	Time: 3 Hours	**Credits:3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course objectives:

- understand how computational power of multiple computing systems distributed remotely can solve complex problems and importance of replication of data in distributed systems.
- understand the core concepts of distributed operating systems including process management, synchronization, memory management and file systems.
- apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, etc.

Course outcomes:

By the end of the course, the student will be able to:

- identify the core concepts of distributed systems and understand the design principles and architectures for distributed systems.
- understand client-server organizations in distributed systems and how processes in different machines exchange information through group communication.
- analyze fault tolerance and recovery in distributed systems.
- understand the design and implementation of distributed file systems.

MTCNIS14	ELECTIVE-II INTERNET OF THINGS	
Instruction: 3Periods/week,	Time: 3 Hours	**Credits:3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- Vision and Introduction to Internet of Things (IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes:

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

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
- Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
- Develop prototype models for various applications using IoT technology.

MTCNIS15	RESEARCH METHODOLOGY AND IPR Common for MTech (CST, IT, CN&IS, AI&ML)	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits:2**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To provide students a comprehensive knowledge about IPR.
- The students will learn the procedure of obtaining Patents, Copyrights, Trademarks & Industrial Design.
- To enable the students to know about various IP rights its recognition and protection.
- To provide knowledge on various types of IP databases.

Course Outcomes:

On successful completion of this course student will be able to

- Distinguish and explain various forms of IPRs like trade mark, copy right, Geo tagged etc.
- Know and identify the methods to fit one's own intellectual work in particular form of IPRs.
- Apply statutory provisions to protect particular form of IPRs.

- Understand current and emerging issues relating to the intellectual property and its protection.

MTCNIS16	ORGANIZATIONAL BEHAVIOR (Audit Course) Common for MTech (CST, IT, CN&IS, AI&ML)	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 0**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To understand the basic concepts of organizational behavior, its foundations and importance.
- To enable students to have a basic perspective of Motivation and Motivation theories.
- To acquaint the students about group behavior in organizations, including communication, leadership conflicts and organizational change and how these are linked to an impact organizational performance.

Course Outcomes:

- Identifying fundamental aspects of organizational dynamics.
- Evaluate main theories of motivation and formulating suitable motivational strategies.
- Analyze the behavior of individuals and groups in organizations.
- Understanding of Leadership theories and Leadership behavior.
- Apply relevant theories, concepts to address important Organizational Behavior questions.

MTCNIS17	TCP/IP LAB	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits:2**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

A TCP/IP Lab course is designed to provide hands-on experience and practical skills in working with TCP/IP networks. The objective of this course is to enable students to:

- ***Apply theoretical knowledge of TCP/IP protocols:*** Students will have the opportunity to apply their understanding of the IP addressing concepts in a hands-on lab environment.
- ***Configure and Troubleshoot IP addresses***: Students will gain experience in

configuring and troubleshooting IP addressing protocols.

- ***Simulate Real-World Network Scenarios:*** Students will have the opportunity to simulate real-world networking scenarios, such as network design, security, and troubleshooting, in a controlled laboratory environment.
- ***Learn Network Monitoring and Analysis Techniques:*** Students will learn how to monitor and analyze network traffic using network monitoring and analysis tools, such as ireshark or tcpdump
- ***Collaborate with Peers:*** Students will have the opportunity to collaborate with their peers on lab assignments and projects, allowing them to develop teamwork skills and share knowledge and experience.

Course Outcomes:

By the end of this course, students will achieve the following:

- Practical Knowledge of TCP/IP Protocols: Students will have practical experience in applying their understanding of the IP addressing concepts in a laboratory environment.
- Ability to Configure and Troubleshoot IP Networks: Students will be able to configure and troubleshoot IP addressing using CIDR notation.
- Proficiency in Networking Tools and Techniques: Students will have developed.
- proficiency in using networking hardware and software, such as network simulation tools and configuring Apache web server and DNS server on windows system to run python networking scripts.
- Confidence in Network Monitoring and Analysis: Students will have the ability to monitor and analyze TCP/IP network traffic using network monitoring and analysis tools, such as Wireshark and tcpdump.
- Teamwork and Collaboration Skills: Students will have developed teamwork and collaboration skills through working on lab assignments and projects with their peers.
- By the end of a TCP/IP Lab course, students should be well-prepared to work with TCP/IP networks in a practical setting and have a solid foundation for further study and certification in the field of networking.

MTCNIS18	**NETWORK SIMULATION &IOT LAB**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits:2**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To Identify and make familiar to the control element in the design of communication protocols for WSNs.
- To Understand the hardware platforms and software frameworks used in functioning

of various wireless sensor Networks (WSN).

- To Understand the concept of routing for sending the data from one node to another node evaluating the results through trace analysis and graphical visualization.
- To Provide in-depth knowledge of estimating of parameter measures and testing process of the wireless communication system.

Course Outcomes:

- Ability to get familiarized with the protocol design requirements, suitable algorithms and state-of-the-art cloud platform to meet industrial requirements.
- Ability to establish networks with an attempt to reduce issue of broadcast and flooding techniques.
- Proactive in understanding the routing protocol's function and their implementation on data transmission delay and bandwidth.
- Ability to implement hardware and software for wireless sensor networks in everyday life.
- Ability to be able to contribute appropriate algorithms to improve existing or to develop new WSN applications.

MTCNIS21	**MOBILE-ADHOC NETWORKS**	
Instruction: 3Periods/week	Time: 3 Hours	**Credits:3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To understand the concepts of mobile adhoc networks
- To understand the concepts of wireless LANs, wireless adhoc networks, types and their routing protocols
- To introduce students to mobile communications and mobile computing
- To understand basics of Mobile Data Networks, MANETs and other wireless technologies

Course outcomes:

By the end of the course, the student should be able to demonstrate:

- Ability to understand the state-of-the-art research in the emerging subject of Mobile Adhoc Networks
- Explain basics, standards and topologies of wireless LANs.
- Understand basics, types, routing protocols and applications of wireless adhoc networks.
- Understand basics of Mobile Data Networks, MANETs and other wireless technologies

MTCNIS22	**COMPUTER SECURITY**

Instruction: 3Periods/week,	Time: 3 Hours	Credits:3
Internal: 30 Marks	External: 70 Marks	Total: 100 Marks

Course Objectives:

- Introduction of the issues in network security- its need and importance, taxonomy, and terminology.
- Exploration of different types of security threats and remedies.
- Understanding of Internet security protocols and standards

Course Outcomes:

By the end of the course, the student should be able to:

- Realize the need for and importance of network and data security on the Internet and in the distributed environments.
- Identify the different types of network security issues and their remedies.
- Implementation of some Internet security protocols and standards

MTCNIS23	ELECTIVE-III WEB APPLICATION SECURITY	
Instruction: 3Periods/week,	Time: 3 Hours	Credits: 3
Internal: 30 Marks	External: 70 Marks	Total: 100 Marks

Course Objectives:

- To reveal the underlying in web application concepts like history, benefits, drawbacks, future.
- To identify and aid in fixing any security vulnerabilities during the web development process.
- To understand the security principles in developing a reliable web application.

Course Outcomes:

- Identify the vulnerabilities in the web applications.
- Identify the various types of threats and mitigation measures of web applications.
- Apply the security principles in developing a reliable web application.
- Use industry standard tools for web application security.
- Apply penetration testing to improve the security of web applications.

MTCNIS23	ELECTIVE-III ANDROID-IOS SECURITY	
Instruction: 3Periods/week,	Time: 3 Hours	Credits: 3
Internal: 30 Marks	External: 70 Marks	Total: 100 Marks

Course Objectives:

This course describes different components of Android applications and iOS Applications.

- Identifies possible vulnerabilities and Security issues in both the platforms.
- Identifies and helps in practicing defensive programming techniques to protect the users of Android and iOS applications from the common attacks.
- Secure coding examples

Course Outcomes:

At the end of this course Students will

- Identify various risks related to Android and iOS applications.
- Understand the structure of Android and iOS files.
- Understand the Android security model and the protections provided by the Android OS.

Understand the iOS security model and the protections provided by the iOS.

MTCNIS23	**ELECTIVE-III IoT SECURITY**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- Able to understand the IoT security issues and IoT Security architecture.
- Identifies the vulnerability on the Internet of Things.
- To gain Knowledge of IoT privacy concerns
- To be familiar with the IoT incident response and Forensic Analysis.

Course Outcomes:

At the end of this course Students will

- Identify various threats and security requirement for IoT devices.
- Understand the Firmware Security and Physical layer security in IoT devices.
- Understand the Identity and Access Management Solutions for the IoT.
- Understand the Cloud Security for the IoT and IoT incident response.

MTCNIS24	**ELECTIVE-IV DIGITAL FORENSICS**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To understand digital forensics basics and tools for conducting forensics of digital devices.
- To understand the digital forensic systems and services
- To understand various techniques of data acquisition and identification analysis
- To understand about processing the crime scene and preserving digital evidence and gain skills required for a digital crime investigator.

Course Outcomes:

- To be able to learn various basics of digital forensics and investigation and the challenges involved in evidence collection, incidence response.
- To learn various Cyber Laws and understand the legal requirements before performing digital investigation.
- To learn methods and tools to backup, recover, preserve evidence.
- To learn various methods to collect evidence from applications, network, hard disk, main memory and be able to generate reports.
- To be able to research using the skills learned and implement or update Cyber forensics methods.

MTCNIS24	**ELECTIVE-IV SENSOR NETWORKS**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To understand the concepts of sensor networks
- To understand the MAC and transport protocols for ad hoc networks
- To understand the security of sensor networks
- To understand the applications of adhoc and sensor networks

Course Outcomes:

By the end of the course, the student will be able to demonstrate:

- Ability to understand the state-of-the-art research in the emerging subject of Ad Hoc and Wireless Sensor Networks
- Ability to solve issues in real-time application development based on ASN.
- Ability to conduct further research in the domain of ASN.

MTCNIS24	**ELECTIVE-IV INTRUSION DETECTION SYSTEM (IDS)**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- Understand when, where, how, and why to apply Intrusion Detection tools and techniques to improve the security posture of an enterprise.
- Apply knowledge of the fundamentals and history of Intrusion Detection to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems
- Analyze intrusion detection alerts and logs to distinguish attack types from false alarms.
- Apply the knowledge to the architecture, configuration, and analysis of specific intrusion detection systems.

Course Outcomes:

- Understand modern concepts related to Intrusion Detection System.
- Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion.
- Identify and describe the parts of all intrusion detection systems and characterize new and emerging.

MTCNIS25	**ENTREPRENEURSHIP (AUDIT COURSE)**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 0**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To familiarize the students with the concepts of Management.
- To relate the concepts of Management with industrial organizations.
- To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
- To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

On completion of the course, the students will be able to:

- Understand the roles, skills, and functions of management.
- Distinguish the different types of business organizations.
- Identify the factors involved in Production Operations Management.
- Diagnose organizational problems and take suitable decisions.
- Establish good Human Resource Management practices.
- Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

MTCNIS26	WIRELESS NETWORKS LAB	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 2**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- The objective of this course is to provide students an overview of Wireless Sensor Networks.
- The students learn issues and challenges related to WSN design, and implementation.
- The course provides required knowledge to students to build real-time WSN applications.
- To study the evolving wireless technologies and standards.

Course Outcomes:

After successfully completing the course student will be able to

- Keep himself updated on latest wireless technologies and trends in the communication field.
- To understand the architectures of various access technologies such as 3G, 4G, Wi-Fi etc.
- To understand various protocols and services provided by next generation networks.
- Understand the transmission of voice and data through various networks.

MTCNIS27	APPLICATION SECURITY LAB	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 2**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- Recognize common web application security vulnerabilities and how to determine if they are present in web applications.
- Recognize web application design assumptions and how to exploit them.
- Be familiar with the capabilities of various Browser Proxies
- Be familiar with the capabilities of various Penetration Testing tools.
- Be prepared to detect Access Control Vulnerabilities
- Be prepared to detect SQL Injection Vulnerabilities
- Be prepared to detect Cross-Site Scripting (XSS) Vulnerabilities
- Be prepared to detect Authentication and Session Vulnerabilities

- Be prepared to test web application security.

Course Outcomes:

- Identify the vulnerabilities in the web applications.
- Identify the various types of threats and mitigation measures of web applications.
- Apply the security principles in developing a reliable web application.
- Use industry standard tools for web application security.
- Apply penetration testing to improve the security of web applications.

MTCNIS31	**ELECTIVE-V MALWARE ANALYSIS**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To understand the impact of malwares during cyber-attacks.
- To be able to classify malwares through analysis and use tools for detection.
- To learn malware propagation and their containment
- To prevent malwares from affecting the network resources and digital assets using tools

Course Outcomes:

- Know various types of malwares, their impact and understand their behaviors.
- Perform different malware analysis techniques on samples using static and dynamic methods.
- Understand malware attack mechanisms, use tools to detect and to contain their propagation.
- Understand Windows based malwares and apply the learned techniques to reduce risks and malware attacks.
- Able to research using the skills learned and implement or update Cyber Security methods for reducing risks due to cyber-attacks through malwares.

MTCNIS31	**ELECTIVE-V BLOCK CHAIN TECHNOLOGIES**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- To understand the basic concepts block chain technology and to explore the driving force behind the crypto currency Bitcoin.
- To understand about the different methods of Decentralization using Block Chain and different Bitcoins and Alternative Coins.
- To understand about Ethereum and applications using Smart contracts and Block Chain Applications

Course Outcomes:

At the end of the course the student will be able to:

- Understand the types, benefits, and limitation of block chain.
- Explore the block chain decentralization and cryptography concepts.
- Enumerate the Bitcoin features and its alternative options.
- Describe and deploy the smart contracts.

MTCNIS31	**ELECTIVE-V SOFTWARE DEFINED NETWORKS**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- Understand the evolution of Software Defined Networks (SDN) and its interoperability.
- Examine the characteristics of SDN and its devices and controllers.
- Understand the OpenFlow specifications and its limitations.
- Comparison of SDN, Overlays and APIs.
- Design of network virtualization tunnels and offloading flows in data centers.
- Design and development of switch and controller in SDN applications.

Course Outcomes:

- Analyze the implications of SDN for research and innovation data centers.
- Brief the OpenFlow basics and optical transport protocols.
- Develop the tunneling and path technologies for real world data center.
- Implementation of the access control for the campus and traffic engineering for service providers.
- Simulation and testing of SDN in open-source cloud software.
- Implementation of switch and controller in SDN applications

MTCNIS32	**OPEN ELECTIVE: BUSINESS ANALYTICS**

Instruction: 3Periods/week,	Time: 3 Hours	Credits: 3
Internal: 30 Marks	External: 70 Marks	Total: 100 Marks

Course objectives:

- To introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization
- To introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference
- To familiarize students with various types of regression including simple linear regression and multiple linear regression
- To introduce students to key concepts in statistical forecasting models for time series data.
- To familiarize students with predictive decision modeling, model analysis and developing spreadsheet applications including building linear optimization models on spreadsheets.

Course outcomes:

After completion of the course the student should be able to:

- Describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data.
- Estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing.
- Estimate and interpret the parameters of simple linear regression and multiple linear regressions.
- Apply forecasting models for various time series data including stationary time series, time series with linear trend and time series with seasonality.
- Implement models on spreadsheets, develop user-friendly applications and build linear optimization models on spreadsheets.

MTCNIS32	OPEN ELECTIVE: OPERATION RESEARCH	
Instruction: 3Periods/week,	Time: 3 Hours	Credits: 3
Internal: 30 Marks	External: 70 Marks	Total: 100 Marks

Course Objectives:

- Formulate a real-world problem as a mathematical programming model.
- Implement and solve the model in EXCEL and LINDO
- Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand.
- Understand the relationship between a linear program and its dual, including strong

duality and complementary slackness

- Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
- Solve specialized linear programming problems like the transportation and assignment problems.
- Solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
- Understand the applications of basic methods for, and challenges in integer programming

Course Outcomes:

By the end of the course, the student will be able to:

- Students will be able to describe characteristics and scope of OR.
- Students will be able to define and formulate mathematical problems.
- Students will be able to select optimal problems solving techniques for a given problem using LP.
- Students will be able to formulate and solve transportation, travelling salesman and transshipment problems.
- Students will be able to formulate and solve optimization problems related to job/ work assignments.
- Students will be able to demonstrate and solve simple models of Game theory.
- Students will be able to evaluate optimum solution using dynamic programming for different applications.
- Students will be able to choose / devise appropriate queuing model for practical application.
- Students will be able to solve different problems related to Network.

MTCNIS32	**OPEN ELECTIVE: 4G-5G MOBILE COMMUNICATION NETWORKS**	
Instruction: 3Periods/week,	**Time: 3 Hours**	**Credits: 3**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

Course Objectives:

- Understand the 5G and beyond broadband networks.
- Analysis the emerging technologies in Software Defined radio and Mobile IP networks.
- Determine the capacity of multi-gigabit wireless networks and High-speed networks.
- Evaluate the energy harvesting tags and low power networks.
- Ability to understand the working of Wi-Fi fingerprinting and RF sensing.
- Understand the wireless technologies for Vehicle to Infrastructure (V2I) and Vehicle to Vehicle (V2V).

Course Outcomes:

- Summarize the spectrum regulation and standards of broadband network.
- Explain the need of adaptive techniques and resource management for 4G networks.
- Evaluate the QoS requirements for SDR and IP Networks.
- Develop the visible light indoor localization and RF sensing networks.
- Explain the necessity of backscatter communication protocols for IoT.
- Design the smart phone localization and drone networks and implement networks through simulation.

AICTE MODEL CURRICULUM

FOR

POST GRADUATE DEGREE COURSE

M.TECH

in

COMPUTER NETWORKS & INFORMATION SECURITY

[W.E.F. 2021-22]

DEPARTMENT OF

COMPUTER SCIENCE AND SYSTEMS ENGINEERING

AU COLLEGE OF ENGINEERING (AUTONOMOUS)

ANDHRA UNIVERSITY

VISAKHAPATNAM-530 003

ANDHRA UNIVERSITY: : VISAKHAPATNAM

M.Tech.

Computer Networks& Information Security

Course Structure and Scheme of Valuation w.e.f. 2021-22

I-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS11	Mathematical Foundations For Cryptography	3	-	70	30	100	3
MTCNIS12	TCP/IP	3	-	70	30	100	3
MTCNIS13	Elective-I	3	-	70	30	100	3
MTCNIS14	Elective-II	3	-	70	30	100	3
MTCST15	Research Methodology &IPR	3	-	70	30	100	2
MTCST16	Organizational Behavior (Audit Course)	3	-	70	30	100	0
MTCNIS17	TCP/IP Lab		3	50	50	100	2
MTCNIS18	Network Simulation & IoT Lab		3	50	50	100	2
Total		**18**	**6**	**520**	**280**	**800**	**18**

Elective-I: Virtual Private Networks/Machine Learning/Unix Network Programming
Elective II: Cloud Computing/ Distributed Operating Systems /IoT

II-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS21	Mobile-Adhoc Networks	3	-	70	30	100	3
MTCNIS22	Computer Security	3	-	70	30	100	3
MTCNIS23	Elective-III 3	3	-	70	30	100	3
MTCNIS24	Elective-IV	3	-	70	30	100	3
MTCST25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTCNIS26	Wireless Networks Lab	-	3	50	50	100	2
MTCNIS27	Application Security Lab	-	3	50	50	100	2
MTCNIS28	Mini Project With Seminar	-	3	-	100	100	2
Total		**15**	**9**	**450**	**350**	**800**	**18**

Elective III: Web Application Security/Android-IoS Security/IoT Security
Elective IV: Digital Forensics/Sensor Networks/Intrusion Detection System(IDS)

III-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 31	Elective-V	3	-	70	30	100	3
MTCNIS 32	Open Elective	3	-	70	30	100	3
MTCNIS33	Dissertation-I / Industrial project		-	100	-	100	10
Total		**6**	**-**	**240**	**60**	**300**	**16**

Elective V: Malware Analysis/Block chain Technologies/Software Defined Networks

Open Elective: Business Anlytics /4G-5G Mobile Communication Networks/ Operation Research

IV-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS41	Dissertation- II	-	-	100	-	100	16
Total		**-**	**-**	**100**	**-**	**100**	**16**

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MTCNIS11 MATHEMATICAL FOUNDATIONS FOR CRYPTOGRAPHY

Instruction: 3Periods/week	**Time:3Hours**	**Credits:3**
Internal: 30Marks	**External:70Marks**	**Total: 100Marks**

UNIT I: Introduction and classical cryptography
Overview of Cryptography and Security(Text Book, Reference 1) , Cryptographic Attacks, services and mechanisms, Mathematics of Cryptography (Reference 2)

UNIT II: Secret key cryptography
Mathematics for Symmetric Key Cryptography (Reference 2), Encryption, Stream ciphers, Block ciphers, Chosen plaintext attacks (Text Book)

UNIT III: Integrity and Hashing
Message integrity, Message integrity from universal hashing, Message integrity from collision resistant hashing, Authenticated encryption (Text Book)

UNIT IV: Public key cryptography
Mathematics for Asymmetric Cryptography (Reference2), Public key tools, Public key encryption, Chosen ciphertext secure public-key encryption, Digital signatures (Text Book)

UNIT V: Modern Cryptographic methods
Fast signatures from one-way functions, Elliptic curve cryptography and pairings, Post-quantum cryptography: lattices and isogenies, Analysis of number theoretic assumptions (Text Book)

UNIT VI: Protocols
Protocols for identification and login, Identification and signatures from sigma protocols (Text Book)

UNIT VI: Cryptographic Proofs
Proving properties in zero-knowledge, Modern proof systems, Authenticated key exchange, Two-party and multi-party secure computation (Text Book)

Text Book: A Graduate Course in Applied Cryptography (V 0.5) by D. Boneh and V. Shoup, available free online.

References:
Introduction to Modern Cryptography (3rd edition), Jonathan Katz and Yehuda Lindell
Cryptography and Network Security 3/e, Behrouz A. Forouzan, Debdeep Mukhopadhyay

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MTCNIS12 TCP/IP

Instruction: 3Periods/week	**Time:3Hours**	**Credits:3**
Internal: 30Marks	**External:70Marks**	**Total: 100Marks**

UNIT I: Review Of Important Networking Concepts: Networking and architectures of TCP/IP andOSI reference models

UNIT II: Address Resolution Protocol (ARP) and RARP, IP Protocol, IP addresses, Over view of ICMP,PING and Trace route, BOOTP and DHCP, IP Forwarding, Congestion Control in the NW layer

UNIT III: Dynamic Routing Protocols: RIP,OSPF

UNIT IV: **Transport Protocols**: TCP and UDP- Connection Management, Flow Control and CongestionControl

UNIT V: LAN Switching, NAT, DHCP

UNIT VI: Domain Name System, IP Multicasting, SNMP, IPV6, MPLS, MOBILE IP,TCP/IP SECURITY

UNIT VII: Introduction to FINGER Protocol, WHOIS Protocol

UNIT VIII: Other Protocols: WAIS, GOPHER, VERONICA, TCPDUMP

TEXT BOOKS:

1. Computer Networks, Andrews S Tanenbaum,, Edition 5, PHI
2. TCP/IP iIllustrated, Volume 1: The Protocols, W. Richard Stevens, W. Richard Stevens,Pearson Education Asia, 2002
3. TCP/IP Tutorial and Technical Overview, A.Rodriguez, J. Gatrell, J. Karas, R.Peschke,IBMRedbook(Available on net forfree)

REFERENCE BOOKS:

1. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4thEdition) byDouglas E. Comer ,Pearson EducationAsia,2000
2. Internetworking with TCP/IP, Vol. III: Client-Server Programming and Applications, Linux/Posix Sockets Version, Douglas E. Comer, David L. Stevens, Michael Evangelista , Pearson EducationAsia,2000

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MTCNIS13 ELECTIVE-I VIRTUAL PRIVATE NETWORK

Instruction: 3Periods/week	**Time:3Hours**	**Credits:3**
Internal: 30Marks	**External:70Marks**	**Total: 100Marks**

UNIT 1 : Introduction to VPN

TCP/IP overview: Layering, Encapsulation, Addressing, IP, UDP,TCP,ICMP, NAT and Private IP Addresses, IPv6, Routing

UNIT 2 : VPN Security

What is VPN, VPN Components, VPN Workflow ,Tunneling, Intranet, Extranet, Remote Access Types of VPN's, VPN Architecture, Advantages & Disadvantages

UNIT 3 : Tunnels

Introduction, IP-in-IP tunnels , PPPoE, GRE, PPTP, L2TP, MPLS

UNIT 4 : SSL & SSH

SSL-Introduction, SSL Protocol, SSL on wire, Open SSL, SSL Security
SSH-Introduction, SSH V1, SSH V2, Building VPN's with SSH

UNIT 5 : Light weight VPN

Introduction, VTun, CIPE, Tinc, Open VPN

UNIT 6 : IPsec

IPsec Architecture, Protocols, IPsec Modes, Security Assosciations
AH- AH Header, Sequence Numbers, AH Processing, Tunnel mode, AH with IPV6
ESP-Header, Tunnel Mode, ESP with IPV6

UNIT 7 : Applications of VPN

Applications of VPN, Application of VPN in industries and business

References:

1. VPN's Illustrated Tunnels, VPN's and IPSec by Jon.c,Snader
2. Virtual Private Networks O'Reilly 2 nd Edition Charlie Scott, Paul Wolfe & Mike Erwin

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MTCNIS13 ELECTIVE-I MACHINE LEARNING

Instruction: 3Periods/week	**Time:3Hours**	**Credits:3**
Internal: 30Marks	**External:70Marks**	**Total: 100Marks**

UNIT 1: Introduction: Introduction to Machine Learning, learning task- illustration, Approaches to Machine Learning, Machine Learning algorithms- Theory, Experiment in biology and Psychology.

UNIT 2: Concept Learning: Introduction, Concept Learning Task- Notation, Concept Learning Search, Version spaces, Candidate Elimination Algorithm, Inductive Bias, Biased hypothesis Space, Unbiased Learner, Bias-free Learning, Active queries, Mistake bound/PAC model – basic results. Overview of issues regarding data sources, success criteria

UNIT 3: Decision Tree Learning: Decision Tree Representation, Basic decision Tree Learning, Inductive bias in Decision tree Learning, Issues in Decision Tree Learning, Minimum Description Length Principle, Occam's razor, Learning with active queries

UNIT 4: Neural Network Learning: Neural Network Representation, Problems for Neural Network Learning, Perceptions and gradient descent, Multi-Layer Network and Back propagation Algorithm, Illustrative Example of Back Propagation Algorithm- Face Recognition, Advanced Topics in ANN.

UNIT 5: Bayesian Approaches: Basics of Bayes Theorem and Concept Learning, Expectation Maximization, Minimum Description Length Principle, Navie Bayes Classifier, Bayesian Belief Networks, EM Algorithm, K-Means Algorithm, Hidden Markov Models Instance-Based Techniques; Lazy vs. eager generalization, k nearest neighbor, Locally Weight Representation, Case-based Reasoning

UNIT 6: Analytical Learning: Inductive and Analytical Learning problems, Learning with perfect Domain Theory, Explanation Based Learning, Inductive Bias in EBL, Search Control Knowledge with EBL, Inductive- Analytical Approaches to Learning, Using prior Knowledge for Initialize the Hypothesis, and Altering Search objective, FOCL Algorithm.

UNIT 7: Genetic Algorithms: Representation of Hypothesis as GA,, Genetic Operators, Fitness function and Selection, Hypothesis Space search, Genetic Programming, Models of Evolution and Learning, Parallelizing GA, Different search methods for induction

Text Books:

1. Machine Learning, Tom Mitchell , McGraw Hill,1997
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani & JeromeFriedman, Springer Verlag, 2001

Reference Books:

1. Pattern Classification, Richard 0. Duda, Peter E. Hart and David G. Stork, JohnWiley & Sons Inc.,2001
2. Neural Networks for Pattern Recognition, Chris Bishop, Oxford University Press,

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MTCNIS13 ELECTIVE-I UNIX NETWORK PROGRAMMING

Instruction: 3Periods/week	**Time:3Hours**	**Credits:3**
Internal: 30Marks	**External:70Marks**	**Total: 100Marks**

Course Objectives

1. To understand inter process and inter-system communication.
2. To understand socket programming in its entirety.
3. To understand usage of TCP/UDP / Raw sockets.
4. To understand how to build network applications.

Course Outcomes:

1. To write socket API based programs.
2. To design and implement client-server applications using TCP and UDP sockets.
3. To analyse network programs.

UNIT - I

Introduction to Network Programming: UNIX standards, OSI model, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

UNIT – II

Socket: Elementary sockets introduction, Address structures, value – result arguments, Byte ordering and manipulation function and related functions.

Elementary TCP sockets – Introduction, Socket, connect, bind, listen, accept, fork and exec functions, concurrent servers. Close function, getsockname and getpeername functions.

UNIT - III

TCP Client/Server: Introduction, TCP Echo server functions, Normal start up, Normal termination and POSIX signal handling, Termination of server process, Crashing and Rebooting of server host, shutdown of server host.

I/O Multiplexing: Introduction, I/O Models, select function, Batch input and buffering, shutdown function, poll function, TCP Echo server.

Socket options: introduction, getsockopt and setsockopt functions. Socket states, Generic socket option, IPV6 socket option, ICMPV6 socket option, IPV6 socket option and TCP socket options.

UNIT – IV

Elementary UDP sockets: Introduction, UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP.

Name and Address conversions: DNS, gethost by Name function, Re-entrant function, obsolete IPv6 Address lookup functions, and other networking information.

UNIT - V

Daemon Processes and inetd Superserver – Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon inetd Function.

Advanced I/O Functions-Introduction, Socket Timeouts, recv and send Functions, readv and writev Functions, recvmsg and sendmsg Functions, Ancillary Data, How Much Data Is Queued? , Sockets and Standard I/O, Advanced Polling.

UNIT - VI

Broadcasting- Introduction, Broadcast Addresses, Unicast versus Broadcast, dg_cli Function Using Broadcasting, Race Conditions.

Multicasting- Introduction, Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, mcast join and Related Functions, dg_cli Function Using Multicasting, Receiving IP Multicast Infrastructure Session Announcements, Sending and Receiving, SNTP: Simple Network Time Protocol.

UNIT – VII

Raw Sockets-Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program, An ICMP Message Daemon,

Data link Access- Introduction, BPF: BSD Packet Filter, DLPI: Data Link Provider Interface, Linux: SOCK_PACKET and PF packet, libpcap: Packet Capture Library, Examining the UDP Checksum Field.

Text Book:

UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education.

References:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education.
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education.
4. Red Hat Linux networking & Systems Administration, Terry Collings & Kurtwall, Wiley publications.

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MTCNIS14 ELECTIVE-II CLOUD COMPUTING

Instruction: 3Periods/week	**Time:3Hours**	**Credits:3**
Internal: 30Marks	**External:70Marks**	**Total: 100Marks**

Course objectives:

1. To import fundamental concepts in the area of cloud computing.
2. To understand the concept of Virtualization and cloud data storage.
3. To learn cloud Application Development and cloud Governance.
4. To gain competence in Map Reduce and Hadoop Overview.

Course Outcomes:

1. Identify the architecture and infrastructure of cloud computing.
2. Develop applications for cloud computing.
3. Design and Implement a novel cloud computing application.

Syllabus:

UNIT 1: Introduction to cloud computing: Cloud computing components, Infrastructure services, storageapplications, database services – introduction to Saas, Paas, Iaas, Idaas, data storage incloud

UNIT 2: Virtualization: enabling technologies, types of virtualization, server virtualization, desktop virtualization, memory virtualization, application and storage virtualization-tools and products available for virtualization

UNIT 3: SAAS and PAAS: Getting started with Saas, SaaS solutions, SOA, PaaS and benefits.

UNIT 4: Iaas and Cloud data storage: understanding Iaas, improving performance for load balancing, server typeswithin Iaas, utilizing cloud based NAS devices, cloud based data storage, and backup services, cloud basedblock storage and database services

UNIT 5: Cloud Application development: Client server distributed architecture for cloud designing cloud based solutions, coding cloud based applications, traditional Apps vs cloud Apps, client side programming, server side programming overview-fundamental treatment of web application frameworks.

UNIT 6: Cloud Governance and economics: Securing the cloud, disaster recovery and business continuity in the cloud, Managing the cloud, migrating to the cloud, governing and evaluating the clouds business impact and economics,

UNIT 7: Inside Cloud: Introduction to MapReduce and Hadoop-over view of big data and its impact on cloud

Text Books:

1. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Kris Jamsa, Jones & Bartlett Publishers, Paper back edition,2013
2. Hadoop Map Reduce cookbook, Srinath Perera and Thilina Gunarathne, Packt publishing

Reference Book:

1. Cloud Computing: A Practical Approach, Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill Edition

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MTCNIS14 ELECTIVE-II DISTRIBUTED OPERATING SYSTEMS

Instruction: 3Periods/week **Time: 3 Hours** **Credits:3**

Internal: 30Marks **External: 70 Marks** **Total: 100Marks**

Unit-1: Introduction to Distributed Systems, What is a Distributed System?, Hardware concepts, Software concepts, Design issues.

Unit-2: Communication in Distributed Systems Lay red Protocols, ATM networks, The Client – server model, Remote Procedure call, Group communication.

Unit-3- Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

Unit-4-Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real time Distributed System.

Unit-5-Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

Unit-6: Distributed Shared Memory, Introduction, What is Shared memory?, Consistency models, Page based Distributed Shared memory, Shared – variable Distributed Shared memory, Object based Distributed Shared Memory.

Text Book:
Distributed Operating Systems, Andrew S. Tanenbanm

Reference Book:
Advanced Concepts in Operating Systems, Makes Singhal and NiranjanG.Shivaratna

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MTCNIS14 ELECTIVE-II INTERNET OF THINGS

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT 1: Introduction to the internet of things. IoT Architecture: HistoryofIoT,M2M–Machine to Machine, Web of Things, IoT protocols The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

UNIT 2: Prototyping connected objects. Open-source prototyping platforms.

UNIT 3: Integrating internet services. XML and JSON. HTTP APIs for accessing popular Internet services (Facebook, Twitter, and others). Practical activities. IoT Application Development: Application Protocols MQTT, REST/HTTP, CoAP, MySQL

UNIT 4: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

UNIT 5: Ubiquitous computing, applications of IOT, Virtualization of network resources and physical devices inIOT.

UNIT 6: Internet of Things Standardization M2M Service Layer Standardization OGC Sensor Web forIoT

Text Book:

Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems author. Marina Ruggieri H, River Publishers Series In Communications

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MTCNIS15 RESEARCH METHODOLOGY AND IPR

Common for M.Tech (CST, IT, CN&IS, AI&ML)

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits: 2**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science& engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 ndEdition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

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MTCNIS16 ORGANIZATIONAL BEHAVIOR (Audit Course)

Common for M.Tech (CST, IT, CN&IS, AI&ML)

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:0**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT I: Organizational Behavior: Concept of Organization - Concept of Organizational Behavior - Nature of Organizational Behavior - Role of Organizational behavior - Disciplines contributing to Organizational Behavior.

UNIT II: Motivation: Definition - Nature of Motivation - Role of Motivation - Theories of Motivation: Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and McGregor's Theory X and Theory Y.

UNIT III: Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

UNIT IV: Leadership: Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

UNIT V: Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication: Downward, Upward and Horizontal communication.

UNIT VI: Organizational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganizational conflict - Conflict management.

UNIT VII: Organizational Change: Nature - Factors inOrganizational change -Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books:

1.L.M.Prasad: Organizational Behavior, Sultan Chand & Sons, New Delhi -110002
2.K. Aswathappa: Organizational Behavior, Himalaya Publishing House, New Delhi

Reference Books:

Stephen Robbins: Organizational Behavior, Pearsons Education, New Delhi.

MTCNIS17 TCP/IP LAB

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:2**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Name of practical:

1. To implement allocation of IP address.
2. To configure internet IP address
3. To assign IP address using CIDR
4. To configure APACHE server
5. To decode header fields of IP datagram
6. To decode header fields of TCP header.
7. To configure a DNS server
8. Identify, download & install open source tools related to TCP/IP.
9. Compile and test TTCP

MTCNIS18 NETWORK SIMULATION &IOT LAB

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:2**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Network Simulation Lab:

1. Performance Analysis of AODV using OPNET
2. Performance Analysis of DSR using NS2
3. Performance Analysis of ZRP using NS3
4. Performance Analysis of WiMax Using OPNET
5. Performance Analysis of Wireless Local Area Network using OPNET
6. Performance Analysis of MAC Protocols using OPNET

Internet of Things Lab:

1. Performance Analysis of QoSMetrics of IEEE 802.15.4 protocol using Cooja Simulator
2. Performance Analysis of QoSMetrics 6LowPAN protocol using Cooja Simulator
3. Performance Analysis of QoSMetrics RPL protocol using Cooja Simulator
4. Performance Analysis of QoSMetrics MQTT protocol using Cooja Simulator
5. Performance Analysis of QoSMetrics AMQP protocol using Cooja Simulator
6. Performance Analysis of QoSMetrics CoAP protocol using Cooja Simulator

MTCNIS21 MOBILE-ADHOC NETWORKS

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT 1: Introduction: Introduction to Wireless Networks, Various Generations of Wireless Networks, Virtual Private Networks- Wireless Data Services, Common Channel Signaling, Various Networks for Connecting to the Internet, Blue tooth Technology, Wifi-Wi Max- Radio Propagation mechanism
, Pathloss Modeling and Signal Coverage

UNIT 2: Wireless Local Area Networks: Introduction-WLAN topologies-IEEE 802.11 Standards ,MAC Protocols, Comparison of 802.11 a,b,g and n Standards, HIPER LAN , ZigBee 802.15.4**,** Wireless Local Loop

UNIT 3: Wireless Adhoc Networks: Basics of Wireless Networks, Infrastructure Versus Infrastructure less Networks – Properties of Wireless, AD hoc Networks, Types of Ad Hoc Networks, Challenges in AD Hoc Networks – Applications of Wireless AD Hoc Networks , Routing Protocols for Ad Hoc Networks: Introduction-Proactive Routing Protocols- Reactive Routing protocols-Hybrid Routing Protocols-QoS Metrics-Energy impact issues in Routing.

UNIT 4: Mobile Communications: Introduction to cellular concept, Frequency Reuse, Handoff, GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Introduction to mobile computing, novel applications, limitations, and architecture.

UNIT 5: Mobile Data Networks: Location/mobility management, Mobile IP, Dynamic routing protocols, Location-based protocols, Emerging topics: sensor networking, Data-Oriented CDPD network, GPRS and higher data rates, Short messaging service in GSM.

UNIT 6: Mobile Ad Hoc Networks (MANETs): Overview, Properties of A MANET, Spectrum of MANET Applications, Routing and Various Routing Algorithms.

UNIT 7: Other Wireless Technologies: Introduction, IEEE 802.15.4 and Zigbee, General Architecture, Physical Layer, MAC layer, Zigbee, WiMAX and IEEE 802.16, Layers and Architecture, Physical Layer, OFDM Physical layer.

UNIT 8: Security in Ad Hoc Networks: Introduction- Security Attacks, Intrusion Detection System, Intrusion Prevention system, Intrusion Response system, Wired Equivalent Privacy(WEP) -A Security Protocol for Wireless Local Area Networks (WLANs), Security in MANETs.

Text Books:

1. Principles of Wireless Networks , KavethPahlavan, K. Prasanth Krishnamurthy, Pearson Publications,Asia,2002
2. Mobile Cellular Communications, G.Sasibhusan Rao, PearsonPublications.

References:

1. Guide to Wireless Ad Hoc Networks: Series: Computer Communications and Networks,
2. Misra, Sudip; Woungang, Isaac; Misra, Subhas Chandra, 2009,Springer

MTCNIS22 COMPUTER SECURITY

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT 1: User Authentication and Database Security

Digital User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, and Security Issues for User Authentication, Practical Application: An Iris Biometric System, Case Study: Security Problems for ATM Systems

The Need for Database Security, Database Management Systems, Relational Databases, SQL Injection Attacks, Database Access Control, Inference, Database Encryption, Data Center Security

UNIT 2: Access Control

Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks, Case Study: RBAC System for a Bank

UNIT 3: Malicious Software

Types of Malicious Software, Advanced Persistent Threat, Propagation — Infected Content – Viruses, Propagation — Vulnerability Exploit – Worms, Propagation — Social Engineering — SPAM E-Mail, Trojans, Payload — System Corruption, Payload — Attack Agent — Zombie, Bot, Payload — Information Theft — Keyloggers, Phishing, Spyware, Payload — Stealthing — Backdoors, Rootkits, Countermeasures

UNIT 4: Network Attacks and Prevention

Denial-of-Service Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack

Intruders, Intrusion Detection, Analysis Approaches, Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots, Snort, Need for firewalls, types of firewalls, IPS

UNIT 5: Software and OS Security

Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks, Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs, Handling Program Input, OS Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/UNIX Security, Windows Security, Virtualization Security

UNIT 6: Security Management issues

IT security management and Risk Management, IT Security Controls, plans and procedures, Physical and Infrastructure Security

UNIT 7: Security Auditing, legal and ethical aspects

Security auditing architecture, Security audit trail, implementing the logging function, audit trail analysis, security information and event management, Cybercrime and computer crime, intellectual property, privacy and ethical issues

Text Book:

1. Computer Security: Principles and Practice, William Stallings, Lawrie Brown, Pearson
Reference Book
2. Cryptography and Network Security, William Stallings, Pearson

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MTCNIS23 ELECTIVE-III WEB APPLICATION SECURITY

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Unit 1: **Web Application Security and Core Defense mechanisms**,
Evolution of Web Applications, Web Application Security, Core Defense Mechanisms: Handling User access, Handling User Input, Handling Attackers

Unit 2: Web **Application Technologies and mapping applications**,
HTTP Protocol, Web functionality, Encoding Schemes, Mapping the Application: Enumerate the content and Functionality, Analysing the application

Unit 3: Client side and Authentication Attacks Bypassing,
Client-side controls: Transmitting data via the client, Capturing the user data- HTML Forms and Browser extensions, Handling client side data securely Attacking Authentication: Authentication Technologies, Design flaws in authentication, Implementation flaws in authentication, securing authentication.

Unit 4: **Session management attacks and Access**,
Controls Session States, weaknesses in Token generation and Session Token handling, Securing session management Common vulnerabilities and attacking access controls, securing access controls.

Unit 5: **Attacking Data stores and Back end components**,
Bypassing logging, Injecting into SQL: Exploiting Basic Vulnerability, Injecting into different statement types, Finding SQL Injection Bugs, Fingerprinting the database, The UNION Operator, Extracting data, Bypassing filters, Second order SQL Injection, Attack escalation, SQL exploitation tools, preventing SQL Injection, Injecting OS commands, manipulating file paths, Injecting into backend HTTP requests

Unit 6: **Attacking Users**
XSS- reflected, stored and DOM, XSS attack payloads and delivery mechanisms. Finding and exploiting XSS vulnerabilities and preventing, CSRF basic examples, Client side injection attacks like HTTP header injection, Cookie Injection attacks, Attacking Browsers: logging keystrokes, stealing browser history and search queries, wnumerating currently used applications, port scanning, exploiting browser bugs, DNS rebinding, browser exploitation and Man in the middle attacks.

Unit 7: Attacking Application Server and architecture
Attacking Application Architecture, Attacking the application server, Approaches to code review, Signatures of common vulnerabilities

Text Book:
The Web Application Hacker's Handbook, 2nd Edition, Dafydd Stuttard, Marcus Pinto
Reference:
1. Bryan and Vincent, "Web Application Security, A Beginners Guide", McGraw-Hill, 2011
2. Web Security Basics, by Shweta Bhasin, Prima Tech

MTCNIS23 ELECTIVE-III ANDROID-IOS SECURITY

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Course Objectives:

This course

Describes different components of Android applications and iOS Applications

1) Identifies possible vulnerabilities and Security issues in both the platforms
2) Identifies and helps in practising defensive programming techniques to protect the users of Android and iOS applications from the common attacks.
3) Secure coding examples

Course Outcomes: At the end of this course Students will

1) Identify various risks related to Android and iOS applications.
2) Understand the structure of Android and iOS files.
3) Understand the Android security model and the protections provided by the Android OS.
4) Understand the iOS security model and the protections provided by the iOS.

Part-I Android Security

1. Introduction to Android App Development

About Android, Why Android, Downloading Android studio, Types of Mobile Apps -Hybrid Apps, Native Apps, Cross-Platform Apps, Mobile Platforms, Progressive Web Apps, Classification of Mobile Security Threats

2. Android Architecture and packet Management

Android's Architecture, Android Framework Libraries, Android's Security Model, Android Application Package Format, Code Signing, APK Install Process, Package Verification

3. Device Security& NFC

Controlling OS Boot-Up and Installation, Disk Encryption, Screen Security, Secure USB Debugging, Android Backup, NFC Overview, Android NFC Support, Secure Elements, Software Card Emulation

Part -II - iOS Security

4. The iOS Fundamentals & Security Model

The iOS Security Model, Secure Boot, App Sandbox, Data Protection and Full-Disk Encryption, The Encryption Key Hierarchy, The Keychain and Data Protection API, Native Code Exploit Mitigations, Jailbreak Detection, Dynamic Patching

5. iOS Application Anatomy

Dealing with plist Files, Device Directories, The Bundle Directory, The Data Directory, The Shared Directory.

6. iOS Security testing

Suggested Testing Devices, Testing with a Device vs. Using a Simulator, Network and Proxy Setup.

7. Mobile Privacy Concerns

Dangers of Unique Device Identifiers, Solutions from Apple, Rules for Working with Unique Identifiers, Mobile Safari and Do Not Track Header, Cookie Acceptance Policy, Monitoring Location and Movement, Managing Health and Motion Information, Managing Health and Motion Information.

Text Book:

1. Android Security Internals- An In-Depth Guide to Android's Security Architecture Author : Nikolay

Elenkov, no starch press(Chapters 1,2,3,10,11 from text book) (For Part 1-Chapters 1,2, 3 from Syllabus)
2. iOS Application Security- The Definitive Guide for Hackers and Developers, Authors : David Thiel, no starch press (Chapters 1,3, 4, 14 from text book) (For Part II - Chapters 4,5,6,7 from Syllabus)

Reference:

1) Hacking Exposed Mobile: Security Secrets & Solutions 1st Edition by Neil Bergman (Author), Mike Stanfield (Author) et al, McGraw Hill

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MTCNIS23 ELECTIVE-III IoT SECURITY

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT 1: Introduction: Securing the Internet of Things, security requirements in IoT architecture, security in enabling technologies, security concerns in IoT applications.

UNIT 2: Security Architecture in the Internet of Things: Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, And Availability, Attacks Specific to IoT.

UNIT 3: Security and Vulnerability in the Internet of Things: Secrecy And Secret-Key Capacity, Authentication/Authorization For Smart Devices, Transport Encryption, Secure Cloud/Web Interface, Secure Software/Firmware, Physical Layer Security.

UNIT 4: Identity and Access Management Solutions for the IoT: Identity and Access Management Solutions for the IoT, An introduction to IAM for the IoT, The identity life cycle, Authentication credentials, IoT IAM infrastructure, Authorization and access control

UNIT 5: Mitigating IoT Privacy Concerns: Mitigating IoT Privacy Concerns, Privacy challenges introduced by the IoT, Guide to performing an IoT PIA, Privacy by design, Privacy engineering recommendations.

UNIT 6: Cloud Security for the IoT: Cloud Security for the IoT, The role of the cloud in IoT systems , The concept of the fog, Threats to cloud IoT services, Cloud-based security services for the IoT.

UNIT 7: IoT Incident Response and Forensic Analysis: IoT Incident Response and Forensic Analysis, Threats to both safety and security, Defining, planning, and executing an IoT incident response, Detection and analysis, IoT forensics

Textbooks:

1. Securing the Internet of Things, Shancang Li and Li Da Xu, 2017, Syngress Elsevier.
2. Practical Internet of Things Security - Brian Russell , Drew Van Duren, Orielly Publication.

References:

1. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, Fei Hu, CRC Press,2020
2. The IoT Architect's Guide to Attainable Security and Privacy, Damilare D. Fagbemi, David M.Auerbach Publications, 2019

MTCNIS24 ELECTIVE-IV DIGITAL FORENSICS

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Unit 1 Introduction

Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computer's roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology

Unit 2 Initial Response and Forensic Duplication

Initial Response & Volatile Data Collection from Windows system - Initial Response & Volatile Data Collection from Unix system - Forensic Duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive.

Unit 3 Preserving and Recovering Digital Evidence

File Systems: FAT, NTFS - Forensic Analysis of File Systems, Storage Fundamentals: Storage Layer, Hard Drives

Unit 4 Evidence Handling

Types of Evidence, Challenges in evidence handling, Overview of evidence handling procedure.

Unit 5 Network Forensics

Intrusion detection; Different Attacks in network, analysis Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing- Internet Fraud.

Unit 6 System Investigation

Data Analysis Techniques - Investigating Live Systems (Windows & Unix) Investigating, Hacker Tools - Ethical Issues – Cybercrime.

Unit 7 Cyber Laws and Global and Indian Contexts

Constitutional law, Criminal law, Civil law, Administrative regulations, Local laws, State laws, Federal laws, International laws, Criminal versus civil cases ,Vicarious liability, Computer related laws CFAA, DMCA, CAN Spam

Text Books

1. Digital Forensics: The Fascinating World of Digital Evidences, Neelakshi Jain, D.R Kalbande, Wiley Books

2. Digital Forensics and Incident Response: A practical guide to deploying digital forensic techniques in response to cyber security incidents : Gerard Jhansen, Packt Publishers

Reference Books

1. Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence by William Oettinger , Pckt Publishers

2. Cyber Forensics by Dejey and Murugan, Oxford University Press

MTCNIS24 ELECTIVE-IV SENSOR NETWORKS

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT 1: Introduction: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for Wireless Sensor Networks(WSNs), Sensor networks vs Enabling Technologies for WSNs, **Single node architecture:** Hardware components, Energy consumption of sensor nodes, Some examples of sensor nodes, Operating systems and execution environments

UNIT 2: Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Designprinciples for WSNs,

UNIT 3: Physical layer and transceiver design considerations in WSNs:
MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol,How about IEEE 802.11 and Bluetooth

UNIT 4: Link layer protocols: Fundamentals: tasks and requirements, Error control, Framing,Link management

UNIT 5: Naming and addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses, Content-based and geographic addressing

UNIT 6: Routing protocols: The many faces of forwarding and routing, Energy-efficient unicast, Broadcastand multicast, Geographic routing.

UNIT 7: Data-centric and content-based networking : Introduction, Data-centric routing, Data aggregation, Data-centric storage

UNIT 8: Transport layer and Quality of Service: The transport layer and QoS in wireless sensor networks, Coverage and deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control

TEXT BOOK:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005
2. Network Management Fundamentals, Alexender Clemn CISCIPress2007

MTCNIS24 ELECTIVE-IV INTRUSION DETECTION SYSTEM (IDS)

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Course Objectives:

1. Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
2. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems
3. Analyze intrusion detection alerts and logs to distinguish attack types from false alarms
4. Apply the knowledge to the architecture, configuration, and analysis of specific intrusion detection systems

Course Outcomes

- Understand modern concepts related to Intrusion Detection System.
- Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion
- Identify and describe the parts of all intrusion detection systems and characterize new and emerging

Unit 1. Introduction

Basic Concepts of Security, Introduction to Intrusions, Need of Intrusion Detection, Classification of Intrusion Detection Systems, Sources of Vulnerabilities, Attacks against various security objectives, Countermeasures of attacks.

Unit II. Intrusion Detection and Prevention Technologies: Host-based intrusion detection system (HIDS), Network-based IDS, Information Sources for IDS, Host and Network Vulnerabilities and Countermeasures. Intrusion detection techniques, misuse detection: pattern matching, rule-based and state-based anomaly detection: statistical based, machine learning based, data mining based hybrid detection.

Unit III. IDS and IPS Architecture:

Tiered architectures, Single-tiered, Multi-tiered, Peer-to-Peer. Sensor: sensor functions, sensor deployment and security. Agents: agent functions, agent deployment and security. Manager component: manager functions, manager deployment and security. Information flow in IDS and IPS, defending IDS/IPS, Case study on commercial and open-source IDS.

Unit IV. Alert Management and Correlation Data fusion:

Alert correlation, Pre-process, Correlation Techniques, Post-process, Alert Correlation architectures. Cooperative Intrusion Detection, Cooperative Discovery of Intrusion chain, Abstraction-based Intrusion Detection, Interest-based communication and cooperation, agent-based cooperation.

Text Book:

C. Endorf, E. Schultz and J. Mellander, Intrusion Detection & Prevention, McGraw-Hill/Osborne , 2004

Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010

References

J. M. Kizza, Computer Network Security, Springer, 2005.Chris Sanders and Jason Smith, Applied Network Security Monitoring: Collection, Detection, and Analysis,Syngress, 2013

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MTCNIS25 ENTREPRENEURSHIP (AUDIT COURSE)

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:0**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT 1: Basic Concepts of Management: Management:-Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management.

UNIT 2: Forms of Business Organizations: Introduction, Types of Business organizations**: Private Sector**- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations**; Public sector**-Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

UNIT 3: ProductionandoperationsManagement: Plantlocation-Factorstobeconsidered in the selection of Plant location; Break - even analysis- Significance andmanagerialapplications;ImportanceofProductionPlanningandControlanditsFunctions;Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

UNIT 4: Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

UNIT 5: Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ;Steps for starting a small enterprise -Incentives for Small Scale Industries by Government.

Textbooks:

1. Sharma,S.C, and Banga,T.R.,Industrial Organization & Engineering Economics, KhannaPublishers,Delhi,2000.
2. VasantDesai,The Dynamics of Entrepreneurial Development and Management (PlanningforfutureSustainablegrowth),HImalayanPublishingHouse,2018.

Reference Books:

1. Aryasri , A.R., Management Science, McGraw HIll Education (India Private Limited , NewDelhi2014.
2. Sheela,P.,andJagadeswaraRao,K.,Entrepreneurship,ShreePublishingHouse,Guntur,

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MTCNIS26 WIRELESS NETWORKS LAB

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:2**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Experiment 1:
Installation of One Simulator.
Experiment 2:
Implementing Epeidemic Routing
Experiment 3:
Performing Average Hop Count of various Routing Protocols
Experiment 4:
Performing the delivery probability of various Routing protocols
Experiment 5:
Switching the LED on/off in octabrix LED
Experiment 6:
Understanding working of octabrix in light conditions
Experiment 7:
Implementing LED color patterns in Octabrix
Experiment 8:
Implementing cloud integration with Octabrix
Experiment 9:
To study the behavior AODV Routing Protocol
Experiment 10:
To study the behavior DSR Routing Protocol
Experiment 11:
To study the behavior OLSR Routing Protocol
Experiment 12:
To study the behavior GRP Routing Protocol

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MTCNIS27 APPLICATION SECURITY LAB

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:2**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

LAB Exercises limited to the following scope

Cycle 1:

1. Install Kali Linux and study the use of burpsuite and metasploit
2. Learn about NMAP and scan open ports in a target server
3. Find the softwares and their version details in the open ports
4. Find vulnerabilities in any one of the softwares installed in the target server system.
5. Learn about the wireshark tool and analyse the packets in a given interface.

Cycle 2:

1. Visit OWASP and learn more about web based vulnerabilities.
2. Implement SQL Injection Attacks
3. Implement Cross site Request Forgery Attack
4. Implement Cross site Scripting Attack
5. Implement Command Injection Attacks

III SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 31	Elective-V	3	-	70	30	100	3
MTCNIS 32	Open Elective	3	-	70	30	100	3
MTCNIS3 3	Dissertation-I / Industrial project		-	100	-	100	10
Total		**6**	**-**	**240**	**60**	**300**	**16**

Elective V: Malware Analysis/Block chain Technologies/Software Defined Networks

Open Elective: Business Anlytics/4G-5G Mobile Communication Networks/ Operation Research

Detailed Syllabus for M.Tech (CN & IS) Third Semester

MTCNIS31 ELECTIVE-V MALWARE ANALYSIS

Instruction: 3Periods/week **Time: 3 Hours** **Credits:3**

Internal: 30Marks **External: 70 Marks** **Total: 100Marks**

UNIT 1: Introduction

Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.

UNIT 2: Static Analysis

X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine.

UNIT 3: Dynamic Analysis

Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, apicalls, registries, network activities.

UNIT 4: Anti-dynamic analysis

Analysis techniques anti-VM, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark.

UNIT 5: Attack mechanisms

Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

UNIT 6: Malware Detection Techniques

Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences.

UNIT 7: kernels and Rootkits

Intro to Kernel – Kernel basics, Windows Kernel API, Windows Drivers, Kernel Debugging - , Rootkit Techniques- Hooking, Patching, Kernel Object Manipulation ,Rootkit Anti-forensics

TEXT BOOK:

1. Michael Sikorski and Andrew Honig, " Practical Malware Analysis", No Starch Press,2012
2. Learning Malware Analysis: Explore the Concepts, Tools, and Techniques to Analyze and Investigate Windows Malware by Monnappa K A

REFERENCES

1. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel", Addison-Wesley, 2005

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MTCNIS31 ELECTIVE-V BLOCK CHAIN TECHNOLOGIES

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Course Objectives:

1: To understand the basic concepts block chain technology and to explore the driving force behind the crypto currency Bitcoin.

2: To understand about the different methods of Decentralization using Block Chain and different Bitcoins and Alternative Coins.

3: To understand about Ethereum and applications using Smart contracts and Block Chain Applications

Course Outcomes:

At the end of the course the student will be able to:

1. Understand the types, benefits and limitation of block chain.
2. Explore the block chain decentralization and cryptography concepts.
3. Enumerate the Bitcoin features and its alternative options.
4. Describe and deploy the smart contracts

Syllabus:

UNIT 1: BlockChain and its History:

History of blockchain, Types of blockchain, Blockchain Components – Permissioned Blockchain Permission less Blockchain – Consortium Blockchain – basics of Consensus Algorithms, Architecture & Properties of Blockchain.

UNIT 2: Decentralization and Consensus Algorithms :

Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations, Distributed systems, Distributed ledger, Merkle tree, structure of a block, Consensus

Algorithms- Proof of Work, Proof of Stack, Proof of Burn, Proof of Elapsed Time, Proof of Activity, Proof of Concept.

UNIT 3: Bitcoin and Alternative Coins :

Bitcoin, Transactions, Bitcoin payments , Bitcoin properties – Transaction life cycle – creation of coin –sending payments – double spending using blockchain – bitcoin anonymity – Ether: Ethercoin properties, Alternative Coins, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

UNIT 4: Ethereum and smart contracts:

Ethereum Architecture, solidity programming basics, Smart Contract, Deploying Smart Contracts, Integration with UI.

UNIT 5: Blockchain Applications :

Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media ,Secure Voting and Digital Identity, Real Estate, Education

Textbooks:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017
2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
3. Blockchain Technology, Author- Chandramouli Subramanian, Asha A George, Abhilash K A, Meena Karthikeyan,University Press (India) Private Limited, 2021

References:

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

First Edition, 2017

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MTCNIS31 ELECTIVE-V SOFTWARE DEFINED NETWORKS

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT I: Introduction: Evolution of Switches and Control Planes, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs. The Evolution of Networking Technology, Forerunners of SDN, Legacy Mechanisms Evolve Toward SDN, Software Defined Networking Is Born,Sustaining SDN Interoperability, Open Source Contributions, Network Virtualization

UNIT II. Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Method.

UNIT III. The OpenFlow Specification, OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.0 to 1.5, Improving OpenFlow Interoperability, Optical Transport Protocol Extensions, OpenFlow Limitations

UNIT IV. Alternative Definitions of SDN: Potential Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization and Alternatives Overlap and Ranking.

UNIT V. SDN in the Data Center: Data Center Demands, Tunnelling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Comparison of Open SDN, Overlays, and APIs, Real-World Data Center Implementations

UNIT VI:SDN Applications: Application Types, A Brief History of SDN Controllers, Using Floodlight for Training Purposes, A Simple Reactive Java Application, Controller Considerations, Network Device Considerations,12.9. Creating Network Virtualization Tunnels, Offloading Flows in the Data Center, Access Control for the Campus, Traffic Engineering for Service Providers

UNIT VI. SDN Open Source Landscape, The OpenFlow Open Source Environment, Open Source Licensing Issues, Profiles of SDN Open Source Users, OpenFlow Source Code, Switch Implementations, Controller Implementations, SDN Applications, Orchestration and Network Virtualization, Simulation, Testing, and Tools, Open Source Cloud Software, Example: Applying SDN Open Source.

Text Books:

Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014 .

Reference :

SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013
Software Defined Networking with OpenFlow By Siamak Azodolmolky, Packt Publishing, 2013

Detailed Syllabus for M.Tech (CN & IS) Third Semester

MTCNIS32 OPEN ELECTIVE: BUSINESS ANALYTICS

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Course objectives:

1. To introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization
2. To introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference
3. To familiarize students with various types of regression including simple linear regression and multiple linear regression
4. To introduce students to key concepts in statistical forecasting models for time series data
5. To familiarize students with predictive decision modeling, model analysis and developing spreadsheet applications including building linear optimization models on spreadsheets.

Course outcomes:

After completion of the course the student should be able to:

1. Describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data
2. Estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing
3. Estimate and interpret the parameters of simple linear regression and multiple linear regressions
4. Apply forecasting models for various time series data including stationary time series, time series with linear trend and time series with seasonality
5. Implement models on spreadsheets, develop user-friendly applications and build linear optimization models on spreadsheets.

Syllabus

UNIT 1. Foundations of Business Analytics: Evolution of Business Analytics, Scope, data and models for Business Analytics, problem solving with Business Analytics, Analytics on spreadsheets, Excel functions for Database queries, Add-ons for Business Analytics. Descriptive Analytics: Data visualization, creating charts in MS Excel, Data Queries, Tables, sorting and filtering, Data summarization with statistics, Data exploration using Pivot tables

UNIT 2. Statistical Sampling: methods, estimating population parameters, sampling error, sampling distributions, interval estimates, confidence intervals, using confidence intervals for decision making, prediction intervals Statistical Inference: Hypothesis testing, one-sample Hypothesis testing, two-tailed test of Hypothesis for mean, two-sample Hypothesis testing, Analysis of variance, chi-square test for independence

UNIT 3. Trendliness and Regression: Modelling Relationships and trends in data, Simple linear regression, least squares regression, regression on analysis of variance, testing hypothesis for regression coefficients, Confidence intervals for regression coefficients, Residual analysis and regression assumptions, Multiple linear regression, building regression models, regression with categorical independent variables with two or more levels, regression with nonlinear terms, advanced techniques for regression modelling

UNIT 4. Forecasting Techniques: Qualitative and judgemental forecasting, statistical forecasting models, forecasting models for stationery time series, forecasting models for time series with linear trend, forecasting models for time series with seasonality, selecting appropriate time-series-based forecasting models, regression forecasting with casual variables, practice of forecasting

UNIT 5. Spreadsheet modeling and Analysis: Strategies for predictive decision modelling, Implementing models on spreadsheet, spreadsheet applications in Business analytics, Model assumptions, complexity and realism, developing user-friendly applications, analyzing uncertainty

and model assumptions, model analysis using analytics solver platform

UNIT 6. Linear Optimization & Applications: Building Linear Optimization Models on spreadsheets, solving Linear Optimization models, Graphical interpretation of linear optimization, Using optimization models of prediction and insight, Types of constraints in optimization models, process selection models, Blending Models, Portfolio Investment models

Text Book

1. "Business Analytics: Methods, Models, and Decisions" James R. Evans, Pearson Publications, Second edition

Reference Book

1. "Business Analytics: The Science of Data-Driven Decision Making", U.Dinesh Kumar, Wiley Publications

Detailed Syllabus for M.Tech (CN & IS) Third Semester

MTCNIS32 OPEN ELECTIVE: OPERATION RESEARCH

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

UNIT I: Overview of Operations Research, Types of OR Models , Phases of Operations Research– OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis

UNIT II: Standard Form of LPP, Basic Feasible Solutions , Unrestricted Variables, Simplex Algorithm , Artificial Variables, Big M Me th od , Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method

UNIT III: Transportation Problem as LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogels Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms

UNIT IV: Assignment Problem, Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-Jobs K Machines Problems, Two-Jobs M- Machine Problems, Crew Scheduling Problems

UNITV: Network Representation of A Project, CPM and PERT , Critical Path Calculations, Time – Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

UNIT VI: Replacement Problems-Individual And Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With and Without Shortages, Inventory Problems With Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems

UNIT VII: Game Theory: Two Person Zero Sum Games , Mixed Strategy Games and Their Algorithms.

Text Books:

1. Operations Research, KantiSwaroop, P.K. Gupta, Man Mohan, Sulthan Chand&SonsEducation
2. Operations Research–AnIntroduction, HandyATaha–PearsonEducation.

Detailed Syllabus for M.Tech (CN & IS) Third Semester

MTCNIS32 OPEN ELECTIVE: 4G-5G MOBILE COMMUNICATION NETWORKS

Instruction: 3Periods/week	**Time: 3 Hours**	**Credits:3**
Internal: 30Marks	**External: 70 Marks**	**Total: 100Marks**

Unit-1: Introduction

1G and2G-voice centric technologies, 3G and 4G-mobile broadband, 5G-beyond mobilebroadband-networked society, Spectrum regulation and standardization from 3G to 5G: Overview, ITU-R activities from 3G to 5G, Spectrum for mobile systems and 5G, GPP standardization.

Unit-2: Emerging Technologies for 4G

Multi antenna Technologies: MIMO; Adaptive Multiple Antenna Techniques; Radio Resource Management - QoS Requirements; Software Defined Radio (SDR) Communication Systems - Advantages of SDR - Problems & Applications in SDR Communication Systems; IP Network Issues - Mobility Management - Mobile IP & its Evolution; Mobile Relay Types/Deployment Concepts - Cooperative Mobile Relaying; Other Enabling Technologies; Overview of 4G Research Initiatives and Developments.

Unit 3: Multi-gigabit wireless networks

Next generation (5G) wireless technologies- Upper Gigahertz and Terahertz wireless Communications: Millimeter wave networking- Directionality and beam forming- Mobilityand signal blockage- IEEE 802.11ad (60 GHz WLAN) MAC and PHY overview: Visible light communication- High-speed networking using LEDs - IEEE 802.15.7 PHY and MAC overview Sensing through visible light- Visible light indoor localization and positioning

Unit 4: Indoor localization and RF sensing

Smartphone localization - WiFi fingerprinting - protocols and challenges - Non-WiFi localization - Device-free sensing with radio frequency - Mining wireless PHY channel state information- Device free localization and indoor human tracking - Activity and gesture recognition through RF.

Unit 5: Low-power networking

Backscatter communication - Radio Frequency Identification (RFID) technology overview – Energy harvesting tags and applications- Internet-of-Things (IoT) - IoT protocol overview - CoAP and MQTT - IPv6 networking in low-power PANs (6LoWPAN)

Unit 6: Future mobile networks

Drone networking - Multi-UAV networks, architectures and civilian applications-Communication challenges and protocols for micro UAVs- Connected and autonomous cars - Wireless technologies for Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communications – Automotive surrounding sensing with GHz and THz signals.

Unit 7: Instructional Activities

Survey minimum of four 5G wireless networks for wireless communication and carry out simulation of those networks.

Text Books:

1. 4G: LTE advanced pro and the road to 5G-by Erik Dahlman, Stefan Parkvall and Johan Skold,3rd Edition, Elsevier Publications
2. 5G NR: The Next Generation Wireless Access Technology-by Erik Dahlman, Stefan Parkvall, Elsevier Publications
3. Zhang, Yin, Chen, Min, ―Cloud Based 5G Wireless Networks‖, Springer, 2016
4. Jonathan Rodriguez, ―Fundamentals of 5G Mobile Networks‖, Wiley 2015.

References Books:

1. Young Kyun Kim and Ramjee Prasad, 4G Roadmap and Emerging Communication Technologies, Artech House, 2006.
2. Savo G. Glisic, Advanced Wireless Networks: 4G Technologies, John Wiley & Sons, 2006.
3. Wireless Communications: Principles and Practice, by Theodore S. Rappaport, Prentice Hall.
4. 802.11n: A Survival Guide, by Matthew Gast, O'Reilly Media.
5. 802.11ac: A Survival Guide, by Matthew Gast, O'Reilly Media.
6. Wireless Networking Complete, by Pei Zheng et al., Morgan Kaufmann.

Hyperlinks:

1. https://www.amazon.in/4G-LTE-Advanced-Pro-Road-5G-ebook/dp/B01IUACTDM
2. http://ieeexplore.ieee.org/document/7414384/
3. https://www.theiet.org/resources/books/telecom/5gwire.cfm?
4. http://ieeexplore.ieee.org/document/7794586/
5. https://www.researchgate.net/publication/311896317_Ultra-reliable_communication_ in_a_factory_ environment_for_5G_wireless_networks_Link_level_and_deployment_study
6. https://www.intechopen.com/books/how-to-link/towards-5g-wireless-networks-a-physicallayer-perspective