POST GRADUATE DEGREE COURSE

M.TECH

in

COMPUTER NETWORKS & INFORMATION SECURITY

[W.E.F. 2024-25]

Department of Computer Science and Systems Engineering

Andhra University College of Engineering (A)

Andhra University

Visakhapatnam-530003

M.Tech.
Computer Networks & Information Security

Scheme of Valuation w.e.f. 2024-25 AB

1st Year I SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 11	Mathematical Foundations For Cryptography	3	-	70	30	100	3
MTCNIS 12	TCP/IP	3	-	70	30	100	3
MTCNIS 13	Elective-I	3	-	70	30	100	3
MTCNIS 14	Elective-II	3	-	70	30	100	3
MTCST 15	Research Methodology & IPR	3	-	70	30	100	2
MTCST 16	Organizational Behavior (Audit Course)	3	-	70	30	100	0
MTCNIS 17	TCP/IP Lab		3	50	50	100	2
MTCNIS 18	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

M.Tech.
Computer Networks & Information Security

Scheme of Valuation w.e.f. 2024-25 AB

1st Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 21	Mobile-Adhoc Networks	3	-	70	30	100	3
MTCNIS 22	Computer Security	3	-	70	30	100	3
MTCNIS 23	Elective-III	3	-	70	30	100	3
MTCNIS 24	Elective-IV	3	-	70	30	100	3
MTCST 25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTCNIS 26	Wireless Networks Lab	-	3	50	50	100	2
MTCNIS 27	Application Security Lab	-	3	50	50	100	2
MTCNIS 28	Integrating Design Thinking Into Innovation Engineering	-	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)

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2nd Year I 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
MTCNIS 33	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 Analytics/4G-5G Mobile Communication Networks/ Operation Research

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2nd Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 41	Dissertation-II	-	-	100	-	100	16
Total		**-**	**-**	**100**	**-**	**100**	**16**

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1st Year I SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 11	Mathematical Foundations For Cryptography	3	-	70	30	100	3
MTCNIS 12	TCP/IP	3	-	70	30	100	3
MTCNIS 13	Elective-I	3	-	70	30	100	3
MTCNIS 14	Elective-II	3	-	70	30	100	3
MTCST 15	Research Methodology & IPR	3	-	70	30	100	2
MTCST 16	Organizational Behavior (Audit Course)	3	-	70	30	100	0
MTCNIS 17	TCP/IP Lab		3	50	50	100	2
MTCNIS 18	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

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

MTCNIS 11 MATHEMATICAL FOUNDATIONS FOR CRYPTOGRAPHY

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

Course Objectives:

This course is aimed at enabling the students to

- Overview of cryptography security, attacks, mathematics of cryptography.
- Understand the concepts Secret key cryptography and integrity and hashing .
- Understand the concept of Public key cryptography.
- Overview of Modern Cryptographic methods.
- Understand the concepts Protocols and Cryptographic Proofs.

Course Outcomes:

After compilation of this course student will be able to

- Understand the concepts of cryptography security, attacks, mathematics of cryptography.
- Get knowledge about the concepts Secret key cryptography and integrity and hashing.
- Get knowledge about the concept of Public key cryptography.
- Understand the concept of Modern Cryptographic methods.
- Get knowledge about the concepts Protocols and Cryptographic Proofs.

Syllabus

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

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

MTCNIS 12 TCP/IP

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

Course Objectives:

- To understand the concepts of OSI model and protocol architecture
- To understand the detailed inner workings of TCP/IP protocol suite
- To understand data link layer design issues and MAC sub layer protocols
- To understand Network layer design issues, various routing algorithms and congestion control algorithms
- To understand transport layer protocols and application layer.

Course Outcomes:

After successful completion of the course, the students are able to

- summarize Functionalities of OSI & TCP/IP layers, Data link and MAC protocols , Routing protocols, Congestion control algorithms, TCP, UDP.
- discover the issues related to data link, medium Access and transport layers by using channel allocation and connection management schemes.
- choose addresses for networking requirements.
- identify Network standards â€“ 802.3 and 802.11 for developing computer networks.
- determine impact of wired and wireless networks in the context of legal, safety and societal issues

Syllabus

UNIT-I

Review Of Important Networking Concepts: Networking and architectures of TCP/IP and OSI reference models

UNIT-II

Address Resolution Protocol (ARP) and RARP, IP Protocol, IP addresses, Overview of ICMP, PING and Traceroute, 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 Congestion Control

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 for free)

REFERENCE BOOKS:

1. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4thEdition) by Douglas 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

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

MTCNIS 13 ELECTIVE-I VIRTUAL PRIVATE NETWORK

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

Course Objectives:

This course is aimed at enabling the students to

- 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.

Syllabus

UNIT-I

Introduction to VPN

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

UNIT-II

VPN Security

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

UNIT-III
Tunnels
Introduction, IP-in-IP tunnels , PPPoE, GRE, PPTP, L2TP, MPLS

UNIT-IV
SSL & SSH
SSL-Introduction, SSL Protocol, SSL on wire, OpenSSL, SSL Security
SSH-Introduction, SSH V1, SSH V2, Building VPN with SSH

UNIT-V
Lightweight VPN
Introduction, VTun, CIPE, Tinc, Open VPN

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

UNIT-VII
Applications of VPN
Applications of VPN, Application of VPN in industries and business

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

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

MTCNIS 13 ELECTIVE-I MACHINE LEARNING

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

Course Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes:

After completing this course, the student will be able to

- Appreciate the importance of visualization in the data analytics solution.
- Apply structured thinking to unstructured problems.
- Understand a very broad collection of machine learning algorithms and problems.
- Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory.
- Develop an appreciation for what is involved in learning from data.

Syllabus

UNIT-I

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

UNIT-II

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-III

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-IV

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-V

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-VI

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-VII

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 & Jerome Friedman, Springer Verlag, 2001

Reference Books:

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

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

MTCNIS 13 ELECTIVE-I UNIX NETWORK PROGRAMMING

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

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.

Syllabus

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.

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

MTCNIS14 ELECTIVE-II CLOUD COMPUTING

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

Course Objectives:

- To import fundamental concepts in the area of 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.

Syllabus

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Iaas and Cloud data storage: understanding Iaas, improving performance for load balancing, server types within Iaas, utilizing cloud based NAS devices, cloud based data storage, and backup services, cloud based block storage and database services

UNIT-V

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-VI

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-VII

Inside Cloud: Introduction to MapReduce and Hadoop-overview 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, Paperback 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

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

MTCNIS 14 ELECTIVE-II DISTRIBUTED OPERATING SYSTEMS

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

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

Course Objectives:

- To provide hardware and software issues in modern distributed systems
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
- To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.

Course Outcomes:

- To provide hardware and software issues in modern distributed systems.
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
- To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.
- To know about Shared Memory Techniques.
- Have Sufficient knowledge about file access.
- Have knowledge of Synchronization and Deadlock.

Syllabus

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Unit-V

Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

Unit-VI

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

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

MTCNIS 14 ELECTIVE-II INTERNET OF THINGS

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

Course Objectives:

- To understand the fundamentals of Internet of Things.
- To build a small low-cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real-world scenario.

Course Outcomes:

Upon completion of this course, students will acquire knowledge about**:**

- Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
- Develop web services to access/control IoT devices.
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario.

Syllabus

UNIT-I

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-II

Prototyping connected objects. Open-source prototyping platforms.

UNIT-III

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-IV

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

UNIT-V

Ubiquitous computing, applications of IOT, Virtualization of network resources and physical devices in IOT.

UNIT-VI

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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MTCNIS 15 RESEARCH METHODOLOGY AND IPR

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

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

Course Objectives:

- To give an overview of the research methodology and explain the technique of defining research
- problem
- To learn the importance of literature survey and understand the theoretical and conceptual frameworks.
- To know the various research designs and different data collection methods.
- To explain various forms of the intellectual property and its rights, its relevance and business impact in the changing global business environment.

Course Outcomes:

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

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing
- theoretical and conceptual frameworks and writing a review.
- Explain various research designs and their characteristics.
- Explain the art of interpretation and the art of writing research reports

Syllabus

Unit-I

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-II

Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit-III

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-IV

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-V

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

Unit-VI

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 the NewTechnological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

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

MTCNIS 16 ORGANIZATIONAL BEHAVIOR (Audit Course)

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

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

Course Objectives:

This course deals with human behavior in organizations:

- To learn Conceptual frameworks, case discussions.
- To learn skill-oriented activities applied to course topics which include: motivation, learning and development, group dynamics, leadership, communication, power and influence,change, diversity, organizational design, and culture.
- Class sessions and assignments are intended to help participants acquire skills and analytic concepts to improve organizational relationships and effectiveness.

Course Outcomes:

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

- Explain the importance & role of management in the business organizations.
- Analyze knowledge on the importance of planning and organizing.
- Identify various leadership styles and their suitability to the situation.
- Apply organizational behavior theories and concepts to individual work experiences.
- Know how to work more effectively in a team environment.

Syllabus

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.

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

MTCNIS 17 TCP/IP LAB

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

Course Objectives:

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To implement and configure IP address.
- Overview of CIDR.
- To configure APACHE server and DNS server.

Course Outcomes:

- Analyze performance of various communication protocols.
- Compare routing algorithms
- Understand the TCP/IP configuration.
- Understand the APSCHE and DNS server.

Syllabus

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

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

MTCNIS18 NETWORK SIMULATION & IOT LAB

Instruction: 3 Periods/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.

Syllabus

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

M.Tech.
Computer Networks & Information Security

Scheme of Valuation w.e.f. 2024-25 AB

1st Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 21	Mobile-Adhoc Networks	3	-	70	30	100	3
MTCNIS 22	Computer Security	3	-	70	30	100	3
MTCNIS 23	Elective-III	3	-	70	30	100	3
MTCNIS 24	Elective-IV	3	-	70	30	100	3
MTCST 25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTCNIS 26	Wireless Networks Lab	-	3	50	50	100	2
MTCNIS 27	Application Security Lab	-	3	50	50	100	2
MTCNIS 28	Integrating Design Thinking Into Innovation Engineering	-	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)

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

MTCNIS 21 MOBILE-ADHOC NETWORKS

Instruction: 3 Periods/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

Syllabus

UNIT-I

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-II

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-III

Wireless Ad Hoc 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-IV

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-V

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-VI

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

UNIT-VII

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-VIII

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

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

MTCNIS 22 COMPUTER SECURITY

Instruction: 3 Periods/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 distributed environments.
- Identify the different types of network security issues and their remedies.
- Implementation of some Internet security protocols and standards

Syllabus

UNIT-I

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-II

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-III

Malicious Software

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

UNIT-IV

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-V

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-VI

Security Management issues

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

UNIT-VII

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

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

MTCNIS23 ELECTIVE-III WEB APPLICATION SECURITY

Instruction: 3 Periods/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.

Syllabus

UNIT-I

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-II

Web Application Technologies and mapping applications,

HTTP Protocol, Web functionality, Encoding Schemes, Mapping the Application: Enumerate the content and Functionality, Analyzing the application

UNIT-III

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-IV

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-V

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-VI

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, enumerating currently used applications, port scanning, exploiting browser bugs, DNS rebinding, browser exploitation and Man in the middle attacks.

UNIT-VII

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

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

MTCNIS23 ELECTIVE-III ANDROID-IOS SECURITY

Instruction: 3 Periods/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

1) Identifies possible vulnerabilities and Security issues in both the platforms
2) Identifies and helps in practicing 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.

Syllabus

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 textbook) (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 textbook) (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

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

MTCNIS23 ELECTIVE-III IoT SECURITY

Instruction: 3 Periods/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 requirements 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.

Syllabus

UNIT-I

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

UNIT-II

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-III

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-IV

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-V

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-VI

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-VII

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

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

MTCNIS24 ELECTIVE-IV DIGITAL FORENSICS

Instruction: 3 Periods/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.

Syllabus

UNIT-I

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-II

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-III

Preserving and Recovering Digital Evidence

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

UNIT-IV

Evidence Handling

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

UNIT-V

Network Forensics

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

UNIT-VI

System Investigation

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

UNIT-VII

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

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

MTCNIS24 ELECTIVE-IV SENSOR NETWORKS

Instruction: 3 Periods/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.

Syllabus

UNIT-I

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-II

Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs,

UNIT-III

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-IV

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

UNIT-V

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

UNIT-VI

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

UNIT-VII

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

UNIT-VIII

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

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MTCNIS24 ELECTIVE-IV INTRUSION DETECTION SYSTEM (IDS)

Instruction: 3 Periods/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 in order to improve the security posture of an enterprise.
- 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
- 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

Syllabus

UNIT-I

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

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

MTCNIS25 ENTREPRENEURSHIP (AUDIT COURSE)

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

Course Objectives:

- To create an awareness about entrepreneurship.
- To demonstrate key entrepreneurial leadership qualities.
- To explain the key strategies for starting a new enterprise.
- To provide knowledge about government plans and programmes and availability of resources.
- To provide knowledge on appropriate training skills required to become first generation entrepreneurs.
- To develop an entrepreneurial mind set.

Course Outcomes:

- Identify the readiness and aptitude for entrepreneurship.
- Ability to prepare business plans.
- Ability to mobilize physical, financial and human resources.
- Apply financial, operational, organizational and marketing knowledge in managing an enterprise.
- Understand how entrepreneurship can impact society.

Syllabus

UNIT-I

Introduction:-

Meaning and Definition of Entrepreneurship - Characteristics and functions of Entrepreneurs – Classification of Entrepreneurs – Barriers to Entrepreneurship – Motivational Factors for Entrepreneurship.

UNIT-II

Business Planning Process:-

Business Plan – Marketing Plan – Production / Operational Plan – Oganisational Plan – Financial Plan.

UNIT-III

Institutions in aid of Entrepreneurs:-

Role of Government in Promoting Entrepreneurship – Role of Commercial Banks – Role of Development Financial Institutions, IDBI, SIDBI, ICICI, NABARD and State Financial Corporations – Role of Consultancy Organisations.

UNIT-IV

Small Scale Industries:

Definition of S.S.I – Types of SSIs – Strengths and Weaknesses of Small Scale Industries – Sickness in SSIs – Reasons and Remedies – MSME's.

UNIT-V

Women Entrepreneurship:-

Importance and Need for Women Entrepreneurship – Problems of Women Entrepreneurs – Government and support for Women Entrepreneurs.

UNIT-VI

Business Project Management:

Business idea- Sources - Project Identification – Project Formulation – Project Report Preparation – Project Design – Project Appraisal – Project Planning – Project Financing.

UNIT-VII

Training for Entrepreneurship Development:-

Need and Importance of Training Entrepreneurs – Objectives and Methods of Training for New and existing Entrepreneurs – Institutions imparting training to Entrepreneurs – Feed Back and Performance of Trainee.

Text Books:

1. Madhurima Lall, ShikhaSahi:**Entrepreneurship**, Excel Books, New Delhi.

2. Vasant Desai: **Dynamics of Entrepreneurship Development**, Himalaya Publishing House,New Delhi.

Reference Books:

1. C.V. Bakshi: **Entrepreneurship Development**, Excel Books, New Delhi.

2. Jain: **Hand Book of Entrepreneurs** OXFORD University Press.

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

MTCNIS26 WIRELESS NETWORKS LAB

Instruction: 3 Periods/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, WiFi etc.
- To understand various protocols and services provided by next generation networks.
- Understand the transmission of voice and data through various networks.

Syllabus

Experiment 1:
Installation of One Simulator.
Experiment 2:
Implementing Epidemic 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

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

MTCNIS 27 APPLICATION SECURITY LAB

Instruction: 3 Periods/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

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.

Syllabus

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 analyze 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

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

MTCNIS 28 INTEGRATING DESIGN THINKING INTO INNOVATION ENGINEERING

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

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

Course Objectives:

- To expose students to the design process as a tool for innovation.
- To develop students' professional skills in client management and communication.
- To study about various ideation tools and generate creative solutions.
- To understand about prototyping

Course Outcomes: After Successful Completion of this activity the student will be able to

- Outline a problem, apply methods of Empathy on user groups
- Describe and Define the problem specific to the user group
- Apply Ideation tools to generate Ideas to solve the problem
- Develop prototype
- Test the ideas and demonstrate Storytelling ability to present the Ideas

Students shall form into groups and Identify a problem (preferably societal problem with engineering orientation to solve) suitable for the design thinking and go through the process week-wise. At the end of each phase, brief documentation shall be submitted and a final report covering all phases has to be submitted at the end of the semester.

Introduction to Design Thinking: A primer on design thinking - Traditional approach, The new design thinking approach. Stages in Design Thinking : Empathize, Define, Ideate, Prototype, Test. Mindset For Design thinking, Design thinking for product and process innovation, Difference between engineering design and design thinking.

Case Studies: General, Engineering and Service applications.

Activities: Identify an Opportunity and Scope of the Project Explore the possibilities and Prepare design brief

Methods and Tools for Empathize and Define phases:
Empathize - Methods Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer Observation, Trend analysis

Define-Methods of Define Phase : Storytelling, Critical Items Diagram, Define Success

Activities: Apply the methods of empathize and Define Phases Finalize the problem statement

Methods and Tools for Ideate phase:
Ideate-Brainstorming, 2x2 Matrix, 6-3-5 method, NABC method;

Activities: Apply the methods of Ideate Phase: Generate lots of Ideas

Methods and Tools for Prototype Phase:
Prototype-Types Of Prototypes-Methods Of Prototyping-Focused Experiments, Exploration Map, Minimum Viable Product;

Activities: Apply the methods of Prototype Phase: Create prototypes for selected ideas

Methods and Tools for Test Phase:
Test- Methods of Testing: Feedback capture grid, A/B testing

Activities: Collect feedback; iterate and improve the ideas

Solution Overview - Create a Pitch - Plan for scaling up - Roadmap for implementation

Activities: Present your solution using Storytelling method

Project Submission: Fine tuning and submission of project report

Reference Books:

1. Tim Brown, Change by Design : How Design Thinking Transforms Organizations and Inspires Innovation, Harper Collins-books, 2009.
2. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Toolbox, John Wiley & Sons, 2020.
3. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Playbook, John Wiley & Sons, 2018.
4. Kristin Fontichiaro, Design Thinking, Cherry Lake Publishing, USA, 2015.
5. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation - Research and Practice, Springer Series, 2016.
6. Gavin Ambrose, Paul Harris, DesignThinking, AVA Publishing, 2010.
7. Muhammad Mashhood Alam, Transforming an Idea into Business with Design Thinking, First Edition, Taylor and Francis Group, 2019.
8. S.Balaram, Thinking Design, Sage Publications, 2011.

Web References:

1. https://designthinking.ideo.com/
2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/
3. https://www.coursera.org/learn/design-thinking-innovation
4. https://swayam.gov.in/nd1_noc20_mg38/preview

M.Tech
Computer Networks and Information Security

Scheme of Valuation w.e.f. 2024-25 AB

2nd Year I 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
MTCNIS 33	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 Analytics/4G-5G Mobile Communication Networks/ Operation Research

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

MTCNIS31 ELECTIVE-V MALWARE ANALYSIS

Instruction: 3 Periods/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.

Syllabus

UNIT-I

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-II

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-III

Dynamic Analysis

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

UNIT-IV

Anti-dynamic analysis

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

UNIT-V

Attack mechanisms

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

UNIT-VI

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-VII

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

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

MTCNIS31 ELECTIVE-V BLOCKCHAIN TECHNOLOGIES

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

Course Objectives:

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

Course Outcomes:

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

- Understand the types, benefits and limitations 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

Syllabus

UNIT-I

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-II

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-III

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-IV

Ethereum and smart contracts:

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

UNIT-V

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

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

MTCNIS31 ELECTIVE-V SOFTWARE DEFINED NETWORKS

Instruction: 3 Periods/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

Syllabus

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-VII

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: 3 Periods/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.

Syllabus

UNIT-I

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-II

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-III

Trendline 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 modeling

UNIT-IV

Forecasting Techniques: Qualitative and judgemental forecasting, statistical forecasting models, forecasting models for stationary 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-V

Spreadsheet modeling and Analysis: Strategies for predictive decision modeling, 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-VI

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: 3 Periods/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.

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, traveling 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.

Syllabus

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, Vogel's 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

UNIT-V

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 Affecting 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, Sultan 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: 3 Periods/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 of 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 networks.
- 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.

Syllabus

UNIT-I

Introduction

1G and 2G-voice centric technologies, 3G and 4G-mobile broadband, 5G-beyond mobile broadband-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-II

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-III

Multi-gigabit wireless networks

Next generation (5G) wireless technologies- Upper Gigahertz and Terahertz wireless Communications: Millimeter wave networking- Directionality and beam forming- Mobility and 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-IV

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-V

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-VI

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-VII

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.

M.Tech.
Computer Networks & Information Security

Scheme of Valuation w.e.f. 2024-25 AB

2nd Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCNIS 41	Dissertation-II	-	-	100	-	100	16
Total		**-**	**-**	**100**	**-**	**100**	**16**