

Gujarat University

Syllabus

M.Tech (Networking & Communications) – II

Subject Name: Network Security

Subject Code: MTNT – 121

Objectives:

To enable students to learn

- The various security standards set by the global industry
- The various security applications that are being used by the industry

Prerequisites:

- Fundamentals of Networking
- Fundamentals of Cryptography
- Fundamentals of Operating Systems

Contents:

1. Kerberos

a. Kerberos v4

Introduction, Tickets and Ticket-Granting Tickets, Configuration, Logging into the Network, Replicated KDC's, Realms, Interrealm Authentication, Key Version Numbers, Encryption for Privacy and Integrity, Encryption for Integrity only, Network Layer Addresses in Tickets

b. Kerberos v5

ASN.1, Names, Delegation of Rights, Ticket Lifetimes, Key Versions, Making Master Keys in Different Realms, Different Optimizations in Cryptographic Algorithms, Hierarchy of Realms, Evading Password-Guessing Attacks, Key Inside Authenticator, Double TGT Authentication, PKINIT: Public Keys for Users, KDC Database, Kerberos V5 Messages

2. Public Key Infrastructure (PKI)

Introduction, Some Terminology, PKI Trust Models, Revocation, Directories and PKI, PKIX and X.509, X.509 and PKIX Certificates, Authorization Futures

3. IPSec

Overview of IPsec, IP and IPv6, AH (Authentication Header), ESP (Encapsulating Security Payload), Comparison of Encodings, Photuris, SKIP, History of IKE, IKE Phases, Phase 1 IKE, Phase-2 IKE: Setting up IPsec SAs, ISAKMP/IKE Encoding

4. SSL/TLS

Introduction, Using TCP, SSL/TLS Basic Protocol, Resumption, Computing the Keys, Client Authentication, PKI as Deployed by SSL, Version Numbers, Cipher Suites, Negotiating Compression Method, Attacks Fixed in v3, Exportability, Encoding

5. Email Security

Distribution Lists, Store and Forward, Security Services for Electronic Mail, Establishing Keys, Privacy, Authentication of the Source, Message Integrity, Non-Repudiation, Proof of Submission, of Delivery, Message Flow Confidentiality, Anonymity, Containment, Annoying Text Format Issues, Names and Addresses, Verifying When a Message was Really Sent

6. PEM & S/MIME

Introduction, Structure of a PEM Message, Establishing Keys, Some PEM History, PEM Certificate Hierarchy, Certificate Revocation Lists (CRLs), Reformatting Data to Get Through Mailers, General Structure of a PEM Message, Encryption, Source Authentication and Integrity Protection, Multiple Recipients, Bracketing PEM Messages, Forwarding and Enclosures, Unprotected Information, Message Formats, DES-CBC as MIC Doesn't Work, Differences in S/MIME, S/MIME Certificate Hierarchy

7. PGP (Pretty Good Privacy)

Introduction, Overview, Key Distribution, Efficient Encoding, Certificate and Key Revocation, Signature Types, Your Private Key, Key Rings, Anomalous Object Formats.

8. Malicious Software

Viruses and Related Threats, Virus Countermeasures, Distributed Denial Services Attacks

9. Firewalls

Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation

10. Intrusion Detection

Intruders, Intrusion Detection, Password Management

References:

- 1) Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall India.
- 2) William Stallings, "Network Security Essentials:- Applications and Standards", Pearson Education.

Accomplishments of the student after completing the Course:

- Understand and appreciate the importance of Network Security in today's world.
- Understand and use good Network Security applications and standards in various applications.

Subject Name: Network Analysis and Design

Subject Code: MTNT – 122

Objectives:

- To introduce the principles of Network Design
- To understand the process of Network Deployments
- To gain basic insight of Network Operations and Maintenance

Prerequisites:

Fundamentals of Networking

Contents:

1. Introduction:

Overview of Analysis, Architecture and Design Process, Systems Methodology, System Description, Service Characteristics, Performance Characteristics, Network Supportability

2. Requirement Analysis – Concepts & Process:

Need for Requirement Analysis, User Requirements, Application Requirements, Device Requirements, Network Requirements, Other Requirements, Requirement Specification and Map Gathering & Listing Requirements, Developing Service Metrics, Characterizing Behavior, Developing RMA Requirements, Developing Delay Requirements, Developing Capacity Requirements, Developing Supplemental Performance Requirements, Environment-Specific: Performance Requirements , Thresholds and Limits, Requirements for Predictable and Guaranteed Performance

3. Flow Analysis:

Overview and types of Flows, Identifying and Developing Flows, Data Sources and Sinks, Flow Models, Flow Prioritization and Specification, Applications of Flow Analysis

4. Network Architecture:

Introduction, Component Architecture, Reference Architecture, Architectural Models, Systems and Network Architecture

5. Addressing and Routing Architecture:

Addressing Mechanisms, Routing Mechanisms, Addressing Strategies, Routing Strategies, Architectural Considerations

6. Network Management Architecture & Security Architecture:

Defining Network Management, Network Management Mechanisms, Architectural Considerations, Security and Privacy Administration, Security Architectural Considerations

7. Network Design:

Design Concepts, Design Process, Vendor, Equipment and Service-Provider Evaluations, Network Layout, Design Traceability, Design Metrics, Testing Network Design, Optimizing Network Design, Documenting Network Design

References:

- 1) McCabe James, “Network Analysis, Architecture, and Design”, Morgan Kaufmann Publishers.
- 2) Priscilla Oppenheimer, “Top-Down Network Design”, Pearson Education India

Accomplishments of the student after completing the course:

At the end of the study, student will be able to

- Capability to make efficient Network Engineering decisions.
- Ability to Design Networks
- Ability to Test, Optimize and Document Networks

Subject Name: Advanced Networking**Subject Code: MTNT – 123****Objectives:**

- To understand the state-of-the-art in network protocols, architectures and applications.
- To study the functionality of various layers of the OSI model / TCP/IP model and understand the interactions between them.
- To develop strong analysis, design, implementation, testing and troubleshooting skills regarding TCP/IP based networks and services.
- Design and implement customized TCP/IP based application layer services.

Prerequisites:

Fundamentals of Networking, C Programming, Linux OS

Contents:**1. Introduction:**

Overview of Internetworking Principles and Underlying Network Technologies, Internetworking Concept and Architectural Model

2. The Network Layer:

Classful IP Addresses, IPv6, Classless and Subnet Address Extensions, Address Resolution Protocol, Internet Protocol, Forwarding IP Datagrams, Internet Control Message Protocol, Mobile IP, Private Network Interconnection

3. The Transport Layer:

User Datagram Protocol, Reliable Stream Transport Service, Client-Server Model of Interaction, Unix Socket Interface

4. The Application Layer:

Bootstrap and Auto-Configuration, Domain Name System, Remote Login and Desktop, File Transfer and Access, Electronic mail, World Wide Web

5. TCP/IP Networks:

Performance Measurement and related tools, Network Simulation, Overview of TCP Modelling, Tools provided by the Operating Systems

References:

- 1) Comer D. "Internetworking with TCP/IP, Volume 1: Principles, Protocols and Architecture, Prentice Hall India (PHI)
- 2) Hassan M, Jain R., "High Performance TCP/IP Networking: Concepts, Issues and Solution", Prentice Hall India (PHI)
- 3) Stevens R. "TCP/IP Illustrated, Volume 1: The Protocols", Pearson India
- 4) Forouzan B.A., "TCP/IP protocol suite", Tata McGraw-Hill (TMH)
- 5) Goralski Walter, "The Illustrated Network", Morgan Kauffman
- 6) Kurose J., Ross K., "Computer Networking – A Top Down Approach", Pearson Education
- 7) Donahoo M., Calvert K., "TCP/IP Sockets in C – Practical Guide for Programmers", Morgan Kauffman
- 8) Stevens R., "Unix Network Programming", Pearson Education
- 9) Tanenbaum, A.S., "Computer Networks", Prentice Hall India (PHI)
- 10) Stallings W., "Computer Networking with Internet Protocols and Technology", Pearson Education
- 11) Snader J., "Effective TCP/IP Programming", Addison-Wesley
- 12) Ekram et. al., "Introduction to Network Simulator NS2", Springer Verlag
- 13) Aboelela E., "Network Simulation Experiments Manual", Morgan Kauffman

Accomplishments of the student after completing the Course:

- Analyze and develop solutions to solve networking problems.
- Have thorough understanding of TCP/IP based systems, services and related tools and technologies
- Effectively use various tools and utilities for TCP/IP networking.

Subject Name: Wireless Communication and Mobile Technology

Subject Code: MTNT – 124

Objectives:

This course is introduction to wireless communication with focus on digital mobile communication system and digital data transfer from computer science point of view. It shows integration of services and applications from fixed networks into networks supporting mobility of end user and wireless access. It emphasizes both on technology and standards of mobile communication and shows merging of classical data transmission technologies and extension of today's Internet applications onto mobile and wireless devices.

Prerequisites:

Knowledge of signals, transmission media, protocols and standards of Internet and networking.

Contents:

1. Introduction: [10%]

Definition, types, applications and history of wireless communication systems. Wireless Transmission: frequencies for radio transmission, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum, introduction to cellular systems.

2. Medium Access Control: [10%]

Motivation for specialized MAC: hidden and exposed terminals, near and far terminals. SDMA, FDMA, TDMA: Fixed TDM, DAMA, PRMA, Reservation TDMA, MACA, Polling, ISMA. Introduction to CDMA systems, Spread spectrum in CDMA systems (DSSS and FHSS), coding methods in CDMA.

3. Telecommunication systems: [20%]

GSM: Mobile services, system architecture, radio interface, protocols, localization and calling, handover, Security, GSM, GPRS

4. Wireless networks and Wireless LANs: [20%]

Types of wireless networks (WLAN, WMAN, WWAN, WPAN and assisting technologies). Wireless LAN: Infrastructure vs Adhoc LAN- IEEE 802.11, HIPERLAN, Bluetooth.

5. Mobile network layer: [10%]

Mobile IP, Dynamic host configuration protocol, mobile adhoc networks, Wireless sensor networks.

6. Mobile Transport layer: [10%]

Traditional TCP, Classical TCP improvements, TCP over 2.5/3G wireless networks

7. Mobile Internet connectivity: [10%]

WAP1.1, Layers of WAP, WAE, WML and WML script, WTA, PUSH architecture, PUSH/PULL services

References:

- 1) Jochen Schiller, "Mobile Communications", Pearson Education.
- 2) Theodore S. Rappaport, "Wireless communications, principles and practices" Pearson Education.
- 3) William C.Y.Lee, "Mobile cellular Telecommunication Analog and digital System", Mcgraw Hill
- 4) Rajpandya, "Mobile and Personal Communication system and services" by
- 5) Dr. Kamilo Feher, "Wireless communication"
- 6) Asoke K Talukder, Roopa R Yavgal, "Mobile Computing", TMH

Accomplishments of the student after completing the course:

At the end of the work student will be able to understand terminologies of wireless communication systems, technical background of wireless transmission media, functioning of mobile phone, technologies in Wireless Networks and Wireless LANs, Mobile Computing, influence of mobility on applications, security or IP networks, higher layers of communication like WAP and current trends in wireless communications and cellular technology
