NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	MTech CSE (Cyber Security)
Course Code:	6CS406CC25
Course Title:	Network Protocols and Security
Course Type:	Core
Year of Introduction:	2025-26

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Course Learning Outcomes (CLO):

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

1. summarise the design and operation of network protocols (BL2)
2. apply security measures like Access Control Lists (ACLs), VLANs, and Layer-2 security mechanisms (BL3)
3. analyse the architecture and protocols within the TCP/IP suite (BL4)
4. design secure networks to protect against common attacks and vulnerabilities. (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Fundamentals**: Overview of Computer Networks and Internet Architecture: OSI vs TCP/IP Models, Network Types (LAN, WAN, MAN, etc.), Communication Standards (Ethernet, Wi-Fi, etc.), Layered Architecture of Network Protocols: Role of Application, Transport, Network, Data Link, and Physical Layers, Protocol Stack Overview	04
Unit-II	**TCP/IP Protocol Suite**: Application Layer Protocols: HTTP, FTP, SMTP, POP3, IMAP, DNS, DHCP, Transport Layer Protocols: TCP vs UDP, TCP Handshake, Segmentation, Flow Control, Congestion Control, Application of TCP/UDP in different use cases, Network Layer Protocols: IPv4 vs IPv6, Routing protocols (RIP, OSPF, BGP), NAT, Subnetting, and Address Resolution Protocol (ARP), Data Link Layer and Physical Layer: Ethernet, MAC Addresses, Frame Format, Error Detection and Correction, Wireless LAN Standards (802.11, Bluetooth)	15
Unit-III	**Networking Devices:** Routers, Switches, Firewalls, and Load Balancers, Functions of Routers and Switches in a Network, Configuration and Management of Network Devices. Basic Protocols Used by Devices: ARP (Address Resolution Protocol), DHCP (Dynamic Host Configuration Protocol), ICMP (Internet Control Message Protocol)	07
Unit-IV	**Router Protocols and Security:** Static Routing vs Dynamic Routing (RIP, OSPF, BGP), Interior and Exterior Gateway Protocols, Routing Tables and Route Summarization, Securing Routing Protocols: Authentication and Encryption, Preventing Routing Attacks (e.g., Route Spoofing, Man-in-the-Middle), Configuring Control Plane Policing (CoPP) to Secure the Router Control Plane, Access Control Lists	08

	(ACLs) in Routers: Introduction to ACLs and Types (Standard, Extended), Configuring and Managing ACLs for Security, ACLs for Traffic Filtering, Preventing DoS Attacks, Best Practices for Writing Secure ACLs, Device Authentication and Authorization: Implementing 802.1X for Network Access Control, Radius and TACACS+ for Device Authentication, Configuring Role-Based Access Control (RBAC) on Routers and Switches	
Unit-V	**Switch Security and Protocols:** Switching Protocols: Spanning Tree Protocol (STP), VLANs, and Trunking, Configuring VLANs and their Security Implications, Switch Security Mechanisms: Preventing VLAN Hopping and Double Tagging Attacks, Port Security: Configuring Port Security to Restrict MAC Addresses, DHCP Snooping, Dynamic ARP Inspection, and IP Source Guard, Layer 2 Security Mechanisms: Preventing MAC Address Flooding and CAM Table Overflow	06
Unit-VI	**Device Security Best Practices:** Device Hardening and Security Policies: Securing Device Configuration and Management, Best Practices for Device Passwords, Configuration Backups, and Firmware Updates, Network Device Monitoring and Logging: Configuring SNMP for Monitoring Devices, Syslog Configuration for Event Logging, Detecting Security Incidents Using Device Logs	05

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References:

1. James Kurose, Keith Ross, Computer Networking: A Top-Down Approach, Pearson
2. B. Forouzan, TCP/IP Protocol Suite, McGraw Hill
3. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall
4. Wendell Odom, CCNA Routing and Switching 200-120 Official Cert Guide, CiscoPress
5. Kevin Dooley and Ian J. Brown, Cisco IOS Cookbook, O'Reilly

Suggested List of Experiments:

Sr.	Name of Experiments/Exercises	Hours
1	Design a home wireless network and configure all devices	02
2	Design and configure network exploring static routing	02
3	Design a subnetted network	02
4	VLAN configuration	02
5	Design a network with multiple routers and configure RIP and OSPF routing algorithm	04
6	Configure IPv6 based network	02
7	NAT configuration	02
8	Packet filtering using ACLs (standard and extended ACL)	02
9	Authentication using RADIUS and TACACS+ server	02
10	Configuring Port Security to Restrict MAC Addresses.	04
11	BPDU Guard and Root Guard for STP Protection	02
12	Layer 2 switch security	04