## Computer Networks

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| Semester | Credit Hours | Prerequisite |
| [BSCS-6] | [3+0] | [None] |

**Course Code: CSCN-348**

**Course Description**

This course is designed for the understanding of the fundamental concepts of computer networking. This course is a fundamental course of networking domain and after this course students would be capable to take advance course of this domain as well as professional courses such as CCNA and CCNP etc. Another objective is to give an overview of layered architecture, layered based networking models such as TCP/IP and OSI. To develop familiarity with common networking protocols such as IP, TCP, UDP, DNS, DHCP, Ethernet, IEEE 802.11 etc. One of the goal of this course to make student familiar with common networking tools, commands and software through which they can get practical exposure.

**Course Learning Outcomes (CLOs)**

The course learning outcome along with domain and BT level are listed below

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| --- | --- | --- | --- | --- |
| S. # | CLO STATEMENT | DOMAIN | BT LEVEL | PLO |
| CLO-1 | **Describe** the key concepts and technologies of computer networks | C | C2-Understanding | 2 |
| CLO-2 | **Analyze** the functions and services provided by each layer of Internet Protocol Stack and Categorize various networking devices according to their roles in different layers and protocols | C | C4-Analysis | 2 |
| CLO-3 | **Evaluate** different scenario at datalink, network and transport layers of OSI model. | C | C6-Evaluation | 4 |
| \* BT= Bloom’s Taxonomy, C=Cognitive Domain, P=Psychomotor Domain, A= Affective Domain | | | | |

**Course Materials**

This course introduces the following topics:

● Protocol layers and service models. OSI and Internet protocols.

● What is the Internet. Concepts of delay, security, and Quality of Service (QoS).

● Application layer protocols and client-server model.

● Sockets programming in C (client-server and web server programs).

● Reliable data transfer. Stop-and-Go evaluation. TCP and UDP semantics and syntax.

● TCP RTT estimation. Principles of congestion control.

● Security. Overview of threats, cryptography, authentication, and firewalls. Discussion of project.

● Principles of routing. Link-state and distance vector. IP semantics and syntax.

● Link-state and distance vector routing.

● Link layer. Error detection. Multiple access protocols. IEEE 802.3 Ethernet.

● Switching and bridging. Media. Signal strength. Data encoding.

● Wireless and mobile networks.

● Network management including SNMP. Network troubleshooting. Hot topics such as SDN and IoT.

● Hot topics such as SDN and IoT.

**Course Weekly Schedule**

The course schedule for 16 weeks is detailed below

| Week | Topic |
| --- | --- |
| 1 | Basic concepts of networking i.e. internet. Network edge and core description.  Packet switched network, Circuit switch network concept. Delay, loss throughput |
| 2 | The concept of layered architecture modeling including OSI and the TCP/IP protocol suite. Client-server communications. Various network attacks. Numerical problems |
| 3 | Principles of application layer. Functioning of various application layer protocols including http, FTP, SMTP. Working of DNS. |
| 4 | Peer to peer applications. |
| 5 | Introduction to Transport layer. Multiplexing and de-multiplexing techniques.  Connectionless transport UDP |
| 6 | Principles of reliable data transfer. Connection oriented TCP |
| 7 | Flow control, RTT estimation. Flow control and congestion control mechanisms |
| 8 | Services of network layer i.e. routing and forwarding. Virtual circuit and datagram networks. |
| 9 | Internal Structure of the Router. Introduction to IPv4 and IPv6. Subnetting, VLSM, Supernetting and ICMP. |
| 10 | Routing concepts. Concept of link state, distance vector routing numerical problems. |
| 11 | Introduction to services of link layer. Error detection and Correction techniques including parity check, checksum and CRC. |
| 12 | Media access control protocols. Switched local area networks i.e. Ethernet, link layer addressing, ARP and VLAN’s. |
| 13 | Introduction to wireless and Mobile networks. Wifi: 802.11 architecture, frame structure, protocol and mobility issues. Personal area networks i.e. Bluetooth. |
| 14 | Vertical and horizontal handoff. Mobile IP and mobility management issues such triangle routing problem. |
| 15 | Protocols of real-time conversational applications i.e. RTP and SIP, basics of networks security. |
| 16 | Symmetric key cryptography and public key encryption. |

**Recommended Textbooks**

1. *Computer Networking: A Top-Down Approach*, 6th edition, by James Kurose and Keith Ross (ISBN-13: 978-0133594140)

**Recommended Reference (Books/Websites/Articles)**

1. *Data Communications and Networking*, by Behrouz a. Ferouzan 4th edition, McGraw-Hill, 2007.

## Computer Networks Lab

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| Semester | Credit Hours | Prerequisite |
| [BSCS-6] | [0+1] | [ None] |

**Course Code: CSCN-331-L**

**Course Description**

**Course Learning Outcomes (CLOs)**

The course learning outcome along with domain and BT level are listed below

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| --- | --- | --- | --- | --- |
| S. # | CLO STATEMENT | DOMAIN | BT LEVEL | PLO |
| CLO-1 | **Demonstrate** knowledge about the practical aspects of Computer Networks | C | C3-Application | 3 |
| CLO-2 | **Practice** network setups and trouble-shoot in simulation and practical environment | P | P3-Guided Response | 4 |
| CLO-3 | **Report** the outcome of an experiment/task in a standard format | A | A2-Responding | 7 |
| \* BT= Bloom’s Taxonomy, C=Cognitive Domain, P=Psychomotor Domain, A= Affective Domain | | | | |

**Course Materials**

This course introduces the following topics to students:

* Internetworking functions of each layer of the OSI reference model and how they are performed in network devices
* Design, implementation, configuration, and monitoring of LAN and WAN services
* Functionality and operation of Cisco's IOS software
* Addition of routing protocols to a network configuration
* Functionality of network protocols including TCP/IP, IPX, and ICMP
* Configuration, monitoring, and verification of standard and extended access lists
* Segmentation of networks using routers, switches, and bridges

**Lab Weekly Schedule**

The course schedule for 16 weeks is detailed below

| Week | Topic |
| --- | --- |
| 1 | Cables, Connectors, and Preparing Ethernet Cables |
| 2 | Understanding Network Commands |
| 3 | IP Addressing and Subnetting |
| 4 | Configuring basic Switch: Switch configuration, Speed, and Duplex |
| 5 | Securing the Switch: Setting up telnet, MOTD banner, etc, Test telnet connection, Line VTY, Cisco Password Encryption, Cisco port security |
| 6 | Virtual LAN (VLANs): Create VLANs, Router On A Stick, Native VLAN, and Mismatch |
| 7 | Servers and CDP: DHCP server, Web Server, CDP Protocol |
| 8 | Open Ended Lab |
| 9 | Switch Redundant connections and Loops (STP) |
| 10 | Setting up basic Router Configurations: Setting up router names and passwords, Adding modules to a Router, Basic router configuration |
| 11 | Setting up Static Routes |
| 12 | Setting up Default Routes |
| 13 | Configuring WAN Connection: Serial connection, PPP encapsulation |
| 14 | Implementing and analyzing Router Information Protocol (RIP) ver. 2 |
| 15 | Setting up an Enterprise level Network and testing connectivity, Access Lists |
| 16 | Open Ended Lab |

**Recommended Textbooks**

1. Press, Cisco. "*Cisco CCNA Exam# 640-507 Certification Guide*." (2000).