**Course Profile**

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| **Course Title:** Computer Networks | | **Course Code:** ETE 331 |
| **Credit:** 3.0 | **Total Mark:** 100 | **Contact Hour:** 1.5 hr |

**Rationale:** This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks and provides the student with fundamental knowledge of the various aspects of computer networking and enables students to appreciate recent developments in the area. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) , routing protocols, bridges, routers and gateways; network naming and addressing; and local and remote procedures. On completion of the course, the student should be able in part to design, implement and maintain a typical computer network (LAN).

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

1. Build an understanding of the fundamental concepts of computer networking.

2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.

3. Introduce the student to advanced networking concepts, preparing the student for entry advanced courses in computer networking.

4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

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| **Learning Outcomes** | **Course Content** | **Teaching Learning Strategy** | **Assessment Strategy** |
| 1. Understand the Computer Networks Fundamentals and what’s the importance of leaning Computer Networks for academic and professional career.  2. Describe Standardization of Networks: The ISO/ OSI Model and TCP/IP Model.  3. Understand the classifications of Networks – LANs, MANs and WANs.  4. Understand the medium and Hardware for Networking. | **Chapter 1.Course Outline and Computer networks basics**   * 1. Introduction of Computer Network fundamentals and It’s importance for academic and professional career.   2. Basic concept about ISO/OSI Model.   3. Different kind Medium and Hardware Device for Networking. | Lecture, Discussion, Problem based learning, Exercise. | Assignment, Q/A, MCQ |
| 1. Understand the Introduction TCP/IP Model and get brief History of TCP/IP Model.  2. Describe the layers of TCP/IP Protocol and their functions.  3. Understand about the HTTP (Hypertext transfer protocol), FTP (File transfer protocol), SMTP (Simple mail transfer protocol), SNMP (Simple network management protocol), DNS (Domain Name Service) etc.  4. Draw the TCP/IP Protocol suite. | **Chapter 2. Introduction to TCP/IP**   * 1. Introduction of TCP/IP Model and brief History. Discuss the importance for how network devices are connected and the way information is transmitted.   2. TCP/IP Protocol normally considered to be a 4 layer system. Describe the four Layers working functions.   3. TCP/IP concept example , Various IP support protocols including ARP, ICMP, DHCP, DNS, HTTP, FTP, SMTV etc. | Lecture, Discussion, Problem based learning, Exercise | Assignment, Q/A, MCQ |
| 1. Understand the Introduction TCP/IP Model and get brief History of ISO/OSI Model.  2. Describe the layers of ISO/OSI Protocol and their functions.  3. Understand how allow manufactures of different systems to interconnect their equipment through standard interfaces.  4. Allow software and hardware to integration well and be portable on differing systems. | **Chapter 3. Introduction to layered protocols and OSI model and Terminology in OSI**  1.1 Introduction of TCP/IP Model and brief History. Discuss the importance for how network devices are connected and the way information is transmitted.  1.2 OSI Model considered to be a 7 layers system.  1.3 Features of OSI model.  Describe the seven Layers working functions.  Draw the working diagram of each layers. | Lecture, Discussion, Problem based learning, Exercise | Assignment, Q/A, MCQ |
| 1. Identify the four standard topologies and their variations. 2. Describe the advantages and disadvantages of each topology. 3. Determine an appropriate topology for a given networkplan. | **Chapter 4. Network Topology**  1.1 Definition of Network Topology.  Main types of Network Topology.  1.2Standard Topologies  1.3 Advantages and Disadvantages of each topology. Considerations When Choosing a Topology: **Money**, **Length of cable needed**, **Future growth** and C**able type**.  1.4 Briefly Discuss of each topology.  Variations on the standard topologies. | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Understand the IP addressing. 2. Internet Protocol:   Ipv4-32 bit and IPV6-128 bit.   1. Understand the five IPv4 classes of IP addresses with the range of IP addresses and the default subnet mask for each class. 2. How to identify the Network ID, host ID, and the default gateway address to determine local and non-local hosts. 3. Understand the difference between a public IP address and a private IP address. 4. Understand about IVP4 Subnetting **.** | **Chapter 5. Internet Protocol Addresses IPV4 Addressing**  1.1 What is an IP address?  Why do we need IP address?  1.2 Address Architecture of the Internet.  IP Address Structure: Network portion and Host portion.  IP addresses can be grouped into one of five different classes.  1.3 Discuss of the Class A,B,C,D and D Address  Including First Octet Range, Number of Possible networks, Number of possible hosts per network and Broadcast Address.  1.4 Number system and conversions of each number.  What is mask and why it is needed?  Discuss Private IP address and Unique IP Address.  1.5 Find out the parameters from a given IP addresses: Class, Default mask, No. of usable subnets, No. of hosts/subnet, Subnet Id, Subnet work mask, IP exits in subnet no, CIDR notation of given IP , Usable Hosts , and Broadcast address. | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Understand the Subnetting Basics. 2. How to create Subnets 3. Understand Subnet mask and CIDR (Classless Inter-Domain Routing). 4. Subnetting Class A, B ,C addresses. 5. Understand VLSM and It’s technique 6. Draw VLSM Design 7. Implementing VLSM Networks 8. Summarization | **Chapter 6.**  **Subnetting and VLSM(Variable Length Subnet Mask).**  1.1 Definition of Subnetting and functions.  Explain the advantages of subnetting .  1.2 How to create Subnets  Subnet mask and CIDR (Classless Inter-Domain Routing).  Subnetting Class A, B ,C addresses.  1.3 Definition of VLSM and functions.  Explain the advantages and disadvantages of VLSM.  1.4 Draw VLSM Design  Implementing VLSM Networks | Lecture, Discussion, Problem based learning, Exercise | Do |
| **1.**. Identify the necessary computer c omponent used in configuration.  2. Determine the functions of each computer component used in configuring. 3. Give the most important component that plays a vital role in a network.  4. To use technology to optimize their use for learning and productivity. | **Chapter 7.**  **Network Hardware**  1.1 Introduction  Introduction to the Computers of a Network  1.2 Computer Accessories and Peripherals   * Keyboard and Mouse * Monitors * Printers   Network Distribution   * Introduction * Network Cables   1.3 Ethernet at the data link layer   * Ethernet addressing * Ethernet Frames   Ethernet at the Physical layer.   * 1. Ethernet Cabling | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Describe Ethernet topology. 2. Explain how CSMA/CD is used within an Ethernet LAN. 3. Compare and contrast two Ethernet frame types. 4. Describe the relationship between IEEE Ethernet standards and the OSI model. 5. Troubleshoot an Ethernet problem. | **Chapter 8.**  **Ethernet Fundamentals**  1.1 Ethernet Networks introduction and it’s function.  Collision Domain  1.2 Broadcast Domain  CSMA/CD  Half and Full-Duplex Ethernet  1.3 Ethernet at the data link layer   * Ethernet addressing * Ethernet Frames   Ethernet at the Physical layer. | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Data Encapsulation Fundamentals 2. **Protocol Data Unit (PDU)** 3. **OSI Layer Model and PDUs** 4. Troubleshoot an Ethernet problem. | **Chapter 9.**  **Data Encapsulation**  1.1 Introduction of Data Encapsulation Process  **Protocol Data Unit (PDU)**  1.2 **OSI Layer Model and PDUs and It’s function**  **1.3 Encapsulation process**   * **TCP Header Encapsulation** * **IP Header Encapsulation** * **MAC Header Encapsulation** * **Physical Layer Encapsulation** * **De-Encapsulation** | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. [What are VLAN's?](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#WhatVLAN) 2. Design VLAM’s 3. [Why use VLAN's?](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#WhyVLAN) 4. [How VLAN's work](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#HowVLAN) 5. [Types of VLAN's](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#Types) 6. [Types of Connections](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#Connections) 7. [Frame Processing](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#Processing) 8. Understand the IOS User interface 9. Connecting to a Cisco IOS Device 10. How to bringing Up a switch   Command Line Interface (CLI) | **Chapter 10.**  **VLAN (Virtual Local Area Network )**  1.1 Introduction of VLANs  Design VLANs  1.2 What are VLANs?  [Why use VLAN's?](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#WhyVLAN)  1.3 [How VLAN's work](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#HowVLAN)  [Types of VLAN's](http://www.cse.wustl.edu/~jain/cis788-97/ftp/virtual_lans/#Types)  **Chapter 11. Internetworking operating System (IOS)**  1.1 Introduction to Internetworking Operating system  Cisco’s IOS  1.2 Connecting to a Cisco IOS Device  Bringing Up a Switch  1.3 Command Line Interface (CLI)   * Entering the CLI * Overview of Router Modes * CLI Prompts * Interfaces * Routing Protocol Configurations * Editing and Help Features | Lecture, Discussion, Problem based learning, Exercise  Lecture, Discussion, Problem based learning, Exercise | Do  Do |
| 1. Understand the Administrative Configurations 2. Router and Switch Interfaces Viewing , Saving ,and Erasing Configurations | **Chapter 12. Internetworking operating System (IOS)**   * 1. Internetworking operating System (IOS)   1.2 Administrative Configurations   * Hostnames * Banners * Passwords * Interface description   1.3 Router and Switches Interfaces   * Bringing up an Interface * Configuring an IP Address on an Interface * Serial Interface commands | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Understand VLSM Design 2. Implementing VLSM Networks 3. Summarization 4. Troubleshooting IP Addressing 5. Determining IP Address problems | **Chapter 13 .VLSM , Summarization , and Troubleshooting TCP/IP**  1.1 Introduction of VLSM  VLSM design  1.2 Implementing VLSM Networks  Summarization  1.3 Troubleshooting IP Addressing  Determining IP Address problems | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Understand the routing basic concept.  2. Describe the primary functions and features of a router.  3. Describe the Routing Classifications.  4. Explain how routers use information in data packets to make forwarding decisions in a small to medium sized network.  5. Compares ways in which a router builds table when operating in a small to medium sized business network. | **Chapter 14. Routing Protocol**  1.1 Definition of routing protocol.  Describe the primary functions and features of a router.   * 1. Functions of Router   1.3 Describe the Routing classifications.  Explain the Static and Dynamic Routing.  1.4 Configure Basic Router Settings  Configure a loopback interface  Verify Interface Settings  Command History Feature  Routing Table Sources | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Understand the Static Routing Implementation. 2. Configure Static and Default Routes 3. Review of CIDR and VLSM 4. Configure summary and Floating Static Routes 5. Troubleshoot Static and Default route issues | **Chapter 15**. **Static Routing Protocol**  1.1 Definition of Static Routing.  Explain the advantage and disadvantages  1.2 Explain the purpose of different types of static routs.  Configure IPv4 and IPv6 static routes by specifying a next-hop address.  1.3 Explain the purpose of CIDR in replacing classful addressing.  Explain the use of legacy classful addressing in network implementation.  Configure an IPv4 and IPv6 default routes.  1.4 Troubleshoot common static and default route configuration issues.  Explain how a router processes packets when a static route is configured. | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Describe how a router determines a path and switches packets 2. Describe the structure of a routing table. 3. Demonstrate the ability to configure devices and apply addresses. 4. Identify a router as a computer with an OS and hardware designed for the routing process. | **Chapter 16**. **Routing Information Protocol (RIP)**  1.1 Definition of Routing Information Protocol (RIP)  Router as a Computer  1.2 Configure Devices and apply Address  Routing Table Structure  1.3 Router path and packet Switching  summery | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. RIP routing updates 2. RIP routing metric 3. RIP scalability and limitations 4. RIP stability features 5. Configuring RIP 6. Describe the operation and configuration of EIGRP, including load balancing and authentication. 7. Identify an approach for troubleshooting common EIGRP problems and offer solutions | **Chapter 17.**  **Routing Information Protocol (RIP)**  1.4 RIP Fundamentals  RIP routing updates  RIP routing metric 1.5 RIP Scalability and LimitationsRIP Stability Features 1.6 Configuring RIP  **Chapter 18.**  **Enhanced Interior Gateway Routing Protocol(EIGRP)**  1.1 EIGRP Fundamentals  EIGRP Features  1.2 EIGRP Components  EIGRP Concept  1.3 EIGRP Configuration Command | Lecture, Discussion, Problem based learning, Exercise  Lecture, Discussion, Problem based learning, Exercise | Do  Do |
| 1. Describe the role of dynamic routing protocols and place these protocols in the context of modern network design. 2. Identify several ways of classify routing protocols. 3. Describe how metrics are used by routing protocols and identify the metric types used by dynamic routing protocols. | **Chapter 19.**  **Dynamic Routing**  1.1 Definition of Dynamic routing.  Classifications of Dynamic routing.  Difference between static and dynamic routing.   * 1. RIPV1 and RIV2 routing. EIGRP routing, OSPF routing   1.3 Identify the different elements of the routing table. | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Describe OSPF terminology and operation within various enterprise environments. 2. Describe the function and operation of packets in OSPF routing. 3. Configure and verify basic OSPF. 4. Describe and configure OSPF in various WAN network types. 5. Configure and verify advanced OSPF features. | **Chapter 20.**  **Open Shortest Path Fast (OSPF)**  1.1 OSPF Fundamentals  OSPF Features  1.2 Adjacency and Designated Routers  Link State Advertisements  OSPF Packet Types  1.3 OSPF States  OSPF Metrics  Routing with OSPF | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Configure and verify basic OSPF. 2. Describe and configure OSPF in various WAN network types. 3. Configure and verify advanced OSPF features. 4. Configure and verify OSPF authentication. | **Chapter 21.**  **Open Shortest Path Fast (OSPF)**  **1**.4 Addressless Interfaces  Using OSPF and RIP  1.5 Importing BGP routes into OSPF  OSPF On Demand Circuits  1.6 OSPF Configuration  Configure and verify advanced OSPF features.  Configure and verify OSPF authentication. | Lecture, Discussion, Problem based learning, Exercise | Do |

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| 1. Identify the characteristics of distance vector routing protocols. 2. Describe the network discovery process 3. Identify the conditions leading to a routing loop and explain the implications for router performance. 4. Recognize that distance vector routing protocols are in use today. | **Chapter 22.**  **Distance Vector Routing Protocol**  1.1 Distance Vector Routing Protocol Fundamentals  Distance Vector Routing Protocol Features  Examples of Distance Vector routing protocols  1.2 Characteristics of Distance Vector routing protocols  Routing Protocol Algorithm  1.3 Advantages and Disadvantages of Distance Vector Routing Protocol  Network Discovery  Routing Table Maintenance  Routing Protocols Today | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Describe the factors that led to the development of IPv6 and possible uses of this new IP structure. 2. Describe the structure of the IPv6 address format, how IPv6 interacts with data link layer technologies, and how IPv6 is supported in Cisco IOS Software. 3. Implement IPv6 services and applications. | **Chapter 23** . **IPV6**  **1.1**   * + What are the parts of an IPv4 address? What is the purpose of the subnet address?   + Describe the factors that led to the development of IPv6 and possible uses of this new IP structure.   1.2   * Describe the structure of the IPv6 address format, how IPv6 interacts with data link layer technologies, and how IPv6 is supported in Cisco IOS Software. * Implement IPv6 services and applications. | Lecture, Discussion, Problem based learning, Exercise | Do |
| 1. Understand the concept Wide Area Networks. 2. WAN Connection Bandwidth 3. WAN Support 4. Cable and DSL | **Chapter 24** . **Wide Area Networks**  **1**.1 WAN Introduction  Defining WAN terms  1.2 WAN Connection Bandwidth  WAN Connection Types  1.3 WAN Support  Cable and DSL  Digital Subscriber Line | Lecture, Discussion, Problem based learning, Exercise | Do |

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| **Recommended Books and Materials** | |
| ***Text Books:***   1. Computer Network, Tanenbaum 2. Data Communications and Networking ,3rd Edition, Behrouz A. Forouzan | ***References:***  1. Fundamental of Communication, Shamim Kaiser, Arifur Rahman, Jafor Alam, A.K.M Fazlul Haque  2. CCNA |