



GUJARAT TECHNOLOGICAL UNIVERSITY

Syllabus for Master of Computer Applications, 2nd Semester

Subject Name: Computer Networking

Subject Code: 629404

With effective
from academic
year 2020-21

1. Learning Objectives:

- To equip the students with basics concept of Computer Networks.
- To familiarize the students with the standard models for the layered approach OSI and TCP/IP to communication between machines in a network and the protocols of the various layers.
- To gain basic insight of programming for network solutions.

2. Prerequisites:

Basic Concept of Data Structures, Operating systems, Programming Language and Knowledge of Linux OS

3. Contents:

Unit	Course Content	Weightage percentage
Unit I	Introduction: Personal Area Network, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network software, protocol hierarchies, Design issues for the layers, connection oriented vs. Connectionless service, service primitives, relationship of services in protocols, Reference Models, Open System Interconnection (OSI), TCP/IP Reference models, Example Networks: ARPANET, NSFNET, Architecture of Internet.	15%
Unit II	Physical Layer Guided Transmission Media, Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Wireless Transmission, Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission, Light Transmission, Digital Modulation and Multiplexing, Public Switched Telephone Networks.	15%
Unit III	Data Link Layer Design issues, Error detection and correction. Elementary data link protocols: Utopian simplex protocol, a simplex stop and wait protocol for an error-free channel, a simplex stop and wait protocol for noisy channel. Sliding Window protocols, Example data link protocols.	15%
Unit IV	Medium Access Control Sublayer The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, IEEE 802.11 Architecture and Protocol	15%



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	Stack, Physical layer, sublayer, Frame Structure, Services, Data link layer switching.	
Unit V	Network Layer Design issues, Routing algorithms: Optimality principle, shortest path routing, Flooding, distance vector routing, Link State routing, Congestion Control Algorithms, The Network layer in the Internet.	15%
Unit VI	Transport Layer: Transport Services, Elements of Transport protocols, Connection establishment, connection release, Error control, flow control, congestion control, UDP and TCP protocols.	15%
Unit VII	Application Layer: Domain name system, Electronic Mail; the World Wide Web, HTTP	10%

4. Text Book(s):

Andrew S Tanenbaum, David. J. Wetherall, "Computer Networks", Pearson Education, 5th Edition,

5. Reference Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, Fourth Edition
2. Kurose and Ross, Computer Networking- A Top-Down approach, Pearson, 5th edition
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, Fifth Edition, 2011.
4. Fred Halsall, Computer Networking and the Internet, Addison Wesley, (5th edition)
5. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011
6. Bhushan H Trivedi, "Computer Networks", Oxford University Press

6. Unit wise coverage from Textbook(s):

Unit 1	Topics
I	Chapter 1: 2,3,4.1 to 4.4,5.1
II	Chapter 2: 2,3,5,6
III	Chapter 3: 1,2,3,4,5
IV	Chapter 4: 1,2,3.1 to 3.7,4,5,6
V	Chapter 5: 1,2.1 to 2.5,3,6.1 to 6.4
VI	Chapter 6: 1.1,1.2, 2.1 to 2.4, 3.1 to 3.2, 4.1, 4.2,5.1 to 5.9
VII	Chapter 7: 1,2,3.1, 3.4

Students are not required to reproduce the entire algorithms/protocol code in the theory exam for any protocols and routing algorithms. Concepts based on these algorithms/ protocols should be asked in theory exam



7. Outcomes

At the end of the course, the student should be able to:

1. Understand concepts of networking and gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
2. Identify the components required to build different types of networks
3. Obtain the skills of subnetting and routing mechanisms.
4. Have a working knowledge of datagram
5. Trace the flow of information from one node to another node in the network

Practical List

Part I: Network Basics

A. Hardware

1. Install & Test Network Interface Card.
2. Prepare and Test Straight UTP Cable.
3. Prepare and Test Cross UTP Cable.
4. Develop a small Network. (Hands on Training.)

B. Software

5. Install Windows 2003/Windows 2008 Network operating System
6. Install & Configure File Server.
7. Install & Configure Print Server
8. Install & Configure Mail Server
9. Install & Configure Proxy Server
10. Install & Configure Web Server
11. Install & Test Router, Repeater and Bridge.
12. Install a small wireless network

Part II: Network Analysis using Wireshark

1. Download Wireshark from its official webpage, it is a network packet analyser
<https://www.wireshark.org/>
2. Install Wireshark under Windows/Linux/MAC/Solaris platform, Windows installer names contain the platform and version. Install WinPcap

Lab1:

Objective: To make the students aware about the IT/Network infrastructure of their parent institute.

Introduction to the lab infrastructure, the cabling/cable type and specifications/ switch/topology/ router/network infrastructure, Internet Connectivity, Wi-Fi Connectivity of your department (labs and lecture halls) and how it is connected with the overall institute level IT infrastructure, How the institute obtains Internet Connectivity from its ISP, The Bandwidth and other specifications, Visit to the Computer Centre of the Institute, Introduction to various Enterprise Servers/Servers of Licensed Software, Server hardware configuration, Server Management Tools, Enterprise Level Firewall, etc. So, lab 1 is intended as an in-



campus IT infrastructure industrial visit for students. Students are supposed to prepare a report of this visit. Students are also supposed to note down the model/make of various network interface devices (NIC card, switch, router) used in their lab/department/institute, download their technical specifications from their respective web-site and attach those specifications in the report. The significance and interpretation of these specifications may be discussed by the faculty member during the corresponding lab/lecture hours pertaining to that particular device.

Lab 2:

Objective: To make the students aware about and learn the detailed use of the following OS level TCP/IP diagnostic and troubleshooting commands: ping, ns lookup

Lab 3:

Objective: To make the students aware about and learn the detailed use of the following OS level TCP/IP diagnostic and troubleshooting commands: ipconfig, arp, netstat, tracert, telnet

Lab 4a:

Objective: Implement a simple TCP socket based client server program in Python in which the client connects to the server. The server displays the ip address and port number of client and sends an acknowledgement message back to client. The client displays the received acknowledgement message on screen.

Lab 4b:

Objective: Implement a simple UDP socket based client server program in Python in which the client connects to the server. The server displays the ip address and port number of client and sends an acknowledgement message back to client. The client displays the received acknowledgement message on screen.

Lab 5:

Objective: Wireshark Installation, understanding the Wireshark Environment / Menu System, to start and stop live capture of traffic from given wired Ethernet network interface, capturing options, store captured data in different supported file formats, to open already stored captured data file.

Lab 6:

Objective: Learn and use view level filters and capture level filters in Wireshark for different traffic types like Ethernet, ARP, IP, TCP, UDP, DNS, HTTP, etc. For each captured category,



observe how different headers are encapsulated within each other. E.g. TCP encapsulated within IP, HTTP encapsulated within TCP, etc.

Lab 7:

Objective: Capture the following traffic types and Interpret/ Analyze the corresponding header and payload: Ethernet and ARP

Lab 8:

Objective: Capture the following traffic types and Interpret/ Analyze the corresponding header and payload: IP and ICMP

Lab 9:

Objective: Capture the following traffic types and Interpret/ Analyze the corresponding header and payload: TCP and UDP

Lab 10:

Objective: Capture the following traffic types and Interpret/ Analyze the corresponding header and payload: HTTP and DNS

Lab 11:

Objective: Capture the following traffic types and Interpret/ Analyze the corresponding header and payload: FTP, SMTP and Telnet

Lab 12:

Objective: Capture the following traffic types and Interpret/ Analyze the corresponding header and payload: Ethernet and ARP

Lab 13:

Objective: Capture Wi-Fi and Bluetooth Traffic and Interpret/ Analyze the corresponding header and payload using Wireless Traffic Sniffing tools like Wireshark-USB/AirCrackng/Kismet, etc.

Lab 14:

Objective: Analyze Email Traffic: Normal POP Communications, POP Problems, Dissect the POP Packet Structure, Filter on POP Traffic, Normal SMTP Communications, SMTP Problems, Dissect the SMTP Packet Structure, Filter on SMTP Traffic

Lab 15:



Objective: Analyze IEEE 802.11 (WLAN): Wireless LANs (WLANs) Traffic, Signal Strength and Interference, Capture WLAN Traffic, 802.11 Traffic Basics like Data Frame, Normal 802.11 Communications

The Practical Examination Exercises would be based on Lab Exercises based on above list EXCEPT Lab # 1, 4a, 4b, 13 and 15. For Lab # 1, 4a, 4b, 13 and 15, documentation/report/file should be maintained.

References:

- 1) <https://technet.microsoft.com/en-us/library/bb727023.aspx>
- 2) <https://docs.python.org/2/howto/sockets.html>
- 3) <https://www.aircrack-ng.org/>
- 4) <https://www.kismetwireless.net/>

Note: Some of the practical's form the above practical list may have seemingly similar definitions. For better learning and good practice, it is advised that students do maximum number of practical's. In the practical examination, the definition asked need not have the same wordings as given in the practical list. However, the definitions asked in the exams will be similar to the ones given in the practical list.

Part III: Exploring using Python

1. Implement a Python Program to print host name and IP address of local host.
2. Implement a Python Program to print host name and IP address of remote host where IP address of remote host is available.
3. Implement a Python Program to print host name and IP address of remote host where hostname of remote host is available.
4. Implement a TCP port scanner program in python for local host.
(Note: Do not try this program for a remote host, especially outside your domain. It could cause legal problems)
5. Implement a UDP port scanner program in python for local host.
(Note: Do not try this program for a remote host, especially outside your domain. It could Cause Legal problems)
6. Implement a TCP based client server program in python using TCP sockets where Server displays the following: a) Host Name, IP address and Port Number on which it is hosted b) IP address and port number of a client requesting connection. Server sends the message "Thanks for Connecting!" back to client. Client displays this message on screen.



7. Implement a UDP based client server program in python using UDP sockets where Server displays the following:
 - a) Host Name, IP address and Port Number on which it is hosted
 - b) IP address and port number of a client sending some dummy message. Server displays the dummy message on screen. Server sends the message “Thanks for Message!” back to client. Client displays this message on screen.
8. Implement a TCP based echo client server program in python.
9. Implement a UDP based echo client server program in python.
10. Implement a TCP based daytime client server program in python.
11. Implement a UDP based daytime client server program in python.
12. Implement a TCP based client server text chat program in python.
13. Implement a UDP based client server text chat program in python.
14. Implement a TCP based echo client server program in python with a multi-threaded server.
15. Implement a TCP based daytime client server program in python with a multi-threaded server.
16. Implement a web client using urllib to:
 - a) Display the html source of a given URL on screen
 - b) Display the URL visited
 - c) Display the header information transmitted in the http response sent by the contacted web-site/web-server.
 - d) Display the http server status code
17. Implement an ftp client using ftplib which connects to an ftp server, takes login/password from user, displays directory list and permits upload and download of files.
18. Write a Python program that makes a connection to a web server and retrieve/display a document using the HTTP protocol.
19. Write a Python program that makes a connection to a web server and retrieve an image using the HTTP protocol.
20. Write a python program to implement a simple server-client program :
21. Write a python program to implement socket programming using multi-threading



Reference Material for Python Network Programming:

1. Learning Python Network Programming, Dr. M.O. Faruque Sarker & Sam Washington, Packt Publishing, 2015
2. Python Network Programming Cookbook, 2nd Edition, Pradeeban Kathiravelu, Dr. M.O. Faruque Sarker, Packt Publishing, 2017
3. Foundations of Python Network Programming, 3rd edition, Brandon Rhodes & John Goerzen, Apress Publications
4. Beginning Python: From Novice to Professional, 2nd edition, 2009 (Indian Reprint), Apress Publications
5. <https://docs.python.org/3/howto/sockets.html>
6. <https://docs.python.org/3/library/socket.html>