Course Title: Data Communication and Networks

Course No.: ICT. Ed. 456

Level: Bachelor. Credit Hour: 3 hours (2T+1P)
Semester: Fifth Teaching Hour: 64hours (32+32)

Nature of course: Theoretical + Practical

1. Course Description

The purpose of this course is to introduce the fundamental concepts on data communication, Data transmission mechanisms, Network Architectures, Internet protocols, Local area networks and the practical aspects of networking. It also aims to develop networking skill such as sub-netting and network infrastructure design and development.

2. General Objectives

After successful completion of this course students will be able to

- Identify the different components and their respective roles in computer network and internet
- Explain different services provided by the Network Layers
- Design an enterprise network employing the WLAN, LAN and VLAN technologies and be able to evaluate the advantages and disadvantages
- Configure a PC to work as a host in a TCP/IP network and to use the IP based commands

3. Course Outlines:

Specific Objectives	Contents	
Describe the basic concept of computer network and Internet Understand layered architecture	1.2. The Network Edge: Access Networks, Physical Media 1.3. The Network Core: Packet Switching, Circuit Switching	
 Describe different services provided by application layer Identify different application layer protocols 	Unit 2: Application Layer 2.1. The Web and HTTP: overview of HTTP, HTTP	5+5

	Case Studies:		
	Netflix and YouTube		
	Practical Works: • Wireshark Lab: HTTP and DNS		
	Witchiark Lab. 111 11 and DNS		
Describe the basics of	Unit 3: Transport Layer	6+6	
transport layer	3.1. Introduction and Transport-Layer Services		
Compare and contrast	3.1.1. Relationship Between Transport and		
different aspect of TCP	Network Layers		
and UDP	3.1.2. Overview of the Transport Layer in the		
Discuss connection less	Internet		
and connection oriented	3.2. Multiplexing and De-multiplexing		
transport	3.3. Connectionless Transport: UDP		
•	3.3.1. UDP Segment Structure		
	3.3.2. UDP Checksum		
	3.4. Principles of Reliable Data Transfer		
	3.4.1. Go-Back-N (GBN)		
	3.4.2. Selective Repeat (SR)		
	3.5. Connection-Oriented Transport: TCP		
	3.5.1. Round-Trip Time Estimation and Timeout		
	3.5.2. Reliable Data Transfer		
	3.5.3. Flow Control		
	3.6. TCP Congestion Control		
	Practical Works:		
	Wireshark Lab: Exploring TCP and UDP Wireshark Lawrence Lawrence Wireshark Lawrence Lawrence Wireshark Lawrence Lawrence Wireshark Lab: Exploring TCP and UDP	0.0	
• Describe the network layer data plane and	Unit 4: The Network Layer	8+8	
control plane differently	4.1. Data Plane		
Understand the router	4.1.1. Inside the Router		
and different routing	4.1.1.1 Input Port Processing and		
algorithms	Destination Based Forwarding		
 Make distinction between 	4.1.1.2 Switching		
IPv4 and IPv6	4.1.1.3 Output Port Processing		
II v4 and II vo	4.1.1.4 Queuing		
	4.1.1.5 Packet Scheduling 4.1.2. The Internet Protocol (IP)		
	4.1.2.1 IPv4 Datagram Format		
	4.1.2.1 IPv4 Datagram Format 4.1.2.2 IPv4 Addressing		
	4.1.2.2 IPV4 Addressing 4.1.2.3 Subnetting		
	4.1.2.4 Network Address Translation		
	(NAT)		
	4.1.2.5 IPv6		
	4.2. Control Plane		
	4.2.1. Routing Algorithms		
	1.2.1. Routing Higoriania		

Algorithm 4.2.1.2 The Distance-Vector (DV) Routing Algorithm 4.2.2. Intra-AS Routing in the Internet: OSPF 4.2.3. Routing Among the ISPs: BGP 4.2.4. ICMP: The Internet Control Message Protocol Practical Works: • Wireshark Lab: IP • Practice Sub-netting to create small networks • Explain Link Layer protocols and services provided by link layer • Get insight on error detection and error correction techniques • Understand DHCP, Eithernet technology and VLANs • Understand DHCP, Eithernet technology and VLANs • S.2.1 Central Partitioning Protocols 5.3.1 Channel Partitioning Protocols 5.3.2 Random Access Protocol 5.3.3 Taking-Turns Protocols 5.3.4 DOCSIS: The Link-Layer Protocol for Cable Internet Access 5.4. Switched Local Area Networks 5.4.1 Link-Layer Addressing and ARP 5.4.2 Eithernet 5.4.3 Link-Layer Switches 5.4.4 Virtual Local Area Networks (VLANs) 5.5. A Day in the Life of a Web Page Request 5.5.1 DHCP, UDP, IP, and Ethernet 5.5.2 DNS and ARP 5.5.3 Intra-Domain Routing to the DNS Server 5.5.4 Web Client-Server Interaction: TCP and HTTP Practical Works: • Wiresbark Labs: 802.11 Ethernet Unit 6: Wireless and Mobile Networks 6.1.1 The 802.11 Wireless LAN Architecture 6.1.2 The 802.11 Wireless LAN Architecture 6.1.3 The IEEE 802.11 Frame 6.1.4 Mobility in the Same IP Subnet		4.2.1.1 The Link-State (LS) Routing	
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		6.1.3 The IEEE 802.11 Frame	
6.1.5 Personal Area Networks: Bluetooth		6.1.4 Mobility in the Same IP Subnet	
		6.1.5 Personal Area Networks: Bluetooth	

6.2. Cellular Networks: 4G and 5G	
Practical Works:	
Wireshark Lab: Wi-Fi	

4 Instructional Techniques

The instructional techniques for this course are divided into two groups. First group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to particular units.

4.1 General Techniques

Reading materials will be provided to students in each unit. Lecture, Discussion, use of multi-media projector, brain storming are used in all units.

4.2 Specific Instructional Techniques

Demonstration is an essential instructional technique for all units in this course during teaching learning process. Specifically, demonstration with practical works will be specific instructional technique in this course. The details of suggested instructional techniques are presented below:

- Unit 1: Assign students to prepare presentation on Internet
- Unit 2: Self-study and ask students to prepare case study report on YouTube and Netflix
- Unit 3: Homework and Assignment on TCP and UDP
- Unit 4: Homework and Assignment on subnetting
- Unit 5: Homework and Assignment on Error Detection and Correction Methods
- Unit 6: Self-study and ask students to make detail report and presentation on Wireless

Technologies: CDMA, 4G, 5G, WiFi: 802.11 Wireless LANs

5 Evaluation:

Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
40 Points	20 Points	40 Points	100 Points

Note: Students must pass separately in internal assessment, external practical exam and semester examination.

a. Internal Evaluation (40 Points):

Internal evaluation will be conducted by subject teacher based on following criteria:

1)	Class Attendance	5 points
2)	Learning activities and class performance	5 points
3)	First assignment (written assignment)	10 points
4)	Second assignment (Case Study/project work with presentation)	10 points
5)	Terminal Examination	10 Points

Total	40 points

b. Semester Examination (40 Points)

Examination Division, Dean office will conduct final examination at the end of semester.

- 1) Objective question (Multiple choice 10 questions x 1mark) 10 Points
- 2) Subjective answer questions (6 questions x 5 marks) 30 Points

Total 40 points

c. External Practical Exam/Viva (20 Points):

Examination Division, Dean Office will conduct final practical examination at the end of semester.

6 Prescribed Textbook, Recommended books and References materials (including relevant published articles in national and international journals)

Prescribed Text Book:

 James F. Kurose & Keith W. Ross, Computer Networking: A Top-Down Approach, 8th Ed., Pearson Education

Recommended Books and Reference Materials:

- Tanenbaum Andrew S., Computer Networks, 4th edition (2nd Impression 2006) or available latest edition
- William Stallings, Data and Computer Communications, 7th Edition (3rd Impression 2007) or available latest edition
- Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, 4th Edition
- Halsall Fred, Data Communications, Computer Networks and OSI, 4th edition (10th Indian reprinting 2005)