



**Level 6 Advanced Diploma in Computer Science (907)
203 Credits**



Unit: Data Communications and Networking	Guided Learning Hours: 220
Exam Paper No.: 4	Number of Credits: 22
Prerequisites: Good computing knowledge	Corequisites: A pass or better in Diploma in System Design or equivalence.
<p>Aim: This unit focuses on design and implementation of network programs and systems, including topics in network protocols, file transfer and client-server computing. The unit explores trends in standardisation, internetworking, development of Wide Area Networks (WANs) and enterprise-wide networks. Other topics include OSI Model, transmission media, network operating systems, topologies, configuration protocols and performance characteristics. The unit analyses technology and applications of business data communications including characteristics of data, fundamentals of transmission, communications hardware and software, network configurations (LAN, MAN, WAN), management, and security. This unit provides a practical study of voice & data communications from the point of the OSI seven-layer and the TCP/IP five-layer protocol model. Traditional circuit switched telecommunications as well as VoIP are taught. This unit also covers the operation of the lower layers in detail by examining some of the foundation laws including Nyquist and Shannon as well as selected protocols. Emphasis is placed on data internetworking, local-area networking and wide-area networking. A survey of and introduction to the structure and regulation of the telecommunications industry. The basics of data communications, telephony, switching systems, ISDN, multiplexing, and networks are introduced. Data communication components, codes and techniques are identified. Methods for selecting, implementing and managing a computer network or telephone system are also reviewed.</p>	
Required Materials: Recommended learning resources.	Supplementary Materials: Lecture notes and tutor extra reading recommendations.
Special Requirements: The course requires a combination of lectures, demonstrations and class discussions.	
<p>Intended Learning Outcomes:</p> <p>1 Network models, how data is transformed into electromagnetic signals, how data is represent using digital signals and the difference between analogue and digital transmission.</p>	<p>Assessment Criteria :</p> <p>1.1 Define the difference between telecommunications and data communications.</p> <p>1.2 Describe the difference between a protocol and a standard.</p> <p>1.3 Familiarise with standards organisations and their duties.</p> <p>1.4 Examine the functions of the layers in the OSI and Internet model.</p> <p>1.5 Compare and contrast the layers in the OSI and Internet model.</p> <p>1.6 Describe the OSI model, including a thorough discussion of each layer's functionality.</p> <p>1.7 Illustrate the versatility of the OSI model by describing a file transfer between two computers as the data passes through the various layers.</p> <p>1.8 Explain the concept of a network.</p> <p>1.9 Explain how the public network functions.</p> <p>1.10 Describe basic signalling functions.</p> <p>1.11 Explain; compare and contrast parallel and serial transmission.</p> <p>1.12 Explain; compare and contrast</p>

<p>2 Bandwidth utilisation, multiplexing, spreading, the transmission medium and the classes of transmission media.</p>	<p>asynchronous and synchronous transmission.</p> <p>1.13 Describe simplex, half-duplex and full-duplex communications.</p> <p>2.1 Describe the difference between digital and analog bandwidth.</p> <p>2.2 Compare different transmission media, including twisted pair wire, coaxial cable, twinaxial cable, fiber optic cable, satellite transmission, and terrestrial microwave transmission.</p> <p>2.3 Compare baseband and broadband transmission.</p> <p>2.4 Discuss multiplexers and their applications.</p> <p>2.5 Explain time division multiplexing; its advantages and disadvantages.</p> <p>2.6 Describe statistical time division multiplexing, and present its advantages and disadvantages.</p> <p>2.7 Explain frequency division multiplexing, and discuss its advantages and disadvantages.</p> <p>2.8 Describe the use of data compression devices to improve communications efficiency.</p>
<p>3 The classification of switched networks, the operations of telephone, cable networks for data transmission; how data can be corrupted during transmission including the data framing process.</p>	<p>3.1 Describe the increased competition in the industry.</p> <p>3.2 Compare different communications service offerings.</p> <p>3.3 Contrast leased and switched services.</p> <p>3.4 Explain the function and elements of packet switching networks.</p> <p>3.5 Describe the features of public packet switching networks.</p> <p>3.6 Describe how error control is handled at the data link layer.</p> <p>3.7 Demonstrate the addressing mechanism used in the data link layer and how network layer addresses are mapped to data link layer addresses.</p> <p>3.8 Describe different sources of data errors.</p> <p>3.9 Explain the echo checking error control method.</p> <p>3.10 Describe the different parity checking methods, including even parity, odd parity, space parity, mark parity, and no parity.</p> <p>3.11 Describe the cyclical redundancy check method of error detection, and explain why it is more reliable at detecting errors than a simple checksum.</p> <p>3.12 Discuss the importance of data security, and review common security concerns.</p> <p>3.13 Discuss the advantages of secure transmission facilities.</p> <p>3.14 Explain the use of passwords, and point out their limitations.</p>

<p>4 Ethernet, the process of connecting LANs, backbone networks, virtual LANs and how wireless LANs operate.</p>	<p>4.1 Define the use of LANs in an organisation. 4.2 Describe the IEEE standards. 4.3 Analyse and identify traditional Ethernet technology and its implementation. 4.4 Describe Fast Ethernet technology and its implementation. 4.5 Describe Gigabit Ethernet technology and its implementation 4.6 Define the main characteristics of IEEE 802.11 wireless LANs. 4.7 Define the applications of IEEE 802.11. 4.8 Define the characteristics of IEEE 802.15 LANs and the Bluetooth technology that implements this standard. 4.9 Examine the concept of virtual LANs. 4.10 Describe the applications and rationale for VLANs. 4.11 Describe the different transmission techniques used in wireless LANs.</p>
<p>5 The implementation of virtual-circuit networks, logical addressing and how networks are internetworked together.</p>	<p>5.1 Define Frame-relay; ATM and ATM LANS. 5.2 Describe IPv4 and IPv6 addresses. 5.3 Describe address mapping; Internet Control Message Protocol (ICMP); Internet Group Management Protocol (IGMP); packet delivery and forwarding; unicast routing protocols and multicast routing protocols. 5.4 Examine the services provided by the telephone network 5.5 Explain how telephone services allow us to connect to the Internet. 5.6 Define how the Internet began. 5.7 Describe the architecture of today's Internet and its relationship with ISPs. 5.8 Describe the importance of the TCP/IP protocol suite. 5.9 Define the role of IP, UDP, and TCP in the Internet. 5.10 Describe the difference between the Internet, an intranet, and an extranet. 5.11 Explain the T-1-2-3/E-1, ISDN, packet switching networks, frame relay networks, and the Internet as digital transmission options.</p>
<p>6 How the delivery of a packet requires the logical and physical addressing, the network layer supervises the handling of packets by the underlying networks and the process-to-process delivery.</p>	<p>6.1 Describe the position of the network layer in the Internet model. 6.2 Define the rationale for the existence of the network layer. 6.3 Describe the concept of host-to-host delivery. 6.4 Analyse the functions of the network layer: packetising, addressing, routing. 6.5 Describe the network-layer protocol, IP, used in the Internet. 6.6 Examine which upper-layer protocol(s)</p>

<p>7 The main focus of congestion control, how to avoid and control congestion including technologies for managing network traffic in a cost effective manner to enhance (quality of service).</p> <p>8 The hierarchy of a domain name space, electronic mail, file transfer, the architecture of World Wide Web (WWW); how HyperText Transfer Protocol (HTTP) is used to access data on the WWW and the functions performed by a network management system.</p> <p>9 The components and categories of cryptography, the services provided by network security, security on the Internet and the structure of the security protocols.</p>	<p>can use the services of IP.</p> <p>7.1 Discuss applications of high bandwidth transmission facilities, like T-1-2-3.</p> <p>7.2 Explain the elements of a T-1-2-3 frame.</p> <p>7.3 Identify QoS issues and concerns.</p> <p>7.4 Define Data traffic</p> <p>7.5 Define congestion</p> <p>7.6 Describe congestion control mechanisms</p> <p>7.7 Describe quality of service (QoS), techniques to improve QoS, integrated and differentiated services.</p> <p>8.1 Describe the hierarchical domain name space</p> <p>8.2 Define distribution of name space</p> <p>8.3 Describe DNS on the internet</p> <p>8.4 Define name resolution.</p> <p>8.5 Define remote logging, electronic mail and file transfer protocol (FTP)</p> <p>8.6 Describe WWW and HTTP</p> <p>8.7 Describe the major network management functions.</p> <p>8.8 Explain the concept of service levels in network management.</p> <p>8.9 Explain the difference between throughput and transmission rate</p> <p>8.10 Describe which one is more meaningful to the end user.</p> <p>9.1 Define how privacy can be achieved through encryption/decryption.</p> <p>9.2 Define the digital signature concept; how it can be used to provide authentication, integrity and non repudiation.</p> <p>9.3 Describe firewalls and their use in isolating an organisation from intruders. Be familiar with VPN technology and how it provides privacy.</p> <p>9.4 Define the different access control methods.</p> <p>9.5 Describe Symmetric-key, asymmetric-key cryptography, message confidentiality, message integrity, message authentication, digital signature, entity authentication, symmetric-key and public-key distribution.</p> <p>9.7 Define IPSecurity (IPSec), Secure Sockets Layer (SSL), Transport Layer Security (TLS), Pretty Good Privacy (PGP) and Firewall</p>
<p>Methods of Evaluation: A 3-hour written essay examination paper with 5 questions, each carrying 20 marks. Candidates are required to answer all questions. Candidates also undertake project/coursework in Data Communications and Networking with a weighting of 100%.</p>	

Recommended Learning Resources: Data Communications and Networking

Text Books	<ul style="list-style-type: none">• Data and Computer Communications by William Stallings ISBN 10: 0131006819• Data Communications and Networking by Behrouz A. Forouzan ISBN 10: 0073250325
Study Manuals 	BCE produced study packs
CD ROM 	Power-point slides
Software 	None

Business & Computing Examinations (BCE)