

Diploma in IT Syllabus

3 Computer Networks

Rationale:

Virtually every computer is connected, or has the potential to be connected, to other computers. When connected locally, they provide vital services such as print servers, file servers, CPU servers and when connected externally, offer access to the Internet, world-wide-web and electronic mail. Millions of people world wide have been exposed to the World Wide Web of computers and the information they provide. The explosion in the use of such technologies and the long established use of local area networks has made the study of computer networks and the underlying communication technology as important as the more traditional foundations of computer science such as computer architecture, operating systems and programming.

Aims:

- To develop an understanding of the modern network technologies in common use today
- To appreciate how computer networks are able to format and transfer data at high speed and over both the local and wide area
- To identify potential and actual limitations with existing networks and identify advances in technology that may solve them

Objectives:

- To be able to demonstrate an understanding of the physical properties and performance characteristics of communication media; specifically copper cable, fibre optics and wireless networks
- To be able to demonstrate an understanding of the importance of communication standards, including an appreciation of protocol layer models and enhancements to those standards
- To be able to demonstrate an appreciation of the theory and practice of common local area networks including virtual and wireless LANs
- To be able to demonstrate an appreciation of the theory and practice of wide area networks and their interconnection
- To be able to demonstrate an appreciation of the significance of network and inter-network protocols; specifically IPv4, IPv6, TCP and UDP

- To be able to describe the importance of reliability and quality of service, including examples of error recovery strategies, traffic differentiation and prioritisation

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and are expected to be familiar with computer architectures, particularly with regard to the representation of information within a computer system. Some practical exposure to local and wide area networks would be useful for context.

Content:

3a INTRODUCTION

Historical perspective, theoretical and practical models of network architecture particularly the ISO OSI seven layer model and the TCP/IP protocol stack. Example networks and services including prototype new technologies. These would include Frame Relay, ISDN, ATM, WiFi, xDSL, WiMAX, 2G and 3G.

3b DIGITAL COMMUNICATION

Physical properties of copper media, fibre optics, radio communication, and data communication standards. Maximum data rates (theoretical and practical) for different media including some simple analysis of signals. Data encoding of digital signals. The distinction between, and analysis of, physical media and wireless media properties. The difference between narrow band and broad band technologies with particular reference to ISDN and xDSL.

3c LOCAL AREA NETWORKS

Types of LAN covering standards, topology and performance. Example architectures such as ethernet and fast ethernet, ATM, and WiFi. The operation of LAN switches and the configuration of virtual LANs.

3d WIDE AREA NETWORKS

Circuit versus packet switching and associated routing and flow control. Detailed examples of existing architectures such as Frame Relay, ISDN, ATM, Multi-protocol Label Switching (MPLS) and Virtual Private Networks (VPN).

3e INTER NETWORKS

Principles of inter networking, architectures, addressing and protocols. Particular reference to IPv4, IPv6, TCP and UDP.

3f ERRORS

The main causes of errors and their effects on transmission. Single bit and burst errors. Various error detection and correction strategies including parity, block sum, Hamming Codes, Cyclic Redundancy Checks and Forward versus Backward error control. Statistical analysis of the effectiveness of error detection and correction code.

3g QUALITY OF SERVICE

A definition of quality of service and the main parameters that define network performance. Router functionality including frame prioritisation, classification and queue management techniques. The provision of quality of service management in practical networks such as Frame Relay, ATM and the Internet.

Primary Texts:

Halsall, Fred, Computer Networking and the Internet, Addison Wesley (5th Ed), 2005, ISBN: 0321263588

Stallings, William, Data and Computer Communications, Prentice Hall Int. (8th Ed), 2007, ISBN: 0132433109

Alternative Texts:

Stallings, William, Wireless Communications and Networks (2nd Edition), 2004, ISBN: 0131967908

Tanenbaum, Andrew, Computer Networks (International Edition) (4th Edition), 2002, ISBN: 0130384887