



Faculty of Computer Studies

T305 B: Digital Communications (Part B)

Course Guide

T305B: Digital Communications (Part B)

Credit Points / Credit Hours: 30 / 8

Pre-Requisites:

T305A

Short Description:

In this course students study about telecommunications concepts such as routing, switching and signaling; coding and modulation; and high-speed networks. Underpinning these topics include material on modeling, including time and frequency domain models, statistical concepts and the representation of complex systems.

Aims:

The aims of this course are:

- To explain the main differences between connection-oriented and connectionless network services.
- To explain the main types of routing technique used in communication networks.
- To describe some of the numbering schemes used in communication networks.
- To describe the Bellman–Ford and Dijkstra’s algorithms to find the least-cost paths in communication networks.
- To explain what is meant by circuit switching and packet switching.
- To explain how multiplexing used on communication links can be viewed as either deterministic or statistical.
- To describe the operation of packet-switched networks and circuit switched networks, including the use of virtual circuits and datagram.
- To describe the reasons for using channel coding.
- To describe the ways of implementing channel coding.
- To describe the principles of optical-fiber communications.
- To describe the applications of optical-fiber communication, indicating their scope and limitations.
- To introduce the areas in which optical-fiber communications are developing, and indicate areas of research.

Learning outcomes:

The learning outcomes of this course are given below:

A. Knowledge and Understanding of:

A1. Routing strategies, numbering schemes, time and space switching, non-blocking arrays.

A2. Access and network signaling, Signaling System 7, Intelligent networks.

A3. Channel codes: including scrambling, Convolutional coding, and cyclic redundancy checks and interleaving.

A4. Modulation schemes: ASK, PSK, FSK, and GMSK.

A5. Optical fiber communications, dense wavelength division multiplexing (DWDM).

A6. ATM (asynchronous transfer mode): the transport mechanism for the broadband integrated services digital network (ISDN).

B. Cognitive skills:

After studying the course, the student will be able to:

- B1. Compare the merits of different approaches to fulfilling a digital communication requirement.
- B2. Make use of technical literature and mathematical modeling.
- B3. Understand the possibilities, the theoretical and practical limits and the compromises inherent in the design of digital communication systems.
- B4. Understand technical descriptions of present and future digital communication equipments, techniques, networks and services.
- B5. Use communication technology more efficiently.

C. Key skills:

After studying the course, the student will be able to:

- C1. Develop abilities to work with technical literature (Journal papers and articles).
- C2. Become more familiar with the way engineers use numbers (including estimations, approximations, and interpretation of probabilistic concepts).
- C3. See how simple algebraic and computer models can be used to gain a better insight into the behavior of engineered systems.
- C4. Develop your skills in the areas of written communication and improve own learning.

D. Practical and / or professional skills:

- D1. Information retrieval from the world-wide web.
- D2. Use of spreadsheet package to generate tables, line graphs and bar charts.
- D3. Use of simulation software tools to model behavior of communication systems.

Course Structure:

This course is divided into the following **three main blocks**:

Block 4: This block considers how signals are routed and switched to get them to the right destination

Block 5: This block examines in more detail how signals are adapted for transmission, through coding and modulation schemes.

Block 6: This block looks at optical fiber communications and the standards for broadband integrated services digital networks (asynchronous transfer mode, ATM). Throughout the course examples are drawn from both fixed and mobile communication networks.

Table of Contents:

Block 4: Systems and processes

Part 1: Routing and switching

- 1 Introduction
- 2 Routing
- 3 Switching
- 4 Summary

Block 4: Systems and processes

Part 2: Signaling

- 1 Introduction
- 2 Signaling system number 7
- 3 Intelligent networks
- 4 Summary

Block 5: Systems and processes

Part 1: Channel coding

- 1 Introduction
- 2 Differential coding and scrambling
- 3 Codes for error detection
- 4 Codes for error correction
- 5 Interleaving
- 6 Summary

Block 5: systems and processes

Part 2: modulation

- 1 Introduction

- 2 Baseband systems
- 3 Modulated systems
- 4 Multiplexing, multiple access and duplexing
- 5 Modulation in optical-fiber systems
- 6 Summary

Block 6: Systems and processes

Part 1: Optical-fiber communication

- 1 Introduction
- 2 Elements of an optical-fiber link
- 3 Optical components
- 4 Summary

Block 6: Systems and processes

Part 2: Multi-service networks

- 1 Introduction
- 2 Basic features of atm
- 3 The layered structure of atm
- 4 The three layers of atm
- 5 Traffic control
- 6 Atm switching

Assessment:

- Tutor-marked assignments: 2 TMAs
- Quiz/Mid-term Assessment: 1 MTA
- Final Exam: 1 Final Exam

Grade Distributions:

- Tutor-marked assignments: 35%
- Quiz/MTA: 15%
- Final Exam: 50%

Course Calendar (Indicative Version):

There are 2 Tutor Marked Assignments, 1 Midterm Assessment and 1 Final Exam associated with this course. Course result is determined on the basis of student's scores in TMAs, Midterm Assessment and the Final Exam. To be sure of passing the course, the student needs to score at least 40% (at least 20% in TMA and Quiz/MTA and at least 20% in the final exam) in the above 3 components and achieve an overall average score of 50%.

Study week	Block Companion	Systems and Processes texts	Modeling Activities	Assignment
				Assessments
1	Block 4: Finding your way across network	Routing		
2		Switching		
3			Traffic	
4		Signaling		
5	Block 5: Accessing network	Channel coding		
7			Pulses and systems	TMA1 due date
8		Modulation		Quiz / MTA
9				
10	Block 6: High capacity networks		Signal impairments	
12		Optical Fiber communications		
13				TMA2 due date
14		Multi-Service networks		
15				
16	Final Exam			