Program Content

Semester	IV	
Course Code:	IT4506	
Course Name:	Computer Networks	
Credit Value:	3 (3L)	
Core/Optional	Core	
Hourly Breakdown	Theory	Independent Learning
	45 hrs	105 hrs

Course Aim:

- The main objective of this course is to provide a broad understanding and describing the basic principles behind computer network designs and implementations.

Intended Learning Outcomes:

After following this course, students should be able to:

- Describe the functionality of IP networks with reference to TCP/IP model.
- Demonstrate the use of computer network principles in identifying suitable network parameters for a network solution.
- Explain the behaviour of a computer network by using computer network principles.
- Analyse a given scenario and identify issues based on computer network principles.

Course Content: (Main Topics, Sub topics)

Topic	Theory (Hrs)
1. Introduction to Computer Networks	5
2. Physical Layer	7
3. Data Link Layer and MAC sublayer	8
4. Network Layer	8
5. Transport Layer	7
6. Application Networking Services	3
7. Network Management	4
8. Software Defined Networks	3
Total	**45**

1. Introduction to Computer Networks (5 hours)

1.1. Uses of Computer Networks **[Ref: 01 - Section 1.1]**

1.1.1. Business Applications

1.1.2. Home Applications

1.1.3. Mobile Users

1.1.4. Social Issues

1.2. Computer Network Hardware and Software **[Ref: 01 - Section 1.2 and 1.3]**

1.2.1.Personal Area Networks
1.2.2.Local Area Networks
1.2.3.Metropolitan Area Networks
1.2.4.Wide Area Networks
1.2.5.Internetworks
1.2.6.Protocol Hierarchies
1.2.7.Design Issues for the Layers
1.2.8.Connection-Oriented Versus Connectionless Service
1.2.9.Service Primitives
1.2.10. The Relationship of Services to Protocols

1.3. Network Reference Models **[Ref: 01 - Section 1.4]**
1.3.1.The OSI Reference Model
1.3.2.The TCP/IP Reference Model
1.3.3.A five-layer reference model
1.3.4.A Comparison of the OSI and TCP/IP Reference Models
1.3.5.A Critique of the OSI Model and Protocols
1.3.6.A Critique of the TCP/IP Reference Model

1.4. Metric Units **[Ref: 01 - Section 1.7]**

2. Physical Layer (7 hours)

2.1. Transmission Media **[Ref: 01 - Section 2.1.3, 2.2 and 2.3]**
2.1.1.The Maximum Data Rate of a Channel
2.1.2.Guided Transmission Media
2.1.3.Wireless Transmission

2.2. Modulation and Multiplexing **[Ref: 01 - Section 2.5.3 and 2.5.4]**
2.2.1.Overview of Multiplexing [Section 2.5*‡]
2.2.2.Frequency Division Multiplexing
2.2.3.Time Division Multiplexing

2.3. Modems, ADSL and Fiber to Home **[Ref: 01 - Section 2.6.3]**

2.4. Circuit Switching and Packet Switching **[Ref: 01 - Section 2.6.5]**

3. Data Link Layer and MAC sublayer (8 hours)

3.1. Design Issues **[Ref: 01 - Section 3.1]**

3.2. Error Detection and Error Correction **[Ref 01: Section 3.2: Pg. (202-205) and Pg. (209-211)]**
3.2.1.Hamming distance
3.2.1.1. Relationship to error detection and correction
3.2.2.Hamming Code
3.2.3.Parity
3.2.4.Checksums

3.3. Elementary Data Link Protocols **[Ref: 01 - Section 3.3 and Pg. (226 - 229)]**
3.3.1.Utopian Simplex Protocol
3.3.2.Simplex Stop-and-Wait Protocol for an Error-Free Channel
3.3.3.Simplex Stop-and-Wait Protocol for a Noisy Channel
3.3.4.Overview of Sliding Window Protocols

3.4. Medium Access Control Sublayer
- 3.4.1. Overview of channel allocation problem [Section 4.1*‡]
- 3.4.2. Multiple Access Protocols **[Ref: 01 - Sections 4.2.2]**
  - 3.4.2.1. Overview of pure and slotted ALOHA [Section 4.2*‡]
  - 3.4.2.2. Carrier Sense Multiple Access Protocols
- 3.4.3. Ethernet **[Ref: 01 - Sections 4.3.2, 4.3.4, 4.3.5, 4.3.6, 4.3.7, and 4.3.8]**
- 3.4.4. Wireless LAN **[Ref: 01 - Sections 4.2.5, 4.4.1, 4.4.2, and 4.4.3]**
- 3.4.5. Data Link Layer Switching **[Ref: 01 - Sections 4.8]**

4. Network Layer (8 hours)

4.1. Internetworking **[Ref 01: Section 5.5]**

4.2. The Network Layer in the Internet **[Ref 01: Section 5.6 except 5.6.9]**
- 4.2.1. IP version 4
  - 4.2.1.1. Prefixes
  - 4.2.1.2. Subnets
  - 4.2.1.3. CIDR—Classless InterDomain Routing
  - 4.2.1.4. Classful and Special Addressing
  - 4.2.1.5. NAT—Network Address Translation
- 4.2.2. IP version 6
  - 4.2.2.1. Main Header
  - 4.2.2.2. Extension Headers
- 4.2.3. ICMP
- 4.2.4. ARP
- 4.2.5. DHCP
- 4.2.6. MPLS
- 4.2.7. OSPF
- 4.2.8. BGP
- 4.2.9. Internet Multicasting

5. Transport Layer (7 hours)

5.1. Transport Layer Services and Primitives **[Ref 01: Section 6.1.1 and 6.1.2]**

5.2. Internet Transport Protocols
- 5.2.1. User Datagram Protocol (UDP) **[Ref 01: Section 6.4]**
  - 5.2.1.1. Introduction to UDP
  - 5.2.1.2. Remote Procedure Call
  - 5.2.1.3. Real-Time Transport Protocols
- 5.2.2. Transmission Control Protocol (TCP) **[Ref 01: Section 6.5 except 6.5.9]**
  - 5.2.2.1. Introduction to TCP
  - 5.2.2.2. The TCP Service Model
  - 5.2.2.3. The TCP Protocol
  - 5.2.2.4. The TCP Segment Header
  - 5.2.2.5. TCP Connection Establishment
  - 5.2.2.6. TCP Connection Release
  - 5.2.2.7. TCP Connection Management Modeling

5.2.2.8. TCP Sliding Window
5.2.2.9. TCP Congestion Control

6. Application Networking Services (3 hours)

6.1. Domain Name System **[Ref 01: Section 7.1]**
6.1.1.The DNS Name Space
6.1.2.Domain Resource Records
6.1.3.Name Servers
6.2. Electronic Mail **[Ref 01: Section 7.2 except 7.2.3]**
6.2.1.Architecture and Services
6.2.2.The User Agent
6.2.3.SMTP (Simple Mail Transfer Protocol) and Extensions
6.2.4.IMAP—The Internet Message Access Protocol
6.3. World Wide Web **[Ref 01: Section 7.3: Pg. (646 - 662)]**
6.3.1.Architectural Overview

7. Network Management (4 hours)

7.1. Firewalls **[Ref 01: Section 8.6.2]**
7.2. Virtual Private Networks **[Ref 01: Section 8.6.3]**
7.3. Network Management Requirements **[Teacher's Note]**
7.3.1.Fault Management
7.3.2.Accounting Management
7.3.3.Configuration Management
7.3.4.Performance Management
7.3.5.Security Management
7.4. Simple Network Management Protocol (SNMP) **[Teacher's Note]**

8. Software Defined Networks (3 hours) [Teacher's Note]

8.1. Control and data planes
8.1.1.Traditional Switch Architecture
8.1.2.Evolution of Switches and Control Planes
8.1.2.1. Simple Forwarding and Routing Using Software
8.1.2.2. Hardware Forwarding and Control in Software
8.1.2.3. Moving Control Off of the Device
8.2. Overview of SDN architecture
8.2.1.Main Components
8.2.2.Introduction to OpenFlow
8.2.3.An example SDN use case - Data Center Orchestration

Teaching /Learning Methods:

You can access all learning materials and this syllabus in the VLE: http://vle.bit.lk/, if you are a registered student of the BIT degree program.

**‡ Teachers may extract and present an overview of the topic from the related sections in the recommended reference book to prepare the student for subsequent topics.*

Assessment Strategy:

Continuous Assessments/Assignments:
The assignments consist of two quizzes, assignment quiz 1 (It covers the first half of the syllabus) and assignment quiz 2 (It covers the second half of the syllabus). The maximum mark for a question is 10 and the minimum mark for a question is 0 (irrespective of negative scores). The final assignment mark is calculated considering both assignments. To pass the online assignment component, students will have to obtain at least 40% for each assignment. Students are advised to complete online assignments before the given deadline. It is compulsory to pass the online assignment component to qualify to obtain the Level II Higher Diploma in IT (HDIT) certificate.
In the course, case studies/Lab sheets will be introduced, and students have to participate in the learning activities.

Final Exam:
Final examination of the course will be held at the end of the semester. The course is evaluated using a two hour question paper which consists of 25 MCQ (1 hour) and 2 Structured Questions (1 hour).

References/ Reading Materials:

- **Ref 01.** Computer Networks by Andrew Tannenbaum, 5th edition, Pearson

  Note: This reference will be updated to Computer Networks by Andrew Tannenbaum, **6th edition** when this edition becomes widely available