

TKU212144

Fundamentals of Telecommunication

Telekomunikasi Dasar

BASIC INFORMATION

Course Credit	3 / 150 minutes per Week
Course Type	Required
Course Classification	Engineering Topics
Prerequisites	-

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Fundamental and Engineering Knowledge (KP.1)

Learning Outcomes

- LO1** Students can explain the basic properties of digital and analog communication systems.
- LO2** Students can explain the concept of modulation at the fundamental level.
- LO3** Students can explain the basic concept of telephony, wireline telephone systems, and television systems.
- LO4** The students are able to explain the basic concepts of radio and wireless communications.
- LO5** The students are able to explain the fundamental theory of data communication.
- LO6** Students are able to explain the basic characteristics of fiber optic and satellite communication systems.

COURSE DESCRIPTION

Fundamental of Telecommunication Courses introduce and learn basic concepts, working principles and telecommunications technologies which include: basic digital and analog communication systems, introduction to modulation concept, telephony and telephone communication systems, television systems, wireless and radio communications, data communications, fiber optic communications, satellite communications and cellular communications. Note: More details on Modulation Concept will be discussed in Communication System Course whereas more details on Analog to Digital Conversion will be discussed in Signal and System Course.

TOPICS

1. Introduction

- 1.1 Minimal Configuration of Communication Systems
- 1.2 Simplex and Duplex Communication
- 1.3 Information: Speech, Video, Data
- 1.4 Signal: Transducer, Analogue, Digital
- 1.5 Analog Communication, Data Communication, Digital Communication
- 1.6 The Concept of Time, Frequency, and Power
- 1.7 Duplexing
- 1.8 Frequency Domain Representation of Baseband Signal
- 1.9 Shifting of Frequency Band via Modulation: Bandpass Signal

2. Analog Modulation

- 2.1 Introduction to Modulation (including Why Modulation is Needed)
- 2.2 Amplitude Modulation (DSBFC, DSBSC, SSB)
- 2.3 AM Demodulation and Limit of Modulation Index
- 2.4 FM with Single Tone Modulating Signal (Description, Equation, Spectrum, Demodulation, Limit of Modulation Index)

3. Transition towards Digital Communication

- 3.1 Elements of Communication System
- 3.2 Targets, Problems, Obstacles, and Limitation of Resources
- 3.3 Advantage and Disadvantage of Digital Communication
- 3.4 Capacity, Nyquist Rate, and Shannon Theorem
- 3.5 Data Integrity (Bit Error Rate)
- 3.6 Analog to Digital Conversion
- 3.7 Introduction to Digital Modulation (more detail in Communication System Course)

Note: With regards to Digital to Analog Conversion, detailed theoretical explanation about Sampling Process, the emergence of Replica in the frequency domain its analysis using the DTFT Concept is covered in Signal and System Course.

4. Telephony

4.1 Telephone, Pulse Dialling, and Dual Tone Multi Frequency

4.2 Local Exchange

4.3 Switching and Local Signalling

4.4 PABX

4.5 PSTN

4.6 Digital Telephony

5. Radio Communication

5.1 Electromagnetic Wave: General Properties and Propagation Characteristic

5.2 Antenna: Basic Operation, Properties, and Installation

5.3 Elements of Radio System

6. Television System

6.1 Scanning and Image

6.2 BWTV, CTV

6.3 Digital Television

7. Data Communication

7.1 Data Communication Principles: Segmentation and Reassembling, Synchronous and Asynchronous Communication, Data Integrity and Accuracy

7.2 Protocol Concepts and Protocol Layers (Protocol Philosophy, OSI Model, and Other Data Communication Model)

7.3. Inter-Layer Communication and Peer-to-Peer Communication

8. Networking Aspect

8.1 Transmission

8.2 Multiple Access

8.3 Transport Network, Signalling, and Management

8.4 Circuit Switching, Message Switching, and Packet Switching

8.5 Connection Oriented and Connectionless

8.6 Switching and Routing

8.7 Network Topology

9. Optical Fiber Communication System (OFCS)

9.1 OFCS Configuration

9.2 Source and Detector

9.3 Optical Fiber: Structure, Dispersion, Propagation Mode, Bending

9.4 Application

10. Satellite Communication

10.1 Orbit and Positioning

10.2 Earth/Ground Station

10.3 Transponder

10.4 Components of Satellite Communication System

10.5 Frequency Allocation and Multiple Access

11. Wireless and Cellular Communication

11.1 Cellular Communication Principle

11.2 Handover and Roaming

11.3 Absolute Radio Frequency Channel Number (ARFCN)

11.4 Relationship between Mobile Station and Base Station: Duplexing and Multiple Access

- 11.5 Channelization
- 11.6 The shape of the Cell
- 11.7 Interference
- 11.8 Frequency Reuse
- 11.9 Power Control
- 11.10 Introduction to Path Loss, Shadowing, and Multipath Fading
- 11.11 Cell Coverage
- 11.12 Development of Cellular Technology

REFERENCES

- [1] Setiyanto, B., Dasar-Dasar Telekomunikasi, Penerbit Sakti, Yogyakarta, 2010.
- [2] Rappaport, Theodore S., Wireless Communications Principles and Practice, 2nd Edition, Prentice Hall PTR, New Jersey, 1996.
- [3] Couch, L. W, Digital and Analog Communication Systems, Leon W. Couch, II, 8th Edition, Pearson Education Inc, 2013.
- [4] Frenzel, Louis E. Principles of Electronic Communication Systems, 2002.
- [5] Haykin, S., M. Moher, Modern Wireless Communications, Pearson Prentice Hall, New Jersey, 2005.
- [6] Freeman, R.L, Fundamental of Telecommunications, 2nd edition, John Wiley and Sons, 2005.