

EE3008: PRINCIPLES OF COMMUNICATIONS

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Principles of Communications

Subject Code

EE - Electrical Engineering

Course Number

3008

Academic Unit

Electrical Engineering (EE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

MA2001 Multi-variable Calculus and Linear Algebra

Precursors

Nil

Equivalent Courses

EE4940

Exclusive Courses

Nil

Additional Information

Co-requisites: EE3210 Signals and Systems

Part II Course Details

Abstract

The course aims to introduce the principles of point-to-point communication. The objective is intended for the students to understand various modulation schemes for analogue- and digital-signal transmission, and to analyse their performance in terms of signal-to-noise ratio, bandwidth requirement, and error performance.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Evaluate analogue AM systems in both the time and frequency domains.		x	x	
2	Describe the FM system in terms of its working principle and implementation. Evaluate a single-tone FM signal in terms of its spectrum lines, bandwidth, and modulation index.		x	x	
3	Explain the working principle of PCM and PAM systems in analogue-to-digital signal conversion, and evaluate their performance in terms of quantization level to SQNR, signal bandwidth, and system data rate.		x	x	
4	Evaluate coherent BPSK, BFSK and QPSK schemes in terms of signal constellation, system bandwidth, and bit error performance.		x	x	
5	Identify different types of transmission media.		x	x	

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Lecture	Key concepts are described and illustrated. Key concepts are worked out based on problems.	1, 2, 3, 4, 5	3 hrs/wk

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3, 4, 5	40	
2	#Assignments (min.: 3)	1, 2, 3, 4, 5	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remark: To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)**Assessment Task**

Examination

Criterion

Achievements in CILOs

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Coursework

Criterion

Achievements in CILOs

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information

Keyword SyllabusSpectrum Analysis

Fourier transform; bandwidth requirement; basic frequency properties of digital signals.

Digital Baseband Transmission for Analogue SignalFormatting analogue information : sampling process, aliasing; pulse amplitude modulation and time division multiplexing; waveform representation of binary digits; Amplitude quantization : quantization noise, uniform and non-uniform quantizing; pulse code modulation (PCM), μ -law companding; Differential PCM.Analog Modulation-AM

Amplitude modulation (AM) : generation and detection, signal to noise ratio; modulation index; spectral analysis; system bandwidth requirement; single-sideband modulation.

Analog Modulation-FM

Frequency Modulation (FM) : narrowband and wideband FM, FM signal generation; spectral analysis of single-tone FM signals; average power and bandwidth; FM receivers.

Digital Modulation/Demodulation

Phase shift keying, frequency shift keying: generation, differential encoding, coherent & non-coherent detection, error performance in an additive Gaussian channel, bandwidth requirement.

Transmission Media

Metallic cable: data rate and bandwidth limitation;

Optical fibre: light propagation, optical sources and detectors;

Satellite: orbit & subsystems, multiple access techniques;

Wireless Network: cellular phone, wireless LAN.

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	H. Stern and S. Mahmoud, Communication Systems Analysis and Design, (Pearson Prentice Hall 2004)
2	S Haykin: Communication Systems, (John Wiley & Sons, 4th Edition, 2001)
3	F G Stremmler: Introduction to Communication Systems, (Addison-Wesley, 3rd Edition, 1990)
4	B Sklar: Digital Communications, Fundamentals and Applications, (Prentice-Hall, 2nd edition 2001)