

“ Digital Communications” Course Definition Form

1. Basic Information:

Course Name	Digital Communications
Course ID	CEE308
Contact Hours (Registered Sessions)	30
Contact Hours (Synchronized Sessions)	18
Mid Term Exam	There is not
Exam	1.5
Registered Sessions Work Load	30
Synchronized Session Work Load	18
Credit Hours	5

2. Pre-Requisites:

Course	ID
Matlab for Numerical Computing	CML201
Analog Communications	CEE306
Digital Signal Processing	CEE205

3. Course General Objectives:

This course aims to enable students to understand the basics of "Digital Communications" and "Information and Communication Theory". This will be performed by:

- The use of Probability Theory in the computation of system performance and detection theory
- Understanding Base Band and Pass Band modulations (As in Wire Communications and Radio Communications) and demodulation methods.
- Understanding noise and its effect on system performance.
- Understanding Key Trade-Offs in Communications: (Modulation and Coding Trade-Off, Spectrum and Power efficiencies Trade-Off).
- Channel Coding for Error Detection and Correction.
- General evaluation of communication system.

This Course is tightly related to other courses like: Analog Communications, Signal and Systems, Digital Signal Processing and constitutes a basic introductory to some other courses in higher levels. The course "Matlab for numerical computing is necessary for Practical Works.

4. Intended Learning Outcomes (ILO):

Code	Intended Learning Outcomes
ILO1	Understanding the basics of Probability Theory and its applications in Digital Communication and detection theory.
ILO2	Understanding Principles of Digital Communications and its trade-offs in the Base Band and Pass Band modulations (As in Wire Communications and Radio Communications) and demodulation methods.
ILO3	Understanding demodulation principles and methods and Comparing the performances and the trade-offs.
ILO4	Understanding the trade-offs between spectrum efficiency and power efficiency.
ILO5	Identifying noise and its effect on signal detection and system performance
ILO6	Understanding error detection and correction principles and their effect on system performance.
ILO7	Learning Channel Coding fundamentals and Trade-Off between modulation and Coding

5. Course Syllabus (18 hours of total synchronized sessions):

- **RS**: Recorded Sessions; **SS**: Synchronized Sessions;

ILO	Course Syllabus	RS	SS	Type	Additional Notes
ILO1	Introduction of Digital communication. Communications systems. Frequency allocations. Information measurement Channel Capacity Coding and Codes efficiency.	3	1.5	√ Exercises √ Assignments Seminars Projects Practices Others	
ILO1	Probability and Random Processes Probability Probability density and distribution functions. Expectation and moments. Important distributions. Random processes. Power Spectral Density.	4.5	3	Exercises Assignments Seminars Projects Practices Others	Matlab workouts
ILO2 ILO3	Base Band Modulation Pulse modulations Pulse code modulation PCM Line Coding. Differential Coding and Linear Prediction Coding.	4.5	3	Exercises Assignments Seminars Projects Practices Others	Matlab workouts
ILO2 ILO3	Pass Band Modulation Recalling Analog Modulation Base Band Modulation for Binary Signals: OOK, BPSK, DPSK, FSK.	6	3	Exercises Assignments Seminars Projects Practices Others	Matlab workouts

	Multi-level Modulation: QPSK, MPSK, QAM. Orthogonal Frequency Division Multiplexing.				
ILO3 ILO4 ILO5 ILO6	Communication system performance in presence of noise Error probability. Eye pattern and Intersymbol interference. Spectrum efficiency. Matched filter. Coherent detection Non-coherent detection.	6	3	Exercises Assignments Seminars Projects Practices Others	Matlab workouts
ILO6 ILO7	Channel Coding and Error Correction. Linear Block Coding. Convolutional Codes. Reed Solomon Codes. Interleaving Codes. Turbo Codes. Modulation and Coding Trade-Offs.	6	4.5	Exercises Assignments Seminars Projects Practices Others	Matlab workouts

6. Assessment Criteria (Related to ILOs):

ISC	Interactive Synchronized Collaboration	Ex	Exams	Rpt	Reports
PF2F	Presentations and Face-to-Face Assessments	PW	Practice Work		

ILO Code	ILO	Intended Results	Assessment Type				
			ISC	PW	Ex	PF2F	Rpt
ILO1	Understanding the basics of Probability Theory and its applications in Digital Communication and detection theory.		X		X		
ILO2	Understanding Principles of Digital Communications and its trade-offs in the Base Band and Pass Band modulations (As in Wire Communications and Radio Communications) and demodulation methods.		X	X	X		
ILO3	Understanding demodulation principles and methods and Comparing the performances and the trade-offs.		X	X	X		
ILO4	Understanding the trade-offs between spectrum efficiency and power efficiency.		X	X	X		
ILO5	Identifying noise and its effect on signal detection and system		X	X	X		

	performance						
ILO6	Understanding error detection and correction principles and their effect on system performance.		X	X	X		
ILO7	Learning Channel Coding fundamentals and Trade-Off between modulation and Coding		X	X	X		

7. Practice Tools:

Tool Name	Description
MATLAB	An important computation tool enabling students to develop their practical skills and understanding the concepts in the course, in addition to modulation and demodulation methods and performance evaluation.

8. Main References:

1. 'Digital and Analog Communication Systems', 8th edition, by Leon W. COUSH II, Pearson Education International, 2013
2. 'Introduction to Analog and Digital Communications', 2nd edition, by Simon Haykin and Michael Moher, John Wiley & Sons, 2007
3. 'Communication Systems', 5th edition, by A. Bruce Carlson, Paul Crilly, McGraw-Hill, 2009
4. 'Digital Communications: Fundamentals and Applications', 2nd edition, by, Bernard SKLAR, Prentice Hall P T R, 2001

9. Additional References:

--