EC422- Introduction to Digital Communications

CREDIT HOURS

3 Hours

CONTACT HOURS (Hours/week)

Lecture: 2; Tutorial: 2; Lab: 2

COURSE COORDINATOR

Dr. Ashraf Mamdouh

TEXT BOOK

- A. Bruce Carlson "Communication Systems" McGraw –Hill, 5th Edition

COURSE DESCRIPTION

Bandpass data transmission - Gram Schmidt orthogonalization procedure, Geometric representation of signals in signal space - Noise effect in signal space, Decision regions and related probability of error - binary modulation techniques (CB-ASK, CB-FSK, CB-PSK) - Optimum FSK, MSK , Non-Coherent Detection, NC-FSK – DPSK

PREREQUISITE:

EC 421

RELATION OF COURSE TO PROGRAM

Required

COURSE INSTRUCTION OUTCOMES

The student will be able to:

- Be familiar with a different pass-band digital modulation systems taking the effect of noise into consideration
- identify the probability of error, bit error rate, spectral properties.
- Design and Realize the transmitter and receiver of a specific digital communication system.

TOPICS COVERED

- Introduction to Pass band Modulation Techniques, Tx and Rx system, Signal Space (SS) techniques. Orthogonal bases functions. Geometric representation of signals.
- Distance, Correlation, Orthogonality. Relation to matched filter theory. Gram-Schmidt orthogonalization procedure.
- Decision rules, Decision boundaries, Decision regions. MAP and ML estimation. Bank of matched filters receivers. Probability of error calculations in presence of AWGN.
- Basic Bandpass modulation techniques, ASK, BPSK, and BFSK. SS representation. Time and frequency expressions.
- Coherent detection of ASK, OOK, BPSK, BFSK signals in presence of noise.
- BPSK, BFSK generation and detection

- Power Spectral Density (PSD) and Spectral efficiencies for ASK, BPSk, BFSK
- QPSK: SS-PSD-Spectral Effiency, Generation of QPSK. OQPSK and π/4 QPSK
- Optimum FSK, MSK: Analysis, relation to OQPSK, generation, detection. GMSK
- M-ary Modulation Techniques: M-ary ASK, M-ary PSK
- M-ary Modulation Techniques: M-ary FSK, QAM
- Union Bound. Error performance of M-ary modulation.
- Non-Coherent Detection. Rayleigh and Rice distributions. Optimum NC detection. NC Matched filter.
- NC-FSK – DPSK generation, detection and Error performance
- Comparison of digital modulation techniques.

CONTRIBUTION OF COURSE TO MEET THE REQUIREMENTS OF CRITERION 5:

Professional component Content			
Math and Basic Sciences	**Engineering Topics**	**General Education**	**Other**
	✓		

RELATIONSHIP OF COURSE TO STUDENT OUTCOMES:

Student Outcomes		Course aspects
A	An ability to apply knowledge of mathematics, science, and engineering	a_1 a_2
B	An ability to design and conduct experiments, analyze and interpret data.	b_1 b_2 b_3 b_4
C	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability	
D	An ability to function on multi-disciplinary teams.	
E	An ability to identify, formulate, and solve engineering problems	e_1 e_2 e_3
F	An understanding of professional and ethical responsibility	
G	An ability to communicate effectively	g_1 g_2 g_3
H	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social content	
I	A recognition of the need for, and an ability to engage in life-long learning.	
J	A knowledge of contemporary issues within and outside the electrical engineering profession.	
k	An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	k