Course Specifications

Program(s) on which this course is given:	Electronics & Electrical Communications Engineering
Major or Minor element of programs:	Major
Department offering the program:	Electronics & Electrical Communications
Department offering the course:	Electronics & Electrical Communications
Academic year / Level:	Third
Date of original/modified specification approval:	2003
Semester of course offering:	Second Semester

A- Basic Information

1.a. Title:	Communications(1b)			**1.b. Code:**	ELC 306 B			
2. Units/Credit hours per week:	2.a. Lectures	3	2.b. Tutorial	1	2.c. Practical	0	2.d. Total	4

B- Professional Information

1. Overall Aims of the Course:	The course is intended for junior students to be able to understand, model, design, basic digital communication systems.
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	1. Describe mathematically a random process (1.7). 2. Identify the advantages of digital communications when compared to analog communications (1.2, 1.7). 3. Identify the different kinds of line codes and their properties (1.2, 1.7). 4. Identify the major sources of error in digital communications, namely, noise and ISI (1.2, 1.7). 5. Describe the Nyquist criterion for zero ISI (1.7). 6. Describe the signal-space concept (1.2, 1.7). 7. Describe the MAP and ML decision rules for optimal reception (1.2, 1.7). 8. Identify and compare between the different types of pass-band digital modulation schemes, namely ASK, PSK and FSK from the point of view of performance and BW efficiency (1.7). 9. Identify and work with a range of programming languages and environments (1.6).
	b) Intellectual Skills
	1. Calculate the probability of error for digital communications receivers (3.1, 3.4). 2. Apply the Nyquist criterion for zero ISI (3.4). 3. Apply the Gram-Schmidt Orthogonalization procedure (3.4). 4. Apply the MAP and ML decision rules for optimal reception (3.4).
	c) Professional and Practical Skills
	1. Design matched filters for any pulse shape (2.1). 2. Use the union bound to approximately calculate the probability of error (2.1, 2.6).
	d) General and Transferable Skills
	1. Use MATLAB to simulate the performance of digital communications systems (4.1, 4.2, 4.6, 4.8).

3. Contents

Topic	Total hours	Lectures	Tutorial/ Practical
• Introduction • Review of probability theory	2	2	0

• Random process o Examples of RP o Ensemble statistics o Specification of a RP o ACF of a RP o Stationarity of a RP o WSS RP o Ergodicity of a RP o PSD of RP o Multiple PRs o PSD of RP o Examples	16	12	4
• Baseband Pulse transmission o Matched filters ▪ Proof of the optimum receiver ▪ Properties of MF ▪ Examples ▪ Equivalence of correlation and MF ▪ Error rate due to noise o Intersymbol Interference ISI ▪ Nyquist criterion for no ISI ▪ Ideal Nyquist channel ▪ Raised cosine spectrum ▪ Design of an optimum, ISI free comm. Systems (the square root raised cosine filters)	12	10	2
• Signal space analysis o Geometric representation of signals o Gaussian process o Conversion of the continuous AWGN channel into vector channel o Coherent detection of signals in noise: the ML decoder o Minimum energy signals o Invariance of the prob of error to rotation and translation	12	8	4
• Passband data transmission o Hierarchy of digital modulation techniques o Passband transmission model o Modulation techniques (signals space representation and prob of error calculation) o BPSK o Union bound on the prob of error o QPSK o M-ary PSK o PAM o QAM Square constellations	14	10	4

o QAM cross constellations o Modulation techniques (signals space representation and prob. of error calculation) o Coherent FSK o Bandwidth efficiency of M-ary digital communication systems. o Detection of Signals with unknown phase. o Non coherent orthogonal demodulation. o Non coherent demodulation of FSK and DPSK. o Comparison of passband digital modulation schemes.			
Total	56	42	14

4. Teaching and Learning Methods	Lectures (Y)	Practical Training/ Laboratory (Y) in ELC 304	Seminar/Workshop(N)
	Class Activity (Y)	Case Study (N)	Projects (Y)
	E-learning (Y)	Assignments /Homework (Y)	Other:

5. Student Assessment Methods	
5.a. Method	**To assess (with reference to the ILOs)**
- Mid-term exam	a1, a2, a3, a4, a5, b2, c1.
- Reports	a3, b2, d1
- Final Exam	a1, a2, a3, a4, a5, a6, a7, a8, a9, b1, b2, b3, b4, c1, c2
5.b. Assessment Schedule	**Week**
- Assessment 1; Mid-term exam	8
- Assessment 2; Reports	6, 8, 12
- Assessment 3; Final Exam	15
5.c. Weighting of Assessments	
- Mid-Term Examination	20%
- Final-term Examination	70%
- Reports	10%
- Total	100 %

6. List of References
6.a. Course Notes
6.b. Essential Books (Text Books)
•“Communication Systems,” Simon Haykin •“Modern Digital and Analog communication Systems,” B.P. Lathi
6.c.Recommended Books.
N/A
6.d. Periodicals, Web Sites, … etc: N/A

7. Facilities Required for Teaching and Learning	
• Basic classroom teaching facilities. (Mics, board, data show…)	
Course Coordinator:	Dr. Mohamed Khairy
Head of Department:	Prof. Dr. Mahmoud El-Hadidi
Date:	**June 2011**