37. Course Specification of Digital Communications

I. Course Identification and General Information:

1.	Course Title:	Digital Communications				
2.	Course Code & Number:	CNE323				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr	Tr.	
		2	2	2	-	4
4.	Study level/ semester at which this course is offered:	Fourth Year/ First Semester				
5.	Pre –requisite (if any):	Probability and Statistics for Engineers (BR131), Signals and Systems (CNE216), Communication Principles (CNE221)				
6.	Co –requisite (if any):	Digital Signal Processing (CNE317)				
7.	Program (s) in which the course is offered:	Communication Engineering and Networks				
8.	Language of teaching the course:	English				
9.	Location of teaching the course:	Electrical Engineering Department				
10.	Prepared By:	Asst. Prof. Dr. Ali Nagi Nosary				
11.	Date of Approval					

II. Course Description:

This course presents an introduction to the basic principles of digital communication systems, a digital communication system is one that transmits a source information (voice, video, data, etc.) from one point to another, by first converting it into a stream of bits, and then into symbols that can be transmitted over channels (cable, wireless, storage, etc.). The course gives an overview of the design of digital communication systems, and explains the mathematical foundation of decomposing the systems into separately designed source codes and channel codes. It introduces the principles and commonly used algorithms in each stage of a digital communication system including encoding, multiplexing, modulation, and errors detection techniques.

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	III. Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a1	Understand the basic concepts of digital communication systems regarding design stages, functions, and applications.	A2
a2	Perform standard calculations regarding digital modulation and error detection.	A2
b1	Analyze and compare various choices of digital modulation methods and coding methods in terms of error probabilities, minimum distances, throughput, and related concept.	B1
b2	Select appropriate methods for solving error detection problems depending on the given conditions and requirements.	B2
c1	Use basic signal processing devices and software simulators to generate signals and apply different types of digital processing to the signal to show the properties and outcome of each type.	C2, C5
d1	Use learned digital communication systems principles as a base to develop a good understanding of modern telecommunication engineering techniques and applications.	D5

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Understand the basic concepts of digital communication systems regarding design stages, functions, and applications.	▪ Lectures ▪ Cooperative Learning ▪ Experiential Learning ▪ Class Discussion	▪ Quizzes, ▪ Homework, ▪ Project, ▪ Practical test, ▪ Mid and Final Exams
a2- Perform standard calculations regarding digital modulation and error detection.	▪ Lectures ▪ Cooperative Learning ▪ Experiential Learning ▪ Class Discussion	▪ Quizzes, ▪ Homework, ▪ Project, ▪ Practical test, ▪ Mid and Final Exams

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(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Analyze and compare various choices of digital modulation methods and coding methods in terms of error probabilities, minimum distances, throughput, and related concept.	▪ Lectures ▪ Cooperative Learning ▪ Experiential Learning ▪ Class Discussion	▪ Quizzes, ▪ Homework, ▪ Project, ▪ Practical test, ▪ Mid and Final Exams
b2- Select appropriate methods for solving error detection problems depending on the given conditions and requirements.	▪ Lectures ▪ Cooperative Learning ▪ Experiential Learning ▪ Class Discussion	▪ Quizzes, ▪ Homework, ▪ Mid and Final Exams

© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Use basic signal processing devices and software simulators to generate and signals and apply different types of digital processing to the signal to show the properties and outcome of each type.	▪ Cooperative Learning ▪ Experiential Learning ▪ Class Discussion	▪ Project, ▪ Practical test

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Use learned digital communication systems principles as the base to develop a	▪ Cooperative Learning ▪ Research	▪ Project

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good understanding of modern telecommunication engineering techniques and applications.		

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction	a1, a2, b1, b2, d1	▪ An overview on Communication Systems. ▪ Digital Communication Systems. ▪ Classification of Signals, Spectral Density and Autocorrelation. ▪ Random Signals. ▪ Signal Transmission Through Linear Systems. ▪ Bandwidth of Digital Data.	2	4
2.	Formatting and transmission of baseband signal	a1, a2, b1, b2, d1	▪ Baseband Systems. ▪ Formatting Textual Data (Character Coding). ▪ Messages, Characters, and Symbols.	3	6

			▪ Formatting Analog Information. ▪ Sources of Corruption ▪ Pulse Code Modulation (PCM). ▪ Uniform and Nonuniform Quantization. ▪ Baseband modulation.		
3.	Baseband demodulation/Detection	a1, a2, b1, b2, d1	▪ Receiver structure. ▪ Detection of Binary signal in GN. ▪ Vector representation of signals (signal space). ▪ Intersymbol Interference ▪ Equalization.	2	4
4.	Bandpass modulation/demodulation	a1, a2, b1, b2, d1	▪ Why Modulate? ▪ Digital Bandpass Modulation Techniques ▪ Detection of Signals in Gaussian Noise ▪ Coherent Detection ▪ Noncoherent Detection ▪ Error Performance for Binary Systems ▪ M-ary Signaling and Performance	2.5	5

			▪ Symbol Error Performance for M-ary Systems ▪ Summary of Digital modulations techniques		
5.	Spread Spectrum Techniques	a1, a2, b1, b2, d1	▪ Spread-Spectrum Overview ▪ Pseudonoise Sequences ▪ Direct-Sequence Spread-Spectrum Systems ▪ Frequency Hopping Systems ▪ Multiple access: FDMA, TDMA and CDMA ▪ CODING	2.5	5
6.	Channel Coding	a1, a2, b1, b2, d1	▪ Waveform Coding and Structured Sequences ▪ Types of Error Control ▪ Structured Sequences ▪ Linear Block Codes ▪ Error-Detecting and Correcting Capability	2	4

Number of Weeks /and Units Per Semester	**14**	**28**

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B - Tutorial Aspect:				
Order	**Tasks/ Experiments**	**Number of Weeks**	**Contact hours**	**Learning Outcomes**
1.	Introduction	1	2	a1, a2, b1, b2, d1
2.	Classification of Signals, Spectral Density and Autocorrelation.	2	4	a1, a2, b1, b2, d1
3.	Formatting and transmission of baseband signal	3	6	a1, a2, b1, b2, d1
4.	Baseband demodulation/Detection	2	4	a1, a2, b1, b2, d1
5.	Bandpass modulation/demodulation	2	4	a1, a2, b1, b2, d1
6.	Spread Spectrum Techniques	2	4	a1, a2, b1, b2, d1
7.	Channel Coding	2	4	a1, a2, b1, b2, d1
Number of Weeks /and Units Per Semester		**14**	**28**	

C - Practical Aspect:				
Order	**Tasks/ Experiments**	**Number of Weeks**	**Contact hours**	**Learning Outcomes**
1.	PAM 1	1	2	a1, a2, b1, c1
2.	PAM 2	1	2	a1, a2, b1, c1
3.	PA Demodulation	1	2	a1, a2, b1, c1
4.	PCM using Quantization	1	2	a1, a2, b1, c1
5.	PCM using DPCM	1	2	a1, a2, b1, c1
6.	PC Demodulation using Quantization	1	2	a1, a2, b1, c1
7.	PC Demodulation using DPCM	1	2	a1, a2, b1, c1
8.	Revision	1	2	a1, a2, b1, c1
9.	Reports submission	1	2	-

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10.	Practical test	1	2	-
Number of Weeks /and Units Per Semester		**10**	**20**	

V. Teaching strategies of the course:

- Lectures
- Cooperative Learning
- Experiential Learning
- Class Discussion
- Research

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Problems Sheet #1	a1, a2, b1, b2	2	2
2.	Problems Sheet #2	a1, a2, b1, b2	4	2
3.	Problems Sheet #3	a1, a2, b1, b2	6	2
4.	Problems Sheet #4	a1, a2, b1, b2	8	2
5.	Problems Sheet #5	a1, a2, b1, b2	10	2
6.	Project (Report, Simulation, Presentation)	a1, a2, b1, b2,c1, d1	12	20
	Total			**30**

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Quiz #1	5th	5	2.5%	a1, a2, b1, b2
2.	Midterm Exam	8th	20	10%	a1, a2, b1, b2
3.	Quiz #2	10th	5	2.5%	a1, a2, b1, b2
4.	Homework (Problems sheets)	10th	10	5%	a1, a2, b1, b2
5.	Practical Reports and Test	11th	20	10%	a1, b1, c1

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6.	Project	12th	20	10%	a1, a2, b1, b2, c1, d1
7.	Final Exam	16th	120	60%	a1, a2, b1, b2
	Total		**200**	**100%**	

VIII. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).	
	1 -Bernard Sklar -1988 - Digital Communications: Fundamentals and Applications, Second Edition, Prentice Hall PTR, Upper Saddle River, New Jersey, U
2- Essential References.	
	1 -A. Bruce Carlson and Paul B. Crilly - 1968 - Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Kogakusha Mcgraw 2- Lan Glover and Peter Grant - 2000 - Digital Communications, Pearson.
3- Electronic Materials and Web Sites *etc*.	
	1 -MatLab (software).

IX. Course Policies:

1.	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic
2.	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-
4.	**Assignments & Projects:** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-
5.	**Cheating:**

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	For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-
6.	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Asst. Prof. Dr. Nasser H. Almofari**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

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