**The University of Texas at Tyler**
**Department of Electrical Engineering**

# EENG 4312– Communications Theory (Required)

## Syllabus

Catalog Description:

Signals, Systems, and modulation techniques, effects of noise in communications system, signal to noise ratio, digital data transmission, probability of error.

Prerequisites: EENG 4311, Co-requisite MATH 3351

Credits: ( 3 hours lecture, 0 hours laboratory per week )

Text(s): Communication Systems Engineering by John G. Proakis, Masoud Salehi, 2nd Edition, Prentice Hall, ISBN-13: 9780130617934

Additional Material: Lecture Handouts

Course Coordinator: Jounsup Park, PhD

Topics Covered: (paragraph of topics separated by semicolons)

Amplitude Modulation; Frequency modulation; Information Theory; Digital Communications

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report / Paper
4. Computer Programming
5. Project / Model
6. Presentation
7. Course Participation

Course Learning Objectives[1]: By the end of this course students will be able to:

1. Compute symbol information, information transmission rate, channel [1]
2. Select mixer filter combinations that will upshift and down shift spectra to desired specifications.[1]
3. Apply Fourier analysis to characterize communication Signals [4]
4. Design communication filter or circuit test it using simulation software [4]
5. Use simulation software to solve problems in time and frequency domain for communication systems[4]
6. Analyze and predict bandwidth and power distribution properties for amplitude modulation systems AM ( with carrier, suppressed carrier, single side band, vestigial sideband )[1,4]
7. Analyze and predict bandwidth and power distribution properties for angle modulation systems phase modulation, frequency modulation[1,4]
8. Explain operation for AM circuits, modulation schemes, demodulation schemes, envelope detectors[1]
9. Explain operation of FM circuits, modulation schemes, demodulation schemes, limiters [1]
10. Explain operation of phase lock loops and solve examples taken from applications in communication [1]
11. Explain advantages and disadvantages of super-heterodyne receivers and be able to solve for the local oscillator frequency and potentially interfering image frequencies[1]

12. Compute signal to noise power rations for AM and FM systems[1]
13. Compute parameters for quantization, and transmission bandwidth for analog to a pulse code modulation process, also TDM, digital data transmission[1]
14. Predict bit error probabilities in presence of additive white Gaussian noise [1]
15. Demonstrate knowledge of terminology, concepts, FCC rules to provide basis to communicate effectively with others in the technical community[1]
16. Find article from IEEE Spectrum, or other source that has relevance. Describe in short essay to describe this items.[3]
17. Write short one page report on role and provide short description for a communications on the role impact of on the role and impact of engineering on Society based on instructor supplied article [3,6]

*[1]Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Student Outcomes (only items in dark print apply)[2]: This course supports the following Electrical Engineering Student Outcomes, which state that our students will possess:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics; [1, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14]
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors; [2, 4]
3. an ability to communicate effectively with a range of audiences;
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts; [16, 17]
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions; [5]
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. [15]

*[2]Numbers in brackets refer to course objective(s) that address the Program Outcome.*

Contribution to Meeting Professional Component: (in semester hours)

| | | |
|---|---|---|
| Mathematics and Basic Sciences: | 0 | hours |
| Engineering Sciences and Design: | 3.0 | hours |
| General Education Component: | 0 | hours |

| | | | |
|---|---|---|---|
| Prepared By: | Ron J. Pieper | Date: | Aug 17, 2012 |
| Modified By: | Hector A. Ochoa | | June 3, 2013 |
| | Hector A. Ochoa | | Aug 18, 2014 |
| | Ron J. Pieper | | Aug 20, 2015 |
| | Seyed Ghorshi | | Aug 20, 2016 |
| | Jounsup Park | | Aug 24, 2019 |
| | | | May 28, 2020 |
| | | | Aug 20, 2020 |

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# EENG 4312 Communications Theory (Fall 2020)

## Course Outline

**Description:** The goal of this course is to provide students an understanding of fundamentals of communication systems. The course will help students to develop analytical and design skills through the lectures about communication systems, channel, modulation, demodulation, and random process. The students will practice designing communication systems through assignments. At the end of the course, the students will be able to use appropriate method and tools to design communication systems achieving specific design goals.

**Prerequisites:** EENG4311, Co-requisite MATH3351

**Credits:** (3hours lecture, 0hours laboratory per week )

**Text(s):** Communication Systems Engineering by John G. Proakis, Masoud Salehi, 2nd Edition, Prentice Hall, ISBN-13: 9780130617934

**Additional Material:** Lecture Handouts will be uploaded on CANVAS before the lecture

**Instructor:** Jounsup Park, PhD (Office: RBN 2013, Email: jpark@uttyler.edu)

**Class :** Mon, Wed, and Fri 10 :10am~11 :05am

**Office hour :** by appointment via Zoom

**Course website :** CANVAS

**Evaluation Methods:** Homeworks: 20%, Midterm Exam: 40%, Final Exam: 40%
Homeworks : Homework problems will be uploaded on CANVAS and students will need to upload their answer on CANVAS by the due date (11:59pm). Late submissions will not be accepted.
Midterm: A total worth of 40% of the final mark will be given to midterm.
Final Examination: The final examination carries weight of 40%. The final examination will take place during the regular examination period.

**Tentative Schedule :**

| week | Mon | Wed | Fri | Contents |
|---|---|---|---|---|
| 1 | Aug 24<br>First day | 26 | 28 | Introduction of Communication Systems |
| 2 | 31 | Sep 2 | 4 | Review of Signals and Systems |
| 3 | 7<br>No class | 9 | 11 | Fourier Series |
| 4 | 14 | 16 | 18 | Fourier Transform |
| 5 | 21 | 23 | 25 | Power and Energy |

| | | | | |
|---|---|---|---|---|
| 6 | 28 | 30 | Oct 2 | Communication Channel |
| 7 | 5 | 7 | 9 | AM DSB-SC |
| 8 | 12 | 14 | 16 | AM DSB-TC |
| 9 | 19 | 21 | 23 | AM SSB-SC |
| 10 | 26 | 28 | 30 | AM VSB-SC |
| 11 | Nov 2 | 4 | 6 | Carrier Acquisition |
| 12 | 9 | 11 | 13 | Angle Modulation FM and PM |
| 13 | 16 | 18 | 20 | FM PM Demodulation |
| 14 | 30 | Dec 2 | 4 | Random Process Review |
| 15 | 7 | 9 | 11 | Noise Modeling |