# UC Irvine
# EECS 141B – Communication Systems
# Spring Quarter 2024

**Meets:** TuTh 3:30-4:50 PM HH 254

**Important: Discussion Hour:** Discussion hour will be performed Wednesdays 8:00 AM-8:50 AM as scheduled in WebSoC. However, it will not be in person, but it will be via Zoom. The sessions will be recorded and made available to students in the course. The URL for the discussion hour Wednesdays 8:00 AM-8:50 AM is uci.zoom.us/my/ayanoglu. The links for recorded sessions are to be announced.

**Instructor:** Prof. Ender Ayanoglu *(pronounced A-ya-no-lu)*
ayanoglu@uci.edu

**Optional Text (Recommended not Required):**

S. Haykin, *Communication Systems,* 4th Ed., Wiley, 2001.
New edition of this text (5th) by S. Haykin and M. Moher, although useful, omits a number of topics we will cover. It is still a useful text, however.

or

S. Haykin, *Digital Communication Systems,* Wiley, 2013.
Updated version of *Communication Systems,* 4th Ed.

**Relevant Texts:**

1. J. G. Proakis, M. Salehi, *Communication Systems Engineering,* 2nd Ed., Prentice-Hall, 2002.
2. B. P. Lathi. Z. Ding, *Modern Digital and Analog Communication Systems,* 4th Ed., Oxford University Press, 2009.
3. R. E. Ziemer, W. H. Tranter, *Principles of Communications,* 7th Ed., Wiley, 2002.

**Covers:**

Signal space analysis. Optimum receivers for digital communication. Maximum a posteriori and maximum likelihood detection. Matched filter and correlation receiver. PAM, QAM, PSK, FSK, and MSK and their performance. Introduction to equalization, synchronization, information theory, and error control codes. Prerequisite: EECS141A. (Design units: 1)

**Grading (tentative):**

10% Homework, 40% Midterm, 50% Final, 5% Extra Credit (ABET and Course Evaluations).

| Lec | Date | Subject | Nts (up to) | Text (4th Ed.) | DUE |
|---|---|---|---|---|---|
| 1 | 4/2 | Digital Communication System Model | p. 2.8 | 5.1-5.2 | |
| 2 | 4/4 | Vector Channel, Optimum Detection | p. 2.15 | 5.3-5.4 | |
| 3 | 4/9 | Optimum Receivers, Probability of Error | p. 2.21 | 5.5-5.6 | |
| 4 | 4/11 | Probability of Error | p. 2.29 | 5.7-5.8 | |
| 5 | 4/16 | Phase Shift Keying (BPSK, QPSK, M-PSK) | p. 3.6 | 6.1-6.3 | **HW1** |
| 6 | 4/16 | Pulse and Quadrature Amplitude Modulation (PAM, QAM) | p. 3.13 | 6.4 | |
| 7 | 4/23 | Frequency and Minimum Shift Keying (FSK, MSK) | p. 3.21 | 6.5 | |
| 8 | 4/25 | Intersymbol Interference, Nyquist Criterion | p. 4.5 | 4.4-4.5 | |
| 9 | 4/30 | Adaptive Equalization | p. 4.12 | 4.10 | **HW2** |
| 10 | 5/3 | LMS Algorithm | p. 4.16 | | |
| 11 | 5/7 | **MIDTERM** | | | |
| 12 | 5/9 | Synchronization, Carrier Phase Recovery | p. 5.7 | 6.14 | |
| 13 | 5/14 | Decision Directed Phase and Timing Recovery | p. 5.12 | | |
| 14 | 5/16 | Introduction to Information Theory | p. 6.9 | 9.1-9.3 | |
| 15 | 5/21 | Mutual Information, Channel Capacity | p. 6.17 | 9.4-9.7 | |
| 16 | 5/23 | Shannon Channel Capacity Limit, Rate-Distortion Theory | p. 6.23 | 9.8-9.13 | **HW3** |
| 17 | 5/28 | Error Control Coding | p. 7.8 | 10.1-10.3 | |
| 18 | 5/30 | Cyclic Codes | p. 7.16 | 10.4 | |
| 19 | 6/4 | Convolutional Codes | p. 7.24 | 10.5 | |
| 20 | 6/6 | The Viterbi Algorithm | p. 7.32 | 10.6 | **HW4** |