

# Dordt University Engineering Department

## EGR 363, Introduction to Communication Systems

Spring, 2023

<b>2022-23 Catalog Description</b>	<p><b>Introduction to Communication Systems (3 credit hours)</b> (Fall, Even)</p> <p>A study of analog and digital communication systems performance and theory with applications in radio, satellite, telephone, computer networking, and radar systems. Topics include linear modulation (AM, SSB, etc.) exponential modulation (FM and PM), sampling theory, the discrete-time and discrete-frequency domains, and basic digital modulation methods such as <math>m</math>-ary PSK, DPSK, OFDM, etc. The topic of noise is considered at the most elementary level sufficient to distinguish the performance of various modulation methods in the presence of noise. Prerequisite: Engineering 220.</p>
<b>Textbook</b>	Proakis and Salehi, <i>Fundamentals of Communication Systems</i> , 2 <sup>nd</sup> ed., Pearson Prentice-Hall, 2014. ISBN 978-0-13-335485-0.
<b>Instructor</b>	<p>Douglas F. De Boer, Professor Emeritus of Engineering, <a href="https://dfdeboer.github.io/">https://dfdeboer.github.io/</a></p> <p>Office Phone, Location, Hours: Prof. dDB does not have an office. Call him at home. Visits may be arranged. Home phone: 712-722-1414. Please call before 10 PM.</p> <p>E-mail <a href="mailto:Douglas.DeBoer@Dordt.edu">Douglas.DeBoer@Dordt.edu</a>,</p>
<b>Course Objectives and Outcomes</b>	<p><i>Creational Structure (SO1):</i> Students will be able to predict the performance of basic analog and digital communication systems in terms of bandwidth and signal-to-noise ratios using deterministic signal models.</p> <p><i>Creational Development (SO2):</i> Students will understand the tradeoffs made when selecting a modulation method. Students will understand some of the standards used in broadcasting and they will study the historical development of one of these standards.</p>
<b>Prerequisites by topic</b>	Calculus including techniques of integration, sequences, and series. Differential equations. Sinusoidal steady state analysis of RLC circuits.
<b>Computer use</b>	<p><a href="#">GNU Octave</a> and <a href="#">Matlab</a> and will be the supported development environments for writing algorithms. Students are encouraged (but not required) to use other programs such as <a href="#">Mathcad</a>, <a href="#">FooPlot</a>, <a href="#">Desmos</a>, and <a href="#">SageMath</a>, etc. for homework solutions when appropriate. Course management will be via Dordt University's subscription to the cloud service "Canvas" by Instructure. An NCEES-approved calculator is recommended for homework, tests and the final exam. See <a href="https://ncees.org/exams/calculator">https://ncees.org/exams/calculator</a></p>
<b>Academic Integrity</b>	<p>This course is subject to Dordt University's policies on academic integrity. (<a href="https://www.dordt.edu/student-life/residential-life/student-services/student-handbook#academic-integrity">https://www.dordt.edu/student-life/residential-life/student-services/student-handbook#academic-integrity</a>.) Also see the standards of scholarship for this course at <a href="https://dfdeboer.github.io/integrity.htm">https://dfdeboer.github.io/integrity.htm</a> also posted on the course web page and see policies on the following pages of this syllabus.</p>
<b>Accommodations</b>	<p>Students who require assistance or accommodations based on the impact of a documented disability must contact Sharon Rosenboom, the Coordinator of Services for Students with Disabilities, to access accommodations. Telephone 722-6490, or e-mail <a href="mailto:Sharon.Rosenboom@Dordt.edu">Sharon.Rosenboom@Dordt.edu</a></p>
<b>Means of Evaluation</b>	<p>Homework (10%), Term Paper (15%), Two Tests (25% each), Final Exam (25%).</p> <p>The term paper will highlight the "cultural development" course goal.</p> <p>Professor De Boer grades using <i>grade points</i> on a scale from 4.00 to 0.00. Nominally, 4.00–3.75 = A, 3.7–3.45 = A–, 3.44–3.15 = B+, 3.14–2.85 = B, 2.84–2.50 = B–, 2.49–2.14 = C+, etc.</p> <p>Details of "Professor De Boer's Method of Grading" at <a href="https://dfdeboer.github.io/GDS.HTM">https://dfdeboer.github.io/GDS.HTM</a></p>
<b>Role of this Course</b>	This course is taught at the junior/senior level. It is required for students in the electrical concentration of the engineering major.

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This class meets for three 50 minute periods each week,  
Monday, Wednesday, and Friday at 8:00 AM – 9:15 AM in Room SB2803.

Dates			Class
	1/13		Introduction—Basic Concepts <i>Text: Chapter 1</i>
1/16	1/18	1/20	Signals and Systems—Fourier Series <i>Text: Chapter 2</i>
1/23	1/25	1/27	Signals and Systems—Fourier Transform <i>Text: Chapter 2</i>
1/30	2/01	2/03	Signals and Systems—Filters <i>Text: Chapter 2</i>
2/06	<b>2/08</b>	2/10	Signals and Systems—Power, Energy, Hilbert Transform <i>Text: Chapter 2, Test on Wednesday 2/10</i>
2/13	2/15	2/17	Linear Modulation—Types (DSB-SC, AM, SSB, VSB) and Properties <i>Text: Chapter 3</i>
2/20	2/22	2/24	Linear Modulation—Modulators and Demodulators, Multiplexing, FDM, Quadrature <i>Text: Chapter 3</i>
2/27	3/01	3/03	Superheterodyne Receiver <i>Text Chapter 3 and supplement</i>
3/06	3/08	3/10	No classes—Spring Break
	3/15	3/17	Exponential Modulation—FM, PM and Properties thereof (3/15 and 3/17 via distance education) <i>Text Chapter 4,</i>
(3/13—Spring Break)			
3/20	3/22	3/24	Exponential Modulation—Modulators and Demodulators. (3/20 via distance education) <i>Text Chapter 4</i>
3/27	<b>3/29</b>	3/31	Exponential Modulation—FM-Radio, Television Standards, AMPS cellular <i>Text Chapter 4, Test on Friday, 3/29</i>
4/03	4/05		Probability and Random Processes—Definitions and Basics <i>Text Chapter 5</i>
	(Easter Break 4/07)		
	4/12	4/14	Probability and Random Variables—Gaussian and White Processes <i>Text Chapter 5</i>
	(4/10 Easter Break)		
4/17	4/19	<b>4/21</b>	Effect of Noise on Analog Communication Systems <i>Text Chapter 6, Term paper due Friday, 4/21</i>
4/24	4/26	4/28	Analog-to-Digital Conversion and the sampling theorem <i>Text Chapter 7.</i>
5/01	5/03	5/05	Analog-to-Digital Conversion and the sampling theorem <i>Text Chapter 7</i>
<b>5/09</b>	<b>Final exam, Tuesday, 8:00 – 10:00 AM</b>		

Note: Schedule may vary by up to five class periods to accommodate the dynamics of this group of students.

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The information on this and the following pages is partially copied from the Student Handbook as per policy in Dordt University's "Syllabus Checklist." Additional information specific to this course (not in the Student Handbook) is in a serif typeface and has a black line down the left margin.

### Academic Integrity

Dordt University is committed to developing a community of Christian scholars where all members accept the responsibility of practicing personal and academic integrity in obedience to biblical teaching. For students, this means not lying, cheating, or stealing others' work to gain academic advantage; it also means opposing academic dishonesty.

**Academic Dishonesty:** Students found to be academically dishonest will receive academic sanctions from their professor (from a failing grade on the particular academic task to a failing grade in the course), who will report the incident and the sanction given to the Student Life Committee for possible institutional sanctions (from a warning to dismissal from the university).

Appeals in such matters will be handled by the student disciplinary process as outlined in the Student Handbook.

Definitions:

**Academic dishonesty** at Dordt University includes, but is not limited to, the following behaviors:

**Stealing/Plagiarizing:** copying another's work or ideas and creating the impression that they are one's own by failing to give proper credit or citation. This includes reading or hearing another's work or ideas and using them as one's own; quoting, paraphrasing, or condensing another's work without giving proper credit; purchasing or receiving another's work and using, handling, or submitting it as one's own work.

**Cheating:** unauthorized use of any study aids, equipment, or another's work during an academic task. This includes using unauthorized aids or other equipment during an examination; copying or looking at another individual's examination; taking or passing information to another individual during or after an examination; taking an examination for another individual; allowing another individual to take one's examination; stealing examinations.

1. All graded academic tasks are expected to be performed on an individual basis unless otherwise stated by the instructor.
2. An academic task may not be submitted by a student for course credit in more than one course without the permission of all instructors.

**Lying/Fabricating:** the intentional, unauthorized falsification or invention of any information or citation during an academic task. This includes changing or adding an answer on an examination and resubmitting it to change the grade; inventing data for a laboratory exercise or report.

**Facilitating Academic Dishonesty:** knowingly allowing or helping another individual to plagiarize, cheat, or fabricate information.

Students must do their own work. In Professor De Boer's courses students may verbally discuss homework but may not show un-graded papers to each other. Detail on this policy can be found on the web at <https://dfdeboer.github.io/integrity.htm#DYOW>. This policy applies to the whole course, not just homework.

### Attendance

Students are expected to be present for every class and laboratory period. Penalties for absence from class are left to the instructor. No designated number of skips is permitted.

**Student Responsibility:** Students shall notify each professor concerning the reason for absence prior to or immediately upon returning to class or in accordance with the instructor's method of accounting for absences. Students shall notify student services concerning all illnesses.

**Unexcused absences** are defined as failing to notify the instructor of the reason for the absence, or if the instructor deems the reason as illegitimate.

**Faculty initiatives:** The instructor may contact student services to check on the illness record of the students. They should also alert student services and contact the student directly concerning excessive absences, and must, if asked, report attendance patterns. Any instructor may, after due warning and according to guidelines established in the class syllabus, penalize the student by reducing the semester grade by a given percentage.

**Student Services Responsibility:** Normally, student services does not notify instructors concerning

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student illness. Student services may alert instructors to serious problems. Decisions to inform instructors about serious problems will be made balancing the need to respect confidentiality and the responsibility to keep instructors appropriately informed about their students. Any student with serious problems is strongly advised to work closely with student services and follow the process to insure adequate communication between all parties in as efficient a way as possible.

**Excused Absence for Activities:** Students have obligations in many realms, so special care shall be taken not to demand commitments for participation in extra-curricular events that cause neglect in other areas. Sponsors/coaches shall inform students from the beginning of the time and effort expected of them. Sponsors/coaches shall demand a minimum of absences from other classes, restrict student involvement to only those crucially involved, and make efforts to choose a time/date for the event that is least invasive of classroom or lab time. In the case of conflicts, resolution shall be the responsibility of the sponsor/coach and the instructor with no penalty to the student (The appeals process outlined in the section titled Complaints Regarding Instruction in the Student Handbook shall be used if needed). The sponsor shall email faculty and student services a list of names, dates, and activities in advance of the event. The student must contact the instructor and make arrangements for any missed work.

Professor De Boer expects to be notified at least a day in advance when you can reasonably be expected to have known that far in advance of a time when you will have to miss a class for a scheduled event of higher priority. In addition to the options listed above, missing classes without notification or for insubstantial reasons could be cause for being classified as an "uncooperative student" which could lead to dismissal from the course.

### Late work

Be coachable. Start work early so you can ask questions in class and by calling the Professor. Anything handed in late will be accepted for possible grading, but no grade will be entered in the grade book, the work will not be returned to you, and the empty grade will function as a zero or an "F." Often the item will never be graded. If, in the judgment of Prof. De Boer, grading the late item might improve the course grade, and if the reasons for the late work are acceptable and if there is no pattern of carelessness, then Prof. De Boer may choose to estimate a grade or actually grade the late work and enter the grade(s) in the grade book. Prof. De Boer may decide to estimate or fully grade a late item at any time after the item is handed in, but sometimes will do so only at the end of the course after all student course activities are complete. Additionally, if a pattern of late work develops, Professor De Boer will warn the student. After that warning if the problem is not resolved, a reduced course grade might result and/or the student may be classified as "uncooperative" which could lead to dismissal from the course.

*(Continues on the next page)*

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### Missed tests or exams

Professor De Boer announces his test schedule in the first week of classes. During the first two or three weeks of classes and possibly at other times, if there is good cause, students may negotiate to change the test date(s) for the entire class to avoid a conflict for any one student. However, in the week before a test Prof. De Boer is very reluctant to negotiate on a test date. If you realize that you have a schedule conflict with a test date, discuss this with Prof. De Boer as soon as possible.

If you are late to a test you must still finish at the scheduled time. If you miss a test or exam entirely the test or exam will go in the grade book as a blank score which will count as an "F." At the end of the semester after all your course work is complete Prof. De Boer will reassess the situation and might choose to estimate what he thinks you might have earned on the test based on any evidence he can find relevant to the situation. If an estimated grade is granted, it may still be discounted to a lower grade than the other tests and exams you completed if negligence is a partial cause for missing the exam or for being grossly late. A dead cell phone battery that causes you to miss an alarm is an example of negligence. If a test is missed due to illness (fever, nausea, etc., not just a "bad cold") then make every reasonable effort to report the illness to student services before the test or during the test period or, in every case, as early as is reasonable. If student services can verify your illness to Prof. De Boer, an estimated grade that is non-punitive will be given at the end of the semester.

### Class Participation

Professor De Boer does not grade class participation or professionalism. These are expected. If your participation is a problem Prof. De Boer will talk about it privately with you. Lack of participation can be a cause for adjusting your course grade downward, even to an "F." if Professor De Boer has not discussed these matters privately with you, you can assume you are doing well enough that your course grade will not be adjusted due to these matters.

### Description of assignments

Homework: Generally, a homework assignment will be due once each week. Expect the assignment to take about six hours to finish. Expect to have to ask for help to finish it. Make use of the telephone or e-mail the professor to get help as you need it.

Tests: Two tests and a final exam will be given. The tests and the final exam are open book and open computer, except the use of social media, texts, chats, or artificial intelligence bots (e.g. ChatGPT from OpenAI) is not allowed (Search engines such as Bing, Google, Yahoo, etc. are allowed.)

Term Paper. A few weeks into the semester a term paper will be assigned. The paper will be due a few weeks before the end of the semester. The paper should be a discussion of a communication standard that relates the technical details of the communication method to the intended purposes of the communication and also discusses alternative technical methods and the reasons why these were or were not accommodated in the standard.

*(end of EGR 363 syllabus)*