Information Theory

EEL 6532
Class Periods: MWF, Period 6, 12:50 PM - 1:40 PM
Location: MAEA 327
Academic Term: Fall 2021

Instructor:
Tan F. Wong
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352-392-2665
Office Hours: MWF 1:40-2:40pm, NEB461 or via Zoom

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
N/A.

Course Description
Basic introduction to information theory. Applications of information theory to communications and other related areas. (3 credit hours)

Course Pre-Requisites / Co-Requisites
EEE 5544 or equivalents, and advanced calculus

Course Objectives
i.   Understand basic arguments and proofs in information theory.
ii. Appreciate information theoretic results as fundamental limits on performance of communications, signal compression, pattern recognition, etc.

Materials and Supply Fees
N/A.

Required Textbooks and Software
[CT]   Title: *Elements of Information Theory*
        Authors: T. M. Cover and J. A. Thomas
        Publication date and edition: 2006, 2nd edition
        ISBN number: 0-471-24195-4

[GK]   Title: *Network Information Theory*
        Authors: A. El Gamal and Y.-H. Kim
        Publication date and edition: 2011
         ISBN number: 978-1-107-00873-1.
        Earlier note version: *Lecture Notes on Network Information Theory*, 2010.
        [Online] Available: http://arxiv.org/abs/1001.3404

Recommended Materials
a.   R. G. Gallager, *Information Theory and Reliable Communication*, Wiley, 1968.
b.   I. Csiszar and J. Korner, *Information Theory: Coding Theorems for Discrete Memoryless Systems*, 2nd edition, Cambridge University Press, 2011. ISBN number: 978-0-521-19681-9.
c.   Te Syn Han, *Information-Spectrum Methods in Information Theory*, Springer, 2003. ISBN number: 3-540-43581-6.
d.   *IEEE Transactions on Information Theory*, Special issue on the 50th anniversary of information theory, Oct. 1998.

Course Schedule

Class	Topic	Text
1	Overview	CT1; GK1
2	Entropy and mutual information	CT2,4,8; GK2
3	Entropy and mutual information	CT2,4,8; GK2
4	Typicality and typical sequences	CT3,7,15; GK2
5	Typicality and typical sequences	CT3,7,15; GK2
6	Typicality and typical sequences	CT3,7,15; GK2
7	Lossless source coding	CT5; GK3
8	Lossless source coding	CT5; GK3
9	Lossless source coding	CT5; GK3
10	Method of types	CT11,13
11	Universal source coding	CT11,13
12	Universal source coding	CT11,13
13	Channel coding theorem for DMCs	CT7; GK3
14	Channel coding theorem for DMCs	CT7; GK3
15	Channel coding theorem for Gaussian channels	CT9; GK3
16	Channel coding theorem for Gaussian channels	CT9; GK3
17	Channel coding with feedback	CT7,9, GK17
18	Lossy source coding (rate-distortion theory)	CT10; GK3
19	Lossy source coding (rate-distortion theory)	CT10; GK3
20	Joint source channel coding	CT7; GK3
21	Packing & covering lemmas	GK3
22	Multiple access channels	CT15; GK4
23	Multiple access channels	CT15; GK4
24	Multiple access channels	CT15; GK4
25	Multiple access channels	CT15; GK4
26	Degraded broadcast channels	CT15; GK5
27	Degraded broadcast channels	CT15; GK5
28	Degraded broadcast channels	CT15; GK5
29	Degraded broadcast channels	CT15; GK5
30	Degraded broadcast channels	CT15; GK5
31	Distributed lossless source coding	CT15; GK10
32	Distributed lossless source coding	CT15; GK10
33	Distributed lossless source coding	CT15; GK10
34	Channels with State	GK7
35	Channels with State	GK7
36	Channels with State	GK7
37	Lossy source coding with side information	CT15; GK11
38	Lossy source coding with side information	CT15; GK11
39	Lossy source coding with side information	CT15; GK11
	Relay channels	CT15; GK16
	Interference channels	GK6
	General broadcast channels	GK8
	Gaussian vector channels	GK9
	Fading channels	GK23

* Will cover selectively if time allows

Attendance Policy, Class Expectations, and Make-Up Policy
Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation. Additional information can be found here: https://catalog.ufl.edu/graduate/regulations/

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (5)	100 each	10%
Midterm Exam	100	40%
Final Exam	100	50%
Total		100%

Grading Policy
The following is given as an example only. The final course grade assignment may change to match class performance.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor

hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:
<u>*Health and Wellness*</u>

Covid-19 Protocols:
• You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

• If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints: http://www.distance.ufl.edu/student-complaint-process.