Spring 2019 – Physics of Speech (SPLH/LING 120)

Instructor.	Evan Edwards, MME, BM
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Email.	evanucm@ku.edu
Office hours.	Monday- 12-1pm in MURPHY 576 Tuesday- 12-1pm in DOLE 3017 or by appointment
Class meeting times.	Tue & Thu: 1:00 pm – 2:15 pm
Place.	Dole 2092
Graduate TA.	Mallory Miller
GTA office.	3025 Dole
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GTA Office Hours.	Friday- 11am-12pm

Notes: (1) Please also read the document on **Course Policies**.
(2) Please refer to your **lab syllabus** for Grad TA information and meeting times.

Course pre-requisites, co-requisites and other restrictions

MATH 101 or 104 or equivalent. PHSX 111 is recommended for students with no background of basic physics.

Course Description

This course offers an introduction to the acoustic structure of speech intended for non-science majors. Course material begins with the basic physics of sound structure and sound propagation and progresses to the application of these basic principles to speech perception and the production of speech sounds by the human vocal tract. This course is intended to provide students with foundational knowledge of speech perception and production as physical processes. Emphasis will be placed on the methods and standards by which scientists measure and evaluate the physical characteristics of speech. Topics will include: simple harmonic motion, the propagation of sound waves, aerodynamic aspects of vocal fold vibration, resonance, digital speech processing, frequency analysis, and speech synthesis. Three class hours and one laboratory per week.

Learning Objectives and Outcomes

- To be able to describe the generation and propagation of simple and complex sound waves
- To be able to perform basic analysis of simple and complex sound waves
- To describe and demonstrate acoustic and articulatory characteristics of consonant and vowels
- To apply basic principles of psychophysics to describe speech production and speech perception

Required Textbooks and Materials

Mullin, W.J., Gerace, W.J., Mestre, J.P., and Velleman, S.L. (2016). Fundamentals of sound with applications to speech and hearing. Amherst, MA: Off the Common Books.

Scientific calculator

Any other required material will be shared on Blackboard.

Assignments (See attached schedule and lab syllabus for all due dates)

Lab assignments & attendance	30%	300 points (30 points per lab)
2 in-class quizzes	15%	150 points (75 points per quiz)
Weekly in-class group assignments	15%	150 points (approx. 15 points each)
1 midterm exam	20%	200 points
1 comprehensive final exam	20%	200 points
Total	**100%**	**1,000 points**

Lab assignments and attendance (300 points; 30% of final grade)

Lab assignments provide an opportunity for students to apply concepts learned from lectures, readings, and class discussions to manipulation and measurement of sounds. Students will learn ways of describing and measuring sounds using software. Attendance is required. See lab syllabus for full description of labs.

In-class Quizzes (150 points; 15% of final grade)

A total of 2 quizzes will be administered in class. Quizzes provide students with sample questions that may be asked on exams and help students identify key concepts covered in the readings and lectures. Students are expected to work independently on quizzes. You will be allowed to bring your calculator as well as one sheet of formulas for each quiz. In calculating final grades, each of the 2 quizzes is worth 7.5% of your grade.

In-class Group Assignments (150 points; 15% of final grade)

Each week during one of the lecture meetings a substantial portion of class time will be devoted to collaborative group work on problem-based assignments. Groups will be assigned by the instructor and group membership will rotate after the midterm. Group assignments are designed to promote active learning of the course material and to facilitate hands-on practice needed to master the problem-based reasoning that is required in this course. GROUP ASSIGNMENTS ARE ALSO AN EXCELLENT STUDY GUIDE FOR THE EXAMS. Each group member who is present will receive the group grade. If you miss class, you will receive a zero for that day's group assignment. Each student will be allowed to drop up to 3 assignments from the calculation of their group assignment grade.

Midterm and Final Exams (400 points; 40% of final grade)

Midterm and final exams: The exams will include (1) multiple-choice (2) short-answer numerical and (3) true-or-false questions to assess your knowledge of the course content and ability to apply concepts and formulas learned in class. Questions will include material covered in the readings and in class lectures, in class group assignments, and discussions. For each of these exams, you will be allowed to bring your calculator as well as one sheet of formulas. Each exam is worth 20% of your grade.

Extra Credit

Extra credit may be earned by participating in class discussions. In order for an extra credit point to be earned, you must be called on by the instructor, and your answer must be correct. It is your responsibility to report to the instructor immediately after class so that extra credit for that day can be noted next to your name in the instructor's grade sheet. Maximum possible extra credit for each student will consist of 1 extra credit point earned per class.

Grading Policy

The University has prescribed definitions for grades. The University Senate Rules and Regulations define grades in the following way http://policy.ku.edu/governance/USRR#art2sect2para3: Grading Scale and Interpretation of Performance Level per University Senate Rules and Regulations

2.2.1.1 The grade of A will be reported for achievement of outstanding quality
2.2.1.2 The grade of B will be reported for achievement of high quality
2.2.1.3 The grade of C will be reported for achievement of acceptable quality
2.2.1.4 The grade of D will be reported for achievement that is minimally passing but at less than acceptable quality
2.2.2 The letters F, U (unsatisfactory), and NC (no credit) shall indicate that the quality of work was such that, to obtain credit, the student must repeat the regular work of the course.

The relationship between total points accumulated and quality of achievement is as follows:

Total Course Points	Percent	Quality of Achievement	Final Letter Grade (GPA)	
935+	94+	Outstanding	A	(4.0)
895-934	90 - 93		A-	(3.7)
865-894	87 - 89		B+	(3.3)
835-864	84 - 86	High	B	(3.0)
795-834	80 - 83		B-	(2.7)
765-794	77 - 79		C+	(2.3)
735-764	74 - 76	Acceptable	C	(2.0)
695-734	70 - 73		C-	(1.7)
665-694	67 - 69		D+	(1.3)
635-664	64 - 66	Minimal	D	(1.0)
595-634	60 - 63		D-	(0.7)
0-594	< 60	Inadequate	F	(0.0)

If your level of achievement during this course is falling short of your goal, you are **strongly encouraged** to consult with the instructor during office hours or by appointment to improve the quality of your learning of course material.

Course Schedule

Note.
(1) The dates of quizzes and exams are fixed.
(2) Schedule of topics may change depending on the pace of learning.
(3) Please check Blackboard for the most current schedule

Week	Tue	Topic	Thu	Topic	Fri	**Lab that week**	Reading
1	Jan 22	Syllabus- Introduction	Jan 24	Background Math, SI Units, Basic Physics etc ICA #1	Jan 25	*INTRO LAB*	Appendix A Ch 10 pg. 178-181
2	Jan 29	Intro to Waves	Jan 31	Intro to Waves – II ICA #2	Feb 1	Lab 1: Generating & Measuring Sine Waves	Ch 1
3	Feb 5	Intro to Waves - III	Feb 7	Intro to Waves – IV	Feb 8	Lab 2: Pitch and Frequency	Ch 1
4	Feb 12	Review ICA #3	Feb 14	**Quiz 1**	Feb 15	NO LAB	
5	Feb 19	Standing Waves in Strings	Feb 21	Standing Waves in Air ICA #4	Feb 22	Lab 3: Loudness and Intensity	Ch 2, Ch 3
6	Feb 26	Resonance / Complex Waves	Feb 28	Complex Waves II ICA #5	Mar 1	Lab 4: Complex Waves	Ch 4, Ch 6
7	Mar 5	Wave Analysis	Mar 7	Wave Analysis II ICA #6	Mar 8	Lab 5: Filters	Ch 7
8	Mar 12	SPRING BREAK	Mar 14	SPRING BREAK	Mar 15	SPRING BREAK	
9	Mar 19	Review	Mar 21	**Midterm Exam**	Mar 22	NO LAB	
10	Mar 26	Speech Production I	Mar 28	Speech Production II ICA #7	Mar 29	Lab 6: Vowel Space	Ch 8
11	Apr 2	Acoustics of Speech Sounds – Consonants I	Apr 4	Acoustics of Speech Sounds – Consonants II ICA #8	Apr 5	Lab 7: Co-articulation and Word Segments	Ch 9
12	Apr 9	Intensity, Loudness, Sound Pressure - I	Apr 11	Intensity, Loudness, Sound Pressure – II ICA #9	Apr 12	Lab 8: Noise and Hearing Loss	Ch 11
13	Apr 16	Review	Apr 18	**Quiz 2**	Apr 19	NO LAB	
14	Apr 23	Speech Perception - I	Apr 25	Speech Perception -II	Apr 26	Lab 9: Speech Perception	Ch 12
15	Apr 30	Speech Intelligibility / Hearing Loss ICA #10	May 2	Special Topics	May 3	Lab 10: Final Lab	Ch 12
16	May 7	Special Topics	May 9	Review	May 10	NO LAB (Stop day)	

The final examination follows KU's policy for final exams
http://policy.ku.edu/governance/USRR#art1sect3

All information provided in this syllabus is meant to serve as guidance and is subject to change. If any of this information changes, I promise to announce this change in class. It is your responsibility, however, to keep track of these changes (especially if you miss a class).

Have a great semester ahead!