



University of Wisconsin-Doctor of Audiology Program

Course: CS&D 850 Hearing Science I - Basic Acoustics and Psychoacoustics

Term: Fall 2023

Number of credits: 3

Lecture Schedule

Time: Mondays and Wednesdays 4.40- 5.55 PM

Location: Goodnight Hall Room 412

Instructor & Methods of Communication

Name: Dhatri S. Devaraju, PhD

Office location: Room 467, Goodnight Hall, 1975 Willow Dr, Madison, WI 53706

Email: devaraju2@wisc.edu (Please include "CS&D 850" in the subject line of emails)

Office hours: By appointment, in-person or over zoom

Please feel free to contact me at any time to arrange a meeting outside of class, if needed.

Reader/Grader: Kelly Schneider, contact: kaschneider5@wisc.edu

Course webpage

Access through <https://canvas.wisc.edu/courses/359808>

All course materials (syllabus, readings and videos, lectures, quizzes, assignments) will be available on canvas. It is your responsibility to check for updates. Lecture slides will be made available at least 1 hour before class.

Instructional modality: In-person for students in Madison campus; distance/remote synchronous for students in the Steven's Point campus

Prerequisites and Co-Requisites: Undergraduate courses in hearing science, acoustics, and introductory audiometry

This course follows the

UW-Madison Definition of Credit Hour – Policy Statement

Generally, UW-Madison will follow the federal credit hour definition: one hour (i.e. 50 minutes) of classroom or direct faculty/qualified instructor instruction and a minimum of two hours of out of class student work each week for approximately fifteen weeks, or the equivalent engagement over a different time-period.

Alternatively, a credit hour will be defined as the learning that takes place in at least 45 hours of learning activities, which include time in lectures or class meetings, in-person or online, laboratories, examinations, presentations, tutorials, preparation, reading, studying, hands-on experiences, and other learning activities; or a demonstration by the student of learning equivalent to that established as the expected product of such a period of study.

In all cases, learning in for-credit courses is guided by a qualified instructor and includes regular and substantive student-instructor interaction.

For this course, the instructor will provide direct instruction, feedback on student work, and course content consistent with the information posted in this syllabus.

Required texts

1. Moore, B.C.J. (2012) An Introduction to the Psychology of Hearing. 6th Edition. Emerald press: Bingley. ISBN: 9004252428
2. Schnupp, J., Nelken, I., & King, A.J. (2011) Auditory Neuroscience – Making sense of sound. MIT Press: Cambridge. ISBN: 9780262113182
Available online at [UW library](#).
3. Primal 3D interactive model: Follow links provided on canvas. You will have free access.

Recommended softwares for visualization

1. [Mozaik](#) – Search for the ear and the mechanisms of hearing download
2. [Mass Eye and Ear Eaton Peabody Laboratory 3D Virtual Models](#)

Course description

The course covers the physical aspects of sound, anatomy and physiology of the auditory system, basic concepts in psychoacoustics with respect to normal and abnormal auditory systems, basic concepts in auditory prosthesis and neuroplasticity.

Course Learning Objectives:

The following course educational objectives line up with the requirements of the American Speech-Language-Hearing Association (ASHA) for certification of audiologists:

CO1: Students will demonstrate initiative in their learning in this course via the ethical use of available resources including but not limited to user's guides, internet, colleagues, etc.

CO2: Upon completion of this course, students will describe the anatomy and physiology of the auditory system.

CO3: Upon completion of this course, students will describe physical aspects of sound as it pertains to auditory perception.

CO4: Upon completion of the course, students will be able to explain the role of the peripheral and central auditory pathway in sound perception.

CO5: Upon completion of the course, students will explain key psychological concepts in sound processing involved in human communication.

CO6: Upon completion of this course, students will describe the consequences of hearing loss and the use of prosthesis on perception.

CO7: Students will analyze and evaluate supporting evidence in a focused topic of choice

Instructor Objectives

In order to help you achieve your learning objectives, I will do the following:

1. Provide organized, clear content and instructions for assignments and assessments.
2. Come to class prepared to answer your questions to the best of my ability. At times that may include asking questions back to you to help lead you to understand the topic without directly answering your questions.
3. Be available during class and office hours to address questions/concerns.
4. Provide a safe space for students to work outside their comfort zone, to make mistakes and learn from them.

Course Units:

This course consists of 5 units in the following order:

Unit 1: Acoustics

Unit 2: Anatomy and physiology

Unit 3: Perception

Unit 4: Hearing loss, prosthesis and plasticity

Unit 5: Self-study (all topics)

Course calendar (subject to changes)

- ✓ Readings assigned for each class must be completed. Sometimes, lectures spill over, and the readings may need to deviate from the calendar
- ✓ If a change is necessary, we will make an announcement in class or canvas

Unit	Date	Unit	Topic	Readings (required are non-italicized; recommended are italicized)	Deadlines
	Wed, Sep 6		Review of syllabus and Introduction	No readings	
I. Acoustics	Mon, Sep 11	1.1	Sound and its Physical Characteristics	Moore Ch 1 (p.1-9) Schnupp Ch 1 (p.14-26)	Quiz, Discussion; special accommodations due.
	Wed, Sep 13	1.2 1.3	Sound transmission, Complex sounds	Schnupp Ch1 (p.3-8, p.34-43) Moore Ch 1 (p.13-22)	Quiz, Discussion
II. Anatomy & Physiology	Mon, Sep 18	2.1, 2.2	External and Middle ear	Schnupp Ch 2 (p.51-54); Moore Ch 1 (p.23-24)	Quiz, Discussion Anatomy assignment opens
	Wed, Sep 20	2.2	Middle ear	Gelfand, 2010 (Canvas)	Quiz, Discussion
	Mon, Sep 25	2.3	Inner ear	Schnupp Ch 2 (p.54-69); Moore Ch 1 (p.24-35)	Quiz, Discussion; presentation topics due
	Wed, Sep 27	2.3 2.4	Inner ear; Auditory nerve	Schnupp Ch 2 (p.69-86); Moore Ch 1 (p. 38-51)	Quiz, Discussion
	Mon, Oct 2	2.4, 2.5	Auditory nerve; Central auditory pathways	Schnupp Ch 2 (p.86-92); Moore Ch 1 (p.51-55)	Quiz, Discussion; Anatomy assignment due Oct 4
	Wed, Oct 4	2.5	Central auditory pathways	Schnupp Ch 2 (p.86-92); Pickles, 2015 (canvas)	Anatomy Assignment Due
	Mon, Oct 9		Exam I		
III. Perception	Wed, Oct 11	3.1	Auditory thresholds	Moore Ch 2	Quiz, Discussion
	Mon, Oct 16	3.2	Frequency selectivity	Moore Ch 3 (p.67-89)	Quiz, Discussion
	Wed, Oct 18	3.3	Masking	Moore Ch 3 (p. 89-131)	Quiz, Discussion
	Mon, Oct 23	3.4	Loudness perception	Moore Ch 4	Quiz, Discussion
	Wed, Oct 25	3.5	Spatial/binaural hearing	Schnupp Ch 5; Moore Ch 7	Binaural assignment opens; Quiz, Discussion
	Mon, Oct 30	3.6	Pitch perception	Schnupp Ch 3 Moore Ch 6	Quiz, Discussion
	Wed, Nov 1	3.7	Speech perception	Schnupp Ch 4; Moore Ch 9	Quiz, Discussion; Sign up presentation topic (unit 5)
	Mon, Nov 6		Exam II (non-cumulative)		
Wed, Nov 8	3.8	Auditory scene analysis	Schnupp Ch 6; Moore Ch 8	Binaural assignment due; Quiz, Discussion	
IV. Hearing loss, prosthesis, plasticity	Mon, Nov 13	4.1	Effects of cochlear hearing loss	Moore pdf, Moore 1996 (canvas)	Quiz, Discussion
	Wed, Nov 15	4.2	Auditory prosthesis	Schnupp Ch 8; Moore 2003 (canvas)	Quiz, Discussion
	Mon, Nov 20	4.3	Plasticity	Schnupp Ch 7	Quiz, Discussion
Wed, Nov 22		Time for presentation prep; no instruction			
Mon, Nov 27		Exam III (non-cumulative)			
V. Self-study (all topics)	Wed, Nov 29		Presentations - Normal aspects,		
	Mon, Dec 4	5	Hearing loss, perception with prosthesis, plasticity (4-5/day)	<i>Readings posted by presenters</i>	Prosem or Brain and bagels summaries due
	Wed, Dec 6				
	Mon, Dec 11				
Wed, Dec 13	Exam week; will meet, if needed to wrap up				

Course grade

Grading scale (*subject to change): Grades are not rounded.

Percentage	100-93	92.9-90	89.9-88	87.9-82	81.9-80	79.9-78	77.9-72	71.9-70	69.9-68	67.9-60	<60
UW-SP Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
UW-Madison Letter Grade	A	A-B		B	B-C		C		D		F

Final grade is based on

- ❖ Three non-cumulative exams
 - ◆ Exam I – 20%
 - ◆ Exam II – 20%
 - ◆ Exam III – 10%
- ❖ Four assignments
 - ◆ Quizzes – 5% (quizzes with the lowest 3 grades can be dropped)
 - ◆ Discussion – 5%
 - ◆ Anatomy assignment – 15%
 - ◆ Binaural listening assignment – 5%
- ❖ One presentation – 15%
- ❖ Class participation & professionalism – 5%

Student Requirements:

You must complete all the following in order to pass this course:

Attendance

You are required to attend class and arrive on time and prepared to begin. Any unexcused absences may result in a failing grade for the course. Excused absences will be granted for reasons such as illness/injury, family emergency or major event, travel to a professional conference, etc. at the discretion of the instructor.

Quizzes

The goal of the quiz is to help you revise the content you learned during the class and from readings. You will have a quiz after each topic which will have the contents from the lecture and the assigned readings/videos posted for the week. Recommended readings/videos will not be included.

The quiz is an open book (i.e., you can refer to your presentations/slides, readings and videos, if needed, while taking the quiz)

The quiz will open after each class on Mondays and Wednesdays, and you will have two days to complete the quiz. You will be given an hour to complete the quiz. The quiz will entail up to 5 to 10 questions and you will get two attempts to answer.

Discussion (once a week)

Each week, you will make discussion post entries. The goal is to review and assess understanding of covered concepts before moving on to new materials. Upon successful completion of this everyday task, students will gain experience in applying theoretical concepts/knowledge to clinical applications.

Each student must contribute ONE post with 4-6 sentences on any of the concept covered in the class and its implication for you as an audiologist. Also, must post your response to ONE of the posts by your peers on your thoughts about what they say.

Implications-for-audiologists could be focused on ONE of the following three questions.

- ✓ Why is it important for an audiologist to understand this topic?
- ✓ How will knowing this information improve an audiologist's clinical practice?
- ✓ If an audiologist does not understand this topic, what are the probable mistakes that could affect patient management?

Exams

Closed/open book/note, non-cumulative, and conducted in class.

Format: short answers, multiple choice, fill in the blanks, True/False, matching, labeling

Questions regarding exams will be answered up until 6 pm the day before the exam.

Anatomy assignment

The goal of the anatomy assignment is to practice identifying the main anatomical features of the auditory system. Upon successful completion of this assignment, you will be able to identify main landmarks of the external, middle and the inner ear.

You will be asked to take pictures of external ears and select a subset of pictures of the middle and inner ear provided, and label all requested parts.

Assignment details including instructions and grading rubric will be provided on canvas

Binaural listening assignment

The goal of the binaural listening assignment is to experience interaural time and level differences independently. Upon successful completion of this assignment, you will be able to differentiate the nature of time and level cues and describe their level/frequency limits.

Listening exercises that run on Praat will be available in files. Instructions with a template for assignment will be available on canvas.

Self-study (research and present)

The goal of this presentation is to improve self-directed learning, assimilation of research findings and presentation skills. Upon successful completion of the presentation, you will be able to evaluate the literature and summarize a focused topic in Hearing Science.

Four class periods are dedicated to presentations. The presentations will cover one of 4 specific themes: normal hearing, hearing loss, prostheses, plasticity. You will pick a topic or theme for presentation at the beginning of the semester.

Based on the topic/theme chosen, a presentation date will be assigned. Instructions, suggested topics and grading rubric will be provided on canvas.

Class Participation and Professionalism

In small, graduate courses such as this one, learning takes place in an interactive format. Class participation is highly encouraged. Class participation will be graded on a 20-point scale (see below for the description of scale). The instructor will engage the students in-class discussion, ask

pop-questions etc to ensure efficient transmission of information. Assessment of each student's participation is at the discretion and opinion of the instructor.

20	<p>Student is consistently prepared for class and participates in class discussions. Student is courteous and helpful to other students and instructor and TA. Student never appears to participate in non-class activities during class (emailing, texting, homework for other classes, clinic work, etc.)</p> <ul style="list-style-type: none"> • Contributes at least one thoughtful point related to class content each class period, as able. • This contribution can be done either verbally, during class, or written, following class.
15	<p>Student is occasionally under prepared for class or does not occasionally participate in class activities. Student is courteous and helpful to other students and instructor and TA. Student occasionally appears to participate in non-class activities during class (email, texting, homework for other classes, clinic work, etc.)</p> <ul style="list-style-type: none"> • Contributes at least one thoughtful point related to class content in half of class periods, as able. Done either verbally, during class, or written, following class.
≤10	<p>Student is frequently under prepared for class or frequently does not participate in class activities. Student is disengaged, disruptive or impolite. Student frequently appears to participate in non-class activities during class (email, texting, homework for other classes, clinic work, etc.)</p> <p><i>Note: Discussion among students in silos is discouraged. Any discussions should involve the whole class unless the instructor is organizing break-out group discussions.</i></p>

Please note that asking questions about course structure, quizzes/exam, schedule etc, do not count towards class participation.

Requirement for UW-Madison students

UW-Madison students are required to attend a minimum of 3 hearing-related seminars (Prosem or Brains and Bagels) during the fall semester.

Each student will be required to write a 300-500 word summary of the seminar attended. The summary should include: research questions asked, methods used, results, and conclusions. The three summaries must be compiled in a single pdf document and uploaded on canvas. The deadline is indicated on the course calendar. Summaries will not contribute to the final grade, but submission is required.

KASA/CFCC REQUIREMENTS:

The following table shows the CFCC standards that are covered in this course and indicates how they are assessed.

A passing grade is a B or better. If a student fails to complete any of the tasks listed below with a passing grade, they will work with the course instructor to either redo the task or complete an additional task to demonstrate competency with this task. If a student is not able to complete the

task, then an improvement plan will be initiated to remediate the skill in question. See the Au.D student handbook section on improvement plans for further details.

Standard	How the standard is assessed	Course or Lab
<i>Foundations of Practice</i>		
A1. Genetics, embryology and development of the auditory and vestibular systems, anatomy and physiology, neuroanatomy and neurophysiology, and pathophysiology of hearing and balance over the life span	Anatomy assignment, quizzes, exams, discussion	Unit 2, 3 & 4
A4. Principles, methods, and applications of acoustics, psychoacoustics, and speech perception, with a focus on how each is impacted by hearing impairment throughout the life span	Binaural listening assignment, quizzes, exams, discussion	Units 1, 3 & 4
A13. Principles of research and the application of evidence-based practice (i.e., scientific evidence, clinical expertise, and client/patient perspectives) for accurate and effective clinical decision making	Self-study presentation	Unit 5
C4. Identifying, describing, and differentiating among disorders of the peripheral and central auditory systems and the vestibular system.	Quizzes, exams, discussion	Unit 2, 3 & 4

Privacy of Student Records & the Use of Audio Recorded Lectures Statement

View [more information about FERPA](#).

Lecture materials and recordings for this course are protected intellectual property at UW-Madison. Students in courses may use the materials and recordings for their personal use related to participation in class. Students may also take notes solely for their personal use. If a lecture is not already recorded, students are not authorized to record lectures without permission unless they are considered by the university to be a qualified student with a disability who has an approved accommodation that includes recording. [Regent Policy Document 4-1] Students may not copy or have lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities, with the exception of sharing copies of personal notes as a notetaker through the McBurney Disability Resource Center. Students are otherwise prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor's express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university's policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct.

Digital Course Evaluation (AEFIS)

UW-Madison uses a digital course evaluation survey tool called [AEFIS](#). For this course, you will receive an official email two weeks prior to the end of the semester, notifying you that your course evaluation is available. In the email you will receive a link to log into the course evaluation with your NetID. Evaluations are anonymous. Your participation is an integral component of this course, and your feedback is important to me. I strongly encourage you to participate in the course evaluation.

Students' Rules, [Rights & Responsibilities](#)

Teaching & Learning Data Transparency Statement

The privacy and security of faculty, staff and students' personal information is a top priority for UW-Madison. The university carefully reviews and vets all campus-supported digital tools used to support teaching and learning, to help support success through [learning analytics](#), and to enable proctoring capabilities. View the university's full teaching and learning [data transparency statement](#).

Diversity & Inclusion Statement

[Diversity](#) is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.

Mental Health and Well-Being Statement

Students often experience stressors that can impact both their academic experience and personal well-being. These may include mental health concerns, substance misuse, sexual or relationship violence, family circumstances, campus climate, financial matters, among others.

Students are encouraged to learn about and utilize UW-Madison's mental health services and/or other resources as needed. Visit uhs.wisc.edu or call University Health Services at (608) 265-5600 to learn more.

Academic Integrity Statement

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary [sanctions](#) include, but are not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

Accommodations for Students with Disabilities Statement

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy ([UW-855](#)) require the university to provide reasonable accommodations to students with disabilities to access and participate in its academic programs and educational services. Faculty and students share responsibility in the accommodation process. Students are expected to inform faculty of their need for instructional accommodations during the beginning of the semester, or as soon as possible after being approved for accommodations. Faculty will work either directly with the student or in coordination with the McBurney Center to provide reasonable instructional and course-related accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. (See: [McBurney Disability Resource Center](#))

Academic Calendar & Religious Observances

[Academic Calendar & Religious Observances](#)

Establishment of the academic calendar for the University of Wisconsin-Madison falls within the authority of the faculty as set forth in [Faculty Policies and Procedures](#). Construction of the academic calendar is subject to various rules and laws prescribed by the Board of Regents, the Faculty Senate, State of Wisconsin and the federal government. For additional dates and deadlines for students, see the [Office of the Registrar's pages](#). Students are responsible for notifying instructors within the first two weeks of classes about any need for flexibility due to [religious observances](#).