

PHYS 102 The Physics of Sound and Music

Fall 2023 Syllabus

PHYS 102, Physics of Sound and Music, is a general education course covering the principles of sound, with applications in the areas of music, acoustics, perception, audiology, and electronic sound production. PHYS 122, Physics of Sound and Music Lab is a corequisite.

Instructor: Dr. James Perkins; jperkins@unca.edu

Meetings: TR 3:15 – 4:30 RRO 125

Office Hours: MWF mornings [by appointment](#)

Textbook: Online, interactive, **free** textbook at <http://www.opus.unca.edu/sound/>

Special thanks to textbook author, Professor Emeritus Dr. Michael Ruiz

Prerequisites: None! This is a general education science perspectives course open to students of all majors. This course and its corequisite lab, PHYS 122, can count as either your Science Perspectives or Laboratory Science [Liberal Arts Core](#) requirement (but not both).

August 2023

Monday	Tuesday	Wednesday	Thursday	Friday	
8/21	8/22	8/23	8/24	8/25	Homework due Friday 11:59pm
	A. What is Sound?	L01. Measurement	B. Vibrations	Last day to DROP	
8/28	8/29	8/30	8/31	9/1	
	C. Waves	L02. Waves	D. Wave Applications		HA, HB



September 2023

Monday	Tuesday	Wednesday	Thursday	Friday	Homework
9/4 Labor Day	9/5 E. Modulation	9/6 L03. The Oscilloscope	9/7 F1. Lissajous Figures	9/8	HC, HD
9/11	9/12 F2. Just Diatonic Scale	9/13 L04. Modulation	9/14 G. Strings	9/15	HE
9/18	9/19 H. Pipes	9/20 L05. The Just Diatonic Scale	9/21 I. Fourier Analysis	9/22	HF, HG
9/25	9/26 J. The Moogerfooger	9/27 E1 Taken in Lab (A-G)	9/28 K. The Laws of E&M	9/29	HH, HI

Class Responsibilities and Resources

1. **Come to Class TR: 3:15 - 4:30** - Personal response “clicker” questions through tpoll.com will be used for attendance grades. Full credit just for answering! If you miss class, contact the instructor (jperkins@unca.edu) for instructions on receiving credit.
2. **Read the Book** - We'll cover two chapters of the interactive textbook each week: <http://www.opus.unca.edu/sound/> Interactive textbook questions are NOT normally required but DO count as extra credit toward your final grade.
3. **Office Hours** - You can drop in on either lab section (W 9:30-10:45 or W 2-3:15) or [make an appointment](#) MWF mornings
4. **Homework** - Each chapter has an associated Homework assignment due about a week after we cover it in class (two assignments due each Friday 11:59pm)
5. **Projects** - Choose 2 from a selection of interactive web projects, music appreciation projects, or science appreciation projects (or do more than 2 for extra credit).
6. **Tests** - Three tests (9/27, 10/25, 11/15) and a cumulative final exam (12/7-12/13) are taken during the lab time slot. Any 1 test may be retaken during final exam week.

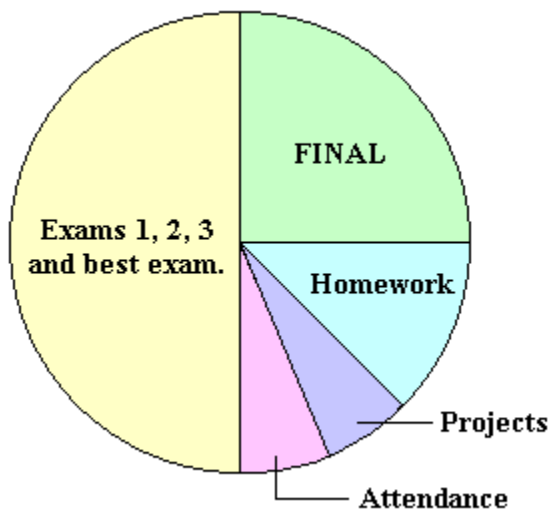


October 2023

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Monday	Tuesday	Wednesday	Thursday	Friday	Homework
10/2	10/3	10/4	10/5	10/6	
	L. Sound Systems	L06. Harmonics	M. Analog Electronics I		HJ, HK
10/9 Fall Break	10/10	10/11 Lab Exam 1	10/12 N1. Analog Electronics II	10/13 First Web Project Due	
10/16	10/17	10/18	10/19	10/20	
	N2. Digital Electronics	L07. Fourier Synthesis	O. Signal Processing	Last day to Withdraw	HL, HM
10/23	10/24	10/25	10/26	10/27	
	P. Moog Synthesizer I	E2 Taken in Lab (H-N)	Q. Moog Synthesizer II		HN, HO

Last day to withdraw from a full semester class is Friday, October 20, 2023.

Grading (This course typically has a class grade point average in the 2.6 to 2.8 range).



- 100 Exam 1 aka E1
- 100 Exam 2 aka E2
- 100 Exam 3 aka E3
- 200 Final aka FN
- 100 Best Exam Percentage
- 100 Web Homework (Due Weekly)
- 50 Two Projects (25 points each)
- 50 Minus 5 per miss after 2 free misses
- 800 Total** (No ± Grades, See Below)

- A (740-800) - apply knowledge in new areas
- B (660-739) - apply knowledge in familiar areas
- C (580-659) - apply knowledge in easy areas
- D (500-579) - misconceptions in principles
- F (0-499) - serious gaps in understanding

Bonus and Borderline: If you attend all classes you get a 10-point bonus. If your grade is borderline, I will consider helping you if you come to class, pay attention, put in effort with homework and extra credit. For very close cases I will also look for a strong Final. Though errors rarely occur, check your grades weekly and report anything you believe to be inaccurate **within the following week**.

Student Learning Objectives: Students should be able to explain the production of sound by a variety of media/instruments/computers, connect sounds and music to the underlying physical principles, use graphs to visually describe sound phenomena, and recall important sound/music innovations, experiments.

November 2023

Monday	Tuesday	Wednesday	Thursday	Friday	Homework
10/30	10/31	11/1	11/2	11/3	
	R. The Ear	L08. Digital Electronics	S. Perception		HP, HQ
11/6	11/7	11/8	11/9	11/10	
	T. Audiology	L09. Spectrograms	U. Spectrograms		HR, HS
11/13	11/14	11/15	11/16	11/17	
	V. Musical Temperment	E3 Taken in Lab (O-U)	W. Woodwind Instruments		HT, HU
11/20	11/21	11/22	11/23	11/24	
	X. Brass Instruments	Thanksgiving			

How to Succeed in Sound

1. Time. Reserve at least 2 hours (reading, study, web apps, multimedia, assignments, etc.) for every hour of class. This time is at least 6 hours per week in addition to class time. If you are a full-time student and have a job, you should NOT work more than 15-20 hours per week.

2. Instructor. Drop by weekly during office hours. If you have any problems, come talk to me.

3. Peers. Ask your classmates for help, e.g., before and after class or lab are good times to meet with a study group. Ask me if you'd like help scheduling a study group! You master the material when you are challenged to explain it to someone else.

Come to every class and take notes. Do not fall behind! Science classes build on previous classes. Use our "Exam Practice", where you see actual exam questions. If you spend lots of time with "Exam Practice" you will virtually see all the possible questions that can be on your exams. But the best advice is to first carefully study the solutions to old exams.

UNCA is committed to making courses accessible to persons with documented special learning needs. To apply, register with the Office of Academic Accessibility and then see me ASAP.

The Friday Rule: If you wait until the due date (Friday), there is no guarantee that the instructor will be available for support, no matter what problems arise, including computer difficulties. However, there will be at least one Grace Period near the end of the semester in order to make up some missed assignments.

December 2023

Monday	Tuesday	Wednesday	Thursday	Friday	Homework
11/27	11/28	11/29	11/30	12/1	
	UGR Symposium	L10. Creature Sounds	Y. String Instruments		HV, HW
12/4	12/5	12/6	12/7	12/8	
Web Project 2 Due & EC	Z. Circle of Fifths	Reading Day	FINAL (A-Z) 11:30-5:30	FINAL (A-Z) 11:30-5:30	HX, HY, HZ
12/11	12/12	12/13	12/14	12/15	
	FINAL (A-Z) 11:30-2	FINAL (A-Z) 8-2		Commencemen t	

Section 1 and 2 (RRO 125): T-R 3:15-4:30 pm.

For adverse weather consult your email, the UNCA Home Page, or the radio.

Music in PHYS 102



The Physics of Sound and Music incorporates classical music, jazz, and popular music. Our course also includes the study of hearing loss and the psychology of perception. You will appreciate sound and its many applications and expressions in the world.

We'll all be asked to bring our favorite songs and music experiences to the class and, by sharing these with each other, given chances to expand our music horizons! While we don't want to neglect experimental, subversive, or provocative art, I think we should agree that listeners should be given context so they can make an informed decision on whether or not to participate. Therefore, I will--and I ask that, if you do choose to share a song with the class that includes profanity or lyrics or sound effects concerning sensitive topics--that we appropriately tag those pieces.

UNCA-WIDE Important Information

Title IX and Sexual Misconduct. UNC Asheville is dedicated to cultivating and maintaining a safe, respectful, and inclusive environment, free from harassment and discrimination. We strive to ensure that all have equal access to the educational and employment opportunities the University provides. If you or someone you know has been affected by sexual or gender-based harassment, including sexual assault, dating or domestic violence, or stalking, please know that help and support are available. UNC Asheville strongly encourages all members of the community to take action, seek support, and report incidents of sexual harassment to the Title IX Office. You may contact the Title IX Office or Heather Lindkvist, the Title IX Coordinator, directly at 828.232.5658 or at titleix@unca.edu or learn more by visiting titleix.unca.edu.

As a faculty member, I am a “responsible employee” and private resource. This means that if you share any information or discuss an incident with me regarding sexual or gender-based harassment, I must disclose this information to the Title IX Coordinator. Our goal is to ensure you are aware of the range of options available to you and have access to the resources you may need.

If you wish to speak with a confidential resource, contact University Health and Counseling Services at 828.251.6520. Off-campus confidential resources include [Our Voice](#) (24-Hour Hotline at 828.255.7576) and [Helpmate](#) (24-Hour Hotline at 828.254.0516).

Office of Academic Accessibility. UNC-Asheville values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the professor know, and/or make an appointment to meet with the Office of Academic Accessibility as soon as possible. Learn more about the process of registering, and the services available through the Office of Academic Accessibility here: accessibility.unca.edu Please use this link <https://universityofncasheville.setmore.com/> to schedule an appointment. While students may disclose disability at any point in the semester, students who receive Letters of Accommodation are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student’s responsibility to follow this process each semester.

Early Alerts. Faculty at UNC Asheville are required to use the university's Academic Indicator (AI) system. The purpose of this system is to communicate with students about their progress in courses. Academic Indicators can reflect that a student’s performance is satisfactory at the time the indicator is submitted or they can indicate concerns (e.g., academic difficulty, attendance problems, or other concerns). Professors use the AI system because they are invested in student success and want to encourage open conversations about how students can improve their performance. When a faculty member submits an indicator that expresses a concern, the student receives an email from Academic Advising notifying them of the indicator. If a student receives three or more indicators, they will need to meet with a professional advisor by scheduling an appointment using the online appointment service at advising.unca.edu and select

'Academic Indicator Appointment' as the type of appointment. The instructor may also request to meet with the student to discuss the indicator. It is in the student's best interest to complete the process quickly, as students who do so are more likely to earn credit for the course. Questions about the Academic Indicator system can be directed to Anne Marie Roberts (amrober1@unca.edu) in the [Academic Success Center](#).

Academic Dishonesty. The university's policy on academic honesty states that "As a community of scholars dedicated to learning and the pursuit of knowledge UNC Asheville relies on the honesty and academic integrity of all the members of its community. Any act of plagiarism or cheating is academic dishonesty. A person who knowingly assists another in cheating is likewise guilty of cheating. According to the instructor's view of the gravity of the offense, a student may be punished by a failing grade or a grade of zero for the assignment or test, or a failing grade in the course. If it seems warranted, the instructor may also recommend to the Provost dismissal or other serious university sanction." I expect that you will exercise integrity in all quizzes, exams, and written assignments. Please email me or pop in during student hours if you have additional questions or need clarification on any point. Note that any violations of academic dishonesty (cheating, signing someone else's quiz sheet, etc.) must be reported to the Provost's Office. While I do encourage students to work together on homework assignments and labs. All work submitted must be: 1) in your own words, and 2) representative of your own understanding.

Special Policies. Currently, there is no masking mandate at UNCA with the exception of healthcare settings and University shuttles. Please respect individuals' personal decisions to either wear or not wear a mask in any given circumstance.

When we're meeting in my office and in office hours, I will wear my mask whenever we need to be in close proximity (for example when we are both looking at the same computer screen). I encourage you to consider at least bringing a mask with you so that you can do the same.

There is no official policy regarding social distancing in the classroom. Please be sensitive to the fact that everyone's comfort level will vary. Whenever possible, please keep several feet between yourself and a classmate. If a classmate requests more space, please do so kindly and without judgment or question.

The course will be offered this semester in a standard, in-person modality. Fortunately, we have several options in the case that a student needs to miss a class. If you are feeling ill, please stay home and contact me by email to request information on how to make up the class without penalty to your grade (typically by watching a video and completing a short assignment).

This syllabus is subject to change. Any substantive changes will be communicated through email.

Equity. The professional academic field of Physics still suffers from drastic underrepresentation of people from minoritized groups. Combating this disparity will necessitate work at all levels and dimensions of education, but must certainly also include course and classroom policies, practices, and climates which celebrate diverse

identities and cultures and support the learning of students of all races, ethnicities, genders, religions, and identities. I hope the students in the class will join me in trying to create a classroom that: rejects all forms of prejudice and discrimination; is free from bullying, harassment, and hostilities; and is unafraid to address our own biases as we learn to understand how others' viewpoints may be different from our own. I welcome questions and suggestions on how best to do this work while also recognizing that feeling comfortable (or feeling required) to share is one way that privilege manifests. No one should feel like they have to speak for anyone but themselves. This is work that must be done as a community, being sure to invite and welcome all voices, but also not falling disproportionately on the shoulders of those already combating bias and underrepresentation. See [AAPT](#), [AIP](#), and [other](#) resources for more information and sources for some of my language and motivation for including this statement in the syllabus.