

Math 105.003, Fall 2016
Music and Mathematics
Syllabus & Policies

Course Objectives: To introduce students to some of the many connections between mathematics and music, and to explore mathematical questions that follow naturally from standard musical considerations such as intonation, melody, rhythm, and composition.

Intended Audience: Liberal Arts Majors, particularly those with an interest in music.

Prerequisites: High School Algebra II or a college algebra course. Some experience with music – in particular, the ability to read music – is preferred, but it is not a strict requirement for this course.

Text: “The Math Behind the Music,” by Leon Harkleroad; Cambridge University Press, First Edition, 2006. (Also, frequent additional notes and practice exercises will be provided by the instructor.)

Technology: A basic scientific calculator (*not* necessarily a graphing calculator) that handles exponents and logarithms. This type of calculator usually costs between \$10 and \$20. DO NOT invest a large amount of money in a calculator if it is to be used only for this class.

Schedule: The class will meet every Monday, Tuesday, Wednesday, and Friday in 123 Henson. Each class meeting will begin at 12:00 PM and end at 12:50 PM.

Tests:

There will be three tests and a final exam. Combined, the three tests will count for 80% of your semester grade going into the final exam. See below ("Evaluation") for details on how the final exam is factored into your grade.

To receive credit for a correct answer on a test, instructions must be followed, all necessary work must be shown, and your work must be neat and organized. For computational problems, you must show all of the necessary steps to arrive at your answer. You should practice this standard of writing mathematics when doing the homework (see below). For written responses, you should write neatly, and you should write in complete sentences with proper spelling, grammar and punctuation. This is not (strictly speaking) a writing class, but as a high school graduate and college student you are expected to have the ability to write reasonably well; therefore, shoddy writing is unacceptable and may affect your grade.

If you *cannot* be in class on a test date, please let me know as soon as possible – preferably well in advance of the test date – and be ready to provide written verification for your excuse if requested. If I accept your reason for missing the test, then I will attempt to arrange to have you take the test at an alternative time and location. If we are unable to make such arrangements, then your grade on the missed test will be determined by your performance on the final exam, other tests, homework assignments, and/or whatever other factors I determine to be appropriate.

Tentative test dates are listed below; any changes to these dates will be announced in class with as much advance notice as possible.

Test #1: Tuesday, September 27

Test #2: Tuesday, October 25

Test #3: Tuesday, November 22

The cumulative final exam will be given on Monday, December 12, at 10:45 AM (as per the Salisbury University [Final Exam Schedule](#)).

Homework, Quizzes, and Class Work

There will be frequent homework assignments, several of which will be graded.

Recommended Homework: Not all homework will be collected. Homework that will be discussed in class, but not collected, will be referred to as "Recommended Homework". In particular, assigned readings will be included under "recommended homework." The recommended homework is intended to help you to prepare yourself for class discussions and tests. In particular, if there is anything in the recommended homework that confused you or seems very difficult, please ask about it!

Collected Homework: Certain homework assignments will be collected and graded. Collected homework will count for 20% of your semester grade going into the final exam.

The work you turn in for collected homework assignments is expected to be neat, legible and well organized. **If your collected homework is difficult to read and/or poorly organized, then it will be returned to you ungraded.** If more than one sheet of paper is being turned in, make sure your name is on each page, and fasten your pages together with a staple or clip.

Each collected assignment will be graded according to a "check" system, which is based primarily on whether you made a sincere effort to complete the assignment.

A checkmark (or "check") grade indicates that the assignment was adequately done – not necessarily that it is entirely correct, but rather that you made a reasonable attempt, showed your work and/or explained your answers, and clearly put an appropriate amount of time and effort into the assignment.

A check-plus indicates superior work – that is, your answers are entirely (or almost entirely) correct and well explained, with all necessary work shown. Also, a check-plus requires that the above policies on neatness, legibility, etc. are followed. (For example – an assignment on which all answers are correct and well justified, but which is difficult to read or otherwise sloppy, will receive only a check rather than a check-plus.)

A check-minus indicates inadequate work that is only minimally acceptable but inadequate due to low quality of work and/or what appears to be insufficient time and effort spent on the assignment.

Homework that is unacceptable – that is, which shows little to no effort, or is completely disorganized and/or impossible to read – will be returned ungraded. In this case, you will receive no credit for the assignment.

The details of how the check system will be converted into a percentage score are as follows: each "check" grade will count as 80% *or* your test average, whichever is higher (so that getting checks or better on all homeworks can only help your grade, not hurt it); each "check plus" will count as 100%; each "check minus" will count as 50%.

Late homework may or may not be accepted, at my discretion. In most such cases, your grade will be reduced as a result of handing in your homework late.

Quizzes & Class Work: I may occasionally give short quizzes on recently covered material. Quizzes may be given in class, or they may be given as take-home assignments to be turned in at the next class meeting. Quizzes may or may not be announced ahead of time. Any quizzes given during the semester will be scored similarly to tests, and quiz scores would be incorporated into your collected homework score.

Attendance and Participation

You are expected to attend every class meeting. If you *must* miss a class, I expect you to let me know ahead of time (or contact me as soon afterwards as possible.) In this case, you will be responsible to find out what you missed in class that day.

All students are expected and encouraged to be active participants in the class. I will observe each student's level of participation throughout the semester. At the end of the semester, I will assign you a score -- probably a number between -2% and +2% (inclusive) -- based on your attendance and participation; this number will be added to your semester average going into the final exam. For example, if your semester average is 88%, but you earn a +2 participation score, then your average will be increased to $88\%+2\%=90\%$. (I reserve the right to assign participation scores of more than 2, or less than -2, in exceptional cases.)

There are many ways to participate -- some in-class, and others out-of-class.

- In-class: I frequently ask questions during class, both during lecture and while demonstrating examples. Students who frequently make an effort to answer these questions, and/or ask relevant questions of their own, will get much more value from the class than those students who do not actively participate. Also, I may provide opportunities for students to present solutions to homework problems in class; such presentations will be accounted for in your participation score.
- Out-of-class: "Participation" refers not just to classroom interaction, but more generally to taking an active role in your own education, rather than regarding it as something that just happens to you. This can certainly occur in locations other than a classroom. For example, visiting me during office hours for help with a homework problem, or with questions about a lecture or the text, would count as participation. (Email and instant messaging with such questions also counts in your favor.) I also consider participating in our course's Supplemental Instruction sessions (see "supplemental instruction" below) and visiting the math and computer science department's tutoring center (see "tutoring" below) for help to be excellent opportunities to engage in out-of-class participation.
- Counter-productive and/or disrespectful actions may negatively impact your participation score. These include, but are not limited to: disruption of a class meeting (this includes ringing cell phones, pagers, etc.); talking when you should be listening; sleeping or texting during class; insulting and/or profane language, especially when directed at another person.

Evaluation

Your semester average up to, but not including, the final exam, will be a weighted average based on your test scores (80% total) and homework (20%).

Once your semester average is calculated, your grade for the course is determined by your letter grade on the final exam, as indicated by the Course Grade Table (see below). On the table, your semester average (not including the final) indicates your row of the table; your letter grade on the final exam then determines your overall grade for the course.

Here is a list of possible final exam grades, with explanations as needed. All percentage ranges/estimates take into account any "curve" that may be used in scoring the exams.

- A+ – requires a 100% score (curved) on the final exam
- A – 90-99% score
- B – 80-89%
- C – 70-79%
- D – 60-69%
- E – 40-59%. This is technically a failing grade for the exam itself, but for the purpose of calculating course grades, I distinguish between I call an E – which indicates *some* degree of preparation and understanding of course content, even if not at a passing level – and an F.
- F – less than 40%. This grade is given to a student who demonstrates a complete lack of preparation. This is counted as the equivalent of not showing up for the final exam at all.

COURSE GRADE TABLE

| | COURSE GRADE | | | |
|---|--------------|-----|-----|-----|
| Average going into the final exam | A | B | C | D |
| High A (95%-100%) | C | E | F | --- |
| Low A (90%-94%) | B | E | F | --- |
| High B (85%-89%) | A | D | E | F |
| Low B (80%-84%) | A+ | C | E | F |
| High C (75%-79%) | --- | B | D | E |
| Low C (70%-74%) | --- | A | D | E |
| High D (65%-69%) | --- | A+ | C | E |
| Low D (60%-64%) | --- | --- | B | D |
| High F (50%-59%) | --- | --- | --- | D |
| Low F (0% - 49%): F for the semester, regardless of final exam grade. | | | | |

Examples:

- Suppose you have an 83% average going into the final. This would put you in the "Low B" row of the table, which means (reading across that row of the table) that you could earn an A for the course by getting an A+ on the final exam. If you did not get an A+ on the final, then you would need at least a C on the final exam to get a B for the course. If you did not get a C or better on the final, then an "E" on the final exam would give you a C for the course. The "F" in the next column indicates that if you did not even do well enough on the final to earn an "E" grade, then you would end up with a D for the course.
- Suppose you have a 72% average going into the final. The "Low C" row of the table indicates that an A on the final exam would give you a B for the course; otherwise, a grade of D or better on the final would give you a C for the course. The "F" in the last column means that even if you fail the final, you will get a D for the course.

Grade Notification

I intend to periodically post grades on MyClasses. To find out where you stand in the course, consult MyClasses or (preferably) come to my office to discuss your grades confidentially. At the end of the semester, I intend to post final exam and course grades on MyClasses as soon as quickly as possible.

Collaboration

Students are encouraged to form study groups, and to discuss any of the recommended homework problems that are not being turned in for a grade. However, for graded assignments, you should be working on your own. The standard that applies to any writing-intensive course applies here as well: if you turn in an assignment with *your* name on it, you are asserting that what you have turned in is entirely *your* own work.

Academic Integrity

Unless specifically instructed otherwise, you are to do your own work on all graded assignments such as tests and collected homework. A student who is caught cheating on any graded assignment will receive a zero on that assignment, and may (at my discretion) receive an F for the course as well. If you receive an F for the course due to academic misconduct, you will not be permitted to withdraw to avoid the F on your grade report. For more details, please read the University policy on academic misconduct:

<http://www.salisbury.edu/provost/AcademicMisconductPolicy.html>

Tutoring

The Math and Computer Science Department offers [free tutoring](#) for its courses; however, note that this course, "Music & Mathematics," is a very specialized course, and the tutors are not (necessarily) musicians, so it's unlikely that they'll be able to help with topics that are specific to this course. However, you may visit the tutors for help with any of the *mathematical* content of this course - for example, if you need help with something like exponents, logarithms, or arithmetic involving fractions. For most questions, though, you should talk to me and/or your classmates.

Electronic Device Policy

I neither encourage nor forbid the use of computers during class meetings (unless a test is being given, in which case they are prohibited). Any usage of a laptop, tablet, smartphone, etc., must be appropriate to the classroom environment (e.g. taking notes, or finding a web page that is relevant to current class discussion). If your activity is inappropriate in any way that is distracting to me, you, or any of your classmates (e.g. Facebook, Twitter, texting, email, random surfing), then you will be told to discontinue using the computer for the rest of the class meeting.

Any other device capable of receiving calls, text messages, etc. (e.g. your cell phone) is to be turned off and kept out of sight during class meetings - *particularly* during tests.

I reserve the right to lower a student's semester average based on violations of the electronic device policy and/or any other disruptive behavior during class meetings.

Copyright Notice

The course materials I create and distribute for this class are protected by federal copyright law as my original works. You are permitted to take notes of lectures and to use course materials for your use in this course. You may not publicly distribute or display or allow anyone else to publicly display or distribute my course materials or lecture notes without my written permission.

Syllabus (tentative)

The following schedule includes the set of topics which I intend to cover, organized by week, as well as test dates. I'll stick to this schedule as much as possible; any significant deviations will be pointed out in class. Much more detail - including references to the text, supplemental notes, homework assignments, etc. - will be provided as the semester progresses.

| Date | Content / Activity |
|---------|--|
| Week 1 | Intro to Tuning - pitch; intervals; frequency ratios; pentatonic scales |
| Week 2 | Pythagorean tuning system; just intonation |
| Week 3 | Equal temperament; "cents" measurement of intervals |
| Week 4 | Rational approximation via continued fractions; Review for Test #1 |
| Sep. 27 | Test #1 (tuning systems) |
| Week 5 | Variations - Transpositions, retrogrades, inversions; Introduction to Modular Arithmetic |
| Week 6 | Introduction to Modular Arithmetic; Music "by the numbers;" connecting modular arithmetic to variations; |
| Week 7 | Introduction to Group Theory; Application of group theory to variations |
| Week 8 | Subgroups; Cosets; Review for Test #2 |
| Oct. 25 | Test #2 (variations; modular arithmetic; group theory) |
| Week 9 | Change ringing; permutations; cycle notation |
| Week 10 | Application of group theory to change ringing ("permutation groups"); Intro to Counting Problems |
| Week 11 | Counting continued: permutations, combinations, Pascal's Triangle |

| | |
|-------------|--|
| Week 12 | Counting (continued) – various applications and examples; Review for Test #3 |
| Nov. 22 | Test 3 (groups; permutations; change ringing; counting) |
| Weeks 13-14 | Sequences and Recursion; Fibonacci’s Sequence and related sequences |
| Dec. 12 | Final Exam – cumulative |

If you have any questions about the class policies or about the course in general, please [send me an email](#) or drop by my office to ask. In particular, please address any questions or concerns about the class policies during the drop-add period (i.e. the first week of classes).

Last modified: 8/29/16

Kurt Ludwick (keludwick@salisbury.edu)