

# 21M.380 MUSIC AND TECHNOLOGY RECORDING TECHNIQUES & AUDIO PRODUCTION

FALL 2016

INSTRUCTOR: FLORIAN HOLLERWEGER

## COURSE SYLLABUS

*Please ensure that you always have access to the latest version of this document. Important information, such as assignment due dates, assigned readings, etc. might be updated throughout the semester.*

## Description

In this course, you will be introduced to music recording and audio production from a practical and theoretical perspective. You will learn about the physical nature and human perception of sound, how it is transformed to and from electrical signals by means of microphones and loudspeakers, and how it can be creatively modeled through mixing consoles, signal processors, and digital audio workstations. You will learn to make informed choices about microphone selection and positioning, and we will cover various editing, mixing, and mastering techniques.

## Intended learning outcomes

A student who has successfully completed this course should have demonstrated:

1. An understanding of basic principles of acoustics and auditory perception
2. A practical and theoretical understanding of basic audio recording and production techniques
3. The ability to use digital audio workstation (DAW) software for the purpose of manipulating audio data
4. A critical awareness regarding the cultural, social, and historical context of music technology

## Instructor

- Prof. Flo(rian Hollerweger)
- Email: [REDACTED]
- Public GPG key: 0XE725 7AF0FE 29DE7A
- Office phone: [REDACTED]

## Office hours

- [REDACTED]
- Room [REDACTED]
- Sign up online at [REDACTED] (or just drop by)

If you can, please sign up for a time slot on the above website – even if it’s just minutes before you attend – which will help me to distribute my attention more evenly among students. That being said, you should *always* feel free to drop by during the above times without any prior arrangement and regardless of how full the schedule might already be. If you cannot make the above hours, please contact me with one or two suggestions for alternative meeting times. Try to prepare something that helps me understand what you are working on (e.g., a specific assignment that you are struggling with).

## Locations of interest

- [REDACTED]: Lectures and office hours
- [REDACTED]: Workshops and recording sessions
- [REDACTED]: Recording equipment storage
- [REDACTED]: Instructor’s office
- [REDACTED]: Lewis Music Library

## Recording equipment at MIT

Our main vehicle for getting hands-on recording experience will be Music and Theater Art’s MObile Sound System (MOSS) designed by Chris Ariza, which later in the course, we will use to record various bands and ensembles in Killian Hall. While the MOSS will be available only for in-class use, you can borrow one of five Zoom H4n portable audio recorders from the Lewis Music Library’s front desk over night for smaller recording jobs.

## Required hardware and software

You will require reliable access to additional audio editing hard- and software to work on your assignments. *Please ensure you have access to the following hard- and software by Monday, September 19, 2016!* By that date, you should also have completed and tested the installation of all software packages.

### Desktop or laptop computer

You will need reliable access to a desktop or laptop computer for working on your assignments. Besides your personal device, it is possible to work on the four iMacs upstairs at the Lewis Music Library, which are equipped with suitable software. Let me know if you’re interested!

### Studio headphones (or nearfield monitor loudspeakers)

It is strongly recommended that you invest in a pair of studio headphones. If you have to work in an environment that is not well acoustically isolated, opt for closed-back headphones. If you have a silent space to work in, you can opt for semi-closed or semi-open headphones, which are more comfortable to wear. See table 1 for recommendations. Completely open headphones tend to be expensive, but can yield great results in sufficiently quiet environments.<sup>1</sup> Don’t even

<sup>1</sup>The video at <https://www.youtube.com/watch?v=oqsyaH1Z6ro> explains the differences between open and closed-back headphones in detail.

Manufacturer and model	Price	Back	Description
Beyerdynamic DT770 Pro 80 $\Omega$	\$175	closed	use on laptop headph. out
Beyerdynamic DT770 Pro 250 $\Omega$	\$175	closed	use on separate amp
Audio-Technica ATH-M series	\$50–\$170	closed	M20x, M30x, M40x, M50x
Sennheiser HD 25-1 II	\$170	closed	
Sennheiser HD 25-SP II	\$120	closed	
Sennheiser HD280 Pro	\$90	closed	
Shure SRH440	\$100	closed	
AKG K240 MKII	\$150	semi-open	
AKG K240 Studio	\$85	semi-open	at Lewis Music Library
AKG K99	\$80	semi-open	
AKG K77	\$50	semi-closed	
AKG K44	\$30	closed	Phasing out of production

TABLE 1. Some headphones suitable for use in this course

Software package	Linux	Mac	Win	Price	Description
Cockos Reaper	(✓)	✓	✓	from \$60	free 2-month trial
Ardour	✓	(✓)		from \$0	open source
Apple Logic Pro X		✓		\$199	moos; Music Library
Bitwig Studio	✓	✓	✓	from \$269	
MAGIX Samplitude Pro X			✓	\$499	free 30-day trial
Avid Pro Tools 12 series		✓		depends	
Steinberg Cubase 7 Elements		✓	✓	\$99.99	

TABLE 2. DAW packages suitable for use in this course (recommended ones on top)

think about using in-ear phones (like they come with your smartphone), mixing on which is the acoustic equivalent of blindfolded graphic design.

If you plan to work on your assignments in the Lewis Music Library, you can borrow a pair of the AKG K240 Studio (55  $\Omega$ ) headphones available from the library's front desk. If you already happen to have a pair of studio headphones or nearfield monitor loudspeakers, or if you are planning to acquire a pair of the latter, feel free to consult me regarding their suitability for this class.

### Digital Audio Workstation (DAW) software package

You will also need a digital audio workstation (DAW) software package (cf., table 2). If you are new to DAWs, you should definitely opt for *Reaper*, which is installed on the four upstairs iMacs in the Lewis Music Library. Those who prefer to work on their own machine can get a non-commercial license for \$60 (with a free two-month trial). *Reaper* runs natively on Mac os x and Windows.

There are only two situations in which *Reaper* might *not* be your tool of choice. If either one applies to you, make sure to get in touch with me, so we can find a good solution together.

**If you run Linux.** *Reaper* runs relatively stable on Linux under Wine, but you should thoroughly test such a setup on your own system *before* using it for your assignments. As an alternative,

passionate tinkerers are more than welcome to use *Ardour* on Linux for their work.<sup>2</sup> I will happily provide support for such setups, but if you want things to 'just work', I suggest you try Reaper first.

**If you already have a DAW.** If you already run one of the other software packages listed in table 2, I am willing to let you use it for your work in this course. However, I do encourage you to use the opportunity to learn a new piece of software (Reaper), and you should be aware that I can provide only limited support for packages other than Reaper and Ardour. Logic users might be interested to hear that this package is installed on the four upstairs iMacs in the Lewis Music Library and is also part of the moss. Packages not listed in table 2 are *not* accepted for use in this course.

## Recommended textbooks

- Rayburn, Ray A. (2011). *Eargle's Microphone Book. From Mono to Stereo to Surround. A Guide to Microphone Design and Application.* 3rd ed. Focal Press. 480 pp. ISBN: 978-0240820750. MIT LIBRARY: 002136103. On course reserve at the Lewis Music Library.
- Senior, Mike (2014). *Recording Secrets for the Small Studio.* 1st ed. Focal Press. 460 pp. ISBN: 978-0415716703. MIT LIBRARY: 002400271. On course reserve at the Lewis Music Library.
- Izhaki, Roey (2011). *Mixing Audio. Concepts, Practices and Tools.* 2nd ed. Focal Press. 600 pp. ISBN: 978-0240522227. MIT LIBRARY: 002302617. Hardcopy and electronic resource. On course reserve at the Lewis Music Library. Accompanying sound examples: <http://www.taylorandfrancis.com/cw/izhaki-9780240522227/p/resources/>.
- Senior, Mike (2011). *Mixing Secrets for the Small Studio.* 1st ed. Focal Press. 352 pp. ISBN: 978-0240815800. MIT LIBRARY: 002092991. Electronic resource. Hardcopy version at MIT LIBRARY: 002178705. On course reserve at the Lewis Music Library.
- Katz, Bob (2014). *Mastering Audio. The Art and the Science.* 3rd ed. Burlington, MA: Focal Press. 408 pp. ISBN: 978-0240818962. MIT LIBRARY: 002307049. On course reserve at the Lewis Music Library.

Purchase of these books is not mandatory, but if you intend to pursue your interest in music technology beyond this course, they should serve you as useful references for years to come. The MIT COOP offers hard copies of all titles for rent and for purchase under this course's number (21M.380).

## Lecture notes

Lecture notes will be made available online solely at the instructor's discretion and pace. You should not rely on their availability and are expected to take your own notes in class. However, I will do my best to keep the following documents available and updated on the Athena course locker (see below).

21m380\_syllabus.pdf is what you are reading right now. You should rely primarily on the latest version of this document to get up-to-date information about upcoming readings, quizzes, and assignment due dates.

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<sup>2</sup>Although Ardour does run also on os x, I do not recommend it. Please get in touch in case you are considering such a setup.

21m380\_slides\_screen.pdf is an adopted version of the slides shown in class that is optimized for screen reading. It contains clickable play buttons (▶) to run audio, video, and other examples,<sup>3</sup> together with instructions on how to download some examples that can only be played from your local hard drive.

21m380\_slides\_print.pdf is a printer-friendly version of the slides scaled to letter format. Use this document if you prefer to study from printed paper. The file does not contain any hyperlinks and is therefore less convenient for screen reading.

21m380\_class\_201\*-\*\*\*.pdf are class-meeting specific handouts that include announcements, reviews, etc. and will sometimes be distributed in printed form in class. Consult these first to catch up on a missed class or otherwise get a quick overview of what we have covered that day.

All these documents will be regularly updated throughout the semester (including content from previous lectures), so it pays off to synchronize your local copies frequently, especially as you prepare for upcoming quizzes.

## Online resources

### Learning Modules (LMOB; formerly Stellar)

The LMOB site at

<https://learning-modules.mit.edu/class/index.html?uuid=/course/21M/fa16/21M.380>

will be used for:

- Copyrighted readings and listenings not available online elsewhere
- Assignment instructions
- Submission of most assignments (except those involving large files)
- Grade communication for individual assignments

### Athena course locker

The Athena course locker at <https://web.mit.edu/course/21/21m.380/> is accessible only via https (not http), only from a browser that has your MIT browser certificates installed, and only after I have set your access permissions sometime during the first two weeks of classes. It will be used for:

- Lecture notes and syllabus (regularly updated)
- Sound and video examples not available online elsewhere
- Submission of large assignments

While the course locker can be accessed via your web browser for read-only purposes, you will have to use an FTP client such as *Filezilla* (free for Mac, Windows, Linux) in order to submit assignments to the course locker later in the course. Instructions will be provided with those assignments.

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<sup>3</sup>Some examples that cannot be published due to copyright restrictions might be indicated through grayed-out play buttons (▶) that do not link anywhere.

Description	Code	Contribution to final grade				$\Sigma$			
3 In-class quizzes	QZ1–QZ3	5%	+	5%	+	10% = 20%			
15 Reading assignments	RDO1–RD15	5	×	1%	+	10	×	0.5% = 10%	
2 Production analyses	PA1+PA2			5%	+	5%	= 10%		
2 Written assignments	WR1+WR2			3%	+	7%	= 10%		
4 Sound editing exercises	ED1–ED4	5%	+	5%	+	5%	+	5%	= 20%
2 Recording session reports	SP1+SP2			3%	+	2%	= 5%		
3 Mixing assignments	MX1–MX3			5%	+	5%	+	15%	= 25%

TABLE 3. Assessment items and final grade contributions

## OpenCourseWare archive

The spring 2012 edition of this course by Chriz Ariza is archived at <http://ocw.mit.edu/courses/music-and-theater-arts/21m-380-music-and-technology-recording-techniques-and-audio-production-spring-2012/>. You can use these excellent materials to complement those for the current semester.

## Assignments, quizzes, and grading

Table 3 lists all assessment items that will count towards your final grade.

- Detailed instructions will be posted for each assignment on the LMOD site. For the reading (RD) assignments, these will include specific questions relating to the respective reading, which you will need to respond to in writing.
- Assignments will generally be submitted via LMOD (file size permitting), or else via the Athena course locker. *Email submissions will not be accepted under any circumstances*, even if LMOD is down.
- You need to complete *all* assignments and quizzes in order to pass this course, and you are expected to submit all assignments on time. Late submissions will initially incur a penalty of one letter grade per 24 hours. Repeat offenders will eventually receive zero scores until the situation improves.
- Your responses to reading assignments will be checked for completeness, but they will not be graded. All other assignments will receive letter grades (without + and – modifiers) according to the scheme outlined in table 4. This grading scheme also applies to your final grade for the course, except that your internal grade report might include a + or – modifier

Letter grade	Numeric score
A	90%–100%
B	80%–89%
C	70%–79%
D	60%–69%
F	0%–59%

TABLE 4. Grading scheme

with an A, B, or C letter grade. Corrected quizzes will be returned with the numeric score in addition to the letter grade.

- Grading will be conducted in accordance with the Academic Procedures and Institute Regulations at <http://catalog.mit.edu/mit/procedures/academic-performance-grades/#gradestext>
- There is no final exam for this course.

## Assignment submission format

You can help me make the grading process much more efficient by sticking closely to the submission guidelines specified in the assignment instructions. For example, I might ask you to submit an assignment in the following format, whose correct interpretation is explained below.

```

submission.zip
├── writeup.pdf (2000 words max.)
└── audio_example.[wav|aif] (44.1 kHz, 24 bit)

```

- Submit a .zip archive named `submission.zip` (and *only* `submission.zip`).
  - Please stick meticulously to all suggested file names.
  - Note that file names use exclusively small letters and underscores instead of spaces.
- The .zip file should contain two (and *only* two) files.
  - Please make sure the .zip archive does not contain an extra subdirectory which its contents unpack into. In Mac os x, you can achieve this by selecting the *files* rather than their parent folder before right-clicking to `Compress N Items`.
  - Extra points (well, not really...) for .zip files that do not contain mysterious `__MACOSX` folders or `.DS_Store` files. ☺
- The first file should be named `writeup.pdf` (and *only* `writeup.pdf`) and be max. 2000 words long.
- The other file should be named either `audio_example.wav` or `audio_example.aif`, meaning that you have two audio file formats to choose from, and should be submitted (only) in 44.1 kHz and 24 bit.

## Attendance

You are expected to attend *all* class meetings in this course.

- Any absences have to be communicated to and approved by the instructor ahead of time, so please email me as soon as you know about any scheduling conflicts. If you will miss an in-class quiz, you need to simultaneously arrange an in-lieu oral exam with the instructor.
- *Unexcused absences from any recording sessions in which you serve as a sound engineer or as a performing musician will not be tolerated and result in a fail grade for the course.* In all other class meetings, you are entitled to a single unexcused absence without penalty, but any further unexcused absences will negatively affect your final grade.

- In-class quizzes missed due to an unexcused absence cannot be repeated and will receive a zero score.

It is your own responsibility to keep track of your attendance and make up for any missed work. Assignment deadlines are not affected by absences, unless specific arrangements are made with the instructor.

## **Use of electronic devices in class**

If you have a laptop, please bring it along to all class meetings that are marked accordingly in the schedule. Keep an eye on syllabus updates before deciding whether to bring your laptop to class, as last-minute changes might occur. The use of laptops is only permitted where necessary for actual coursework, and I will announce when this is the case. The use of cellphones in class is not permitted.

## **Workload**

This is a 12-unit class, which means you should expect to invest about 9 hours of work per week beyond the 3 class hours.

## **Academic integrity**

Please make sure you are familiar with MIT's policies on academic integrity (<https://integrity.mit.edu>). The guidelines that this handbook provides with regards to plagiarism and proper citation apply to this course.

## 21M.380 Music and Technology (Fall 2016)

Date	Time	Where	Content	Bring laptop	Assignments		Quizzes
					out	due	
Wed, 9/7	12:30pm–2pm	24-033F	The art of sound recording		WR1, RD01	RD00	QU
Mon, 9/12	12:30pm–2pm	24-033F	Physics of sound		PA1, RD02	WR1, RD01	
Wed, 9/14	12:30pm–2pm	24-033F	Microphones		RD03	RD02	
Mon, 9/19	12:30pm–2pm	24-033F	Perception of sound		RD04	PA1, RD03	
Wed, 9/21	12:30pm–2pm	14W-111	Workshop: MOSS intro & mic handling		RD05	RD04	
Mon, 9/26	12:30pm–2pm	24-033F	Basic sound editing techniques	✓	ED1		QZ1
Wed, 9/28	12:30pm–2pm	14W-111	Workshop: Cables, preamps, patchbays		RD06	RD05	
Mon, 10/3	12:30pm–2pm	24-033F	Filters and EQs	✓	ED2, RD07	ED1, RD06	
Wed, 10/5	12:30pm–2pm	24-033F	Stereo recording techniques		RD08	RD07	
Mon, 10/10			<b>No class (Columbus Day)</b>		RD09	ED2	
Wed, 10/12	12:30pm–2pm	24-033F	Dynamics & compression	✓	ED3	RD08	
Mon, 10/17	12:30pm–2pm	14W-111	Workshop: Stereo recording practice		RD10	RD09	
Wed, 10/19	12:30pm–2pm	14W-111	Workshop: Headphone monitoring		SP1, RD11	ED3	
Mon, 10/24	12:30pm–2pm	24-033F	Digital audio		ED4		QZ2
Wed, 10/26	12:30pm–2pm	24-033F	Mixing consoles		RD12	RD10	
Mon, 10/31	12:30pm–2pm	14W-111	Student presentations: Recording session plans			SP1, RD11	
Wed, 11/2	12:30pm–2pm	24-033F	Mixing strategies	✓	MX1	ED4	
Mon, 11/7	12:30pm–2pm	14W-111	Recording session 1 (piano solo)		SP2, RD13	RD12	
Wed, 11/9	12:30pm–2pm	24-033F	Room acoustics & reverberation	✓	MX2	MX1	
Mon, 11/14	12:30pm–2pm	14W-111	Recording session 2 (Love and a Sandwich)		RD14	RD13	
Wed, 11/16	12:30pm–2pm	14W-111	Recording session 3 (Pscience Phiction)		WR2	MX2	
Mon, 11/21	12:30pm–2pm	24-033F	Quiz, review, preview		PA2		QZ3
Wed, 11/23	12:30pm–2pm	24-033F	Sound quality & critical listening			RD14	
Mon, 11/28	12:30pm–2pm	14W-111	Recording session 4 (piano trio)		RD15	WR2	
Wed, 11/30	12:30pm–2pm	14W-111	Recording session 5 (violin & piano duet)		MX3	PA2	
Mon, 12/5	12:30pm–2pm	24-033F	Mastering techniques			RD15	
Wed, 12/7	12:30pm–2pm	24-033F	Workshop: Command-line sound editing	✓		SP2	
Mon, 12/12	12:30pm–2pm	14W-111	Guest speaker Al Kooper: <i>The role of the producer</i>				
Wed, 12/14	12:30pm–2pm	24-033F	Workshop: 5.1 surround sound			MX3	