

The Queen's University of Belfast
BSc in Music Technology

Module Title: **Fundamentals of Sound Synthesis**
Module Code: **MTE1001**
Module Convener: **Gary Kendall (g.kendall@qub.ac.uk, Ex. 4445)**
Teaching Assistant: **Andres Cabrera (mantaraya36@gmail.com)**

Teaching Schedule:

Lectures, Monday 11 am - 1 pm, SARC Multimedia Room

Tutorial, Monday noon – 1 pm, SARC BSc Lab

The scheduling of tutorial sessions in the BSc Lab will begin around the 7th week. Until that time, the noon to 1 pm time will be used for lectures in the Multimedia Room.

Course Contents:

This module focuses on fundamental concepts that underpin core areas of Music Technology. This includes an introduction to the characteristics of digital signals, the generation and manipulation of sounds and the use of software synthesis programs. Specific techniques of sound synthesis that are fundamental to the field will be surveyed.

Assessment:

Notebooks (3)	75%
Synthesis Programming	20%
Attendance	5%

- Late submissions of Notebooks will be penalized according to the School's policy.
- Late submissions of synthesis programming assignments are governed by rules described below.

Attendance: It is expected that you will attend all classes and participate in discussions. Missing more than three sessions during one semester will result in a zero for attendance.

Learning Outcomes:

- Students will be able to discuss and describe the fundamental elements of sound synthesis.
- Students will be able to read and comprehend the literature of synthesis at an appropriate level.
- Students will be able to relate elements of sound synthesis to the history and literature of technological music.
- Students will be able to generate and manipulate musical signals.

Skills

- Ability to conceptualize and evaluate information about musical signals.
 - Develop written communication skills relevant to the subject.
 - Ability to utilize sound synthesis software to achieve synthesis goals.
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Assignments

I. Notebooks 1-3---#1: weeks 1-8(A); #2: weeks 9-12(A) & 1-4(S); #3 weeks 5-12(S)

- Over the span of the course, you will construct three notebooks that reflect the knowledge you have acquired. These should both capture the evolution of your experience within the module and represent a summary of what you have learned.
- Each person comes to this class with a unique background. An important function of these assignments is to be a vehicle for you to construct a representation of what you have gathered from this module in a way that is relevant to you. These assignments also put the course's emphasis on your process of integrating information from lectures, readings, etc. Together they ought to be an information resource you can keep after the class is over. The Notebook assignments also ask that you take time to reflect on the nature of your learning experience in the class and seek to relate the module to your everyday experience.
- Work on each Notebook should be accumulative. This kind of assignment preferences consistent day-by-day, week-by-week work. Don't even think about putting it off. Get started today.

Your notebook must contain the following two sections:

1. Summary of the Class Topics.

(Organized by topics.) Write a summary of the topics covered in the class in your own words. Every topic is supported by class lectures and readings. Imagine that you are writing this for yourself in the future or for someone like yourself. Synthesize the information from lectures and readings into a whole and construct an organized summary of the material. (Do not simply include your lecture notes! Do not forget the readings!) Organize your text by topics and use subject headings and subheadings to help organize the material. (Do not include lecture dates or general impressions of lectures!) Write full sentences and complete paragraphs. (Do not write sentence fragments and constantly make lists.)

Sources: Feel free to use any text or images from the lecture slides without references. If you quote something from the readings or elsewhere, be sure to use quotation marks and to indicate the source with an insertion such as "(Roads, pp 47-8)." If you use sources from elsewhere be sure also to identify your sources "(Wikipedia, 'Herbert Eimert')." It is a serious academic offense to represent other people's work as your own and may lead to dismissal from the university.

2. Reflections.

(Organized by the date of the entry.) Personal reflections (at least one for every two weeks) that capture the evolution of your subjective reactions to and ideas about the module. Include here any reflections you have on your learning process, ways in which the class impacts your day-to-day thoughts and experiences, etc. This is also the place to provide feedback to the instructor on how well the course is serving you.

On-line Materials.

Lecture slides, SuperCollider lecture documents, readings, some musical examples and programming assignments will be available on-line. Readings are drawn from Curtis Roads, *The Computer Music Tutorial*, MIT Press, 1996. Visit: <http://www.garykendall.net/classes/Synthesis/> for these files.

Assessment. The Notebooks should be turned in on the following dates:

- Monday, November 22, week 9 (autumn)
- Monday, February 28, week 5 (spring)
- Monday, May 23, during Assessment period

II. Synthesis Programming (starting approximately in autumn week 7)

Synthesis assignments will be assigned as part of the module's Tutorial part. They will all involve audio programming with SuperCollider. Assignments will typically involve parts that involve demonstrations of topics covered in lecture and other parts that are more creative and exploratory.

Assessment. The due date for each assignment will be a Monday two weeks following the announcement of the assignment. Each programming assignment will be assessed as either complete, complete second try, incomplete or not received (C, CS, I, or N).

- C: To be complete, all components of the assigned need to be completed in the submitted work in the first instance. Omitting elements will lead to an incomplete.
- CS: All components of the assignment have been completed after the first review
- N: If the assignment is not received by the due date, it is assigned an N and there is no opportunity to redo the assignment.
- I: If you receive an incomplete, you will have an additional two weeks to redo the assignment and to turn in a revised version. If the revised version fulfills all elements of the assignment, it will considered complete and receive a C. Revised work files should have the letter 'Rev' appended to the original file name. The final component mark for the programming assignments as a whole is determined by the number of completed assignments.

SuperCollider is a *free* downloadable program. The version that we will be using in class is for Mac OS X (though version are available for Linux and Windows). You will also have on-line access to copies of the lecture notes as SuperCollider documents that you can read and execute. To download SuperCollider:

1. Go to <http://supercollider.sourceforge.net/> and follow links under "Downloads."
2. Under the appropriate operating system, download the appropriate release. Mac and Linux users will likely want to select the SuperCollider 3.4 release. Be sure to select the one "With-Extras." The PC version 3.3.1 is admittedly a little behind the other versions, but should be sufficient for this class.
3. On the Mac: Install both the SuperCollider application and the "Optional Installs." From within the "Optional Installs" copy the sc3-plugin-extensions folder to ~Library/Application Support/SuperCollider/Extensions.

Course Schedule

Part 1 Weeks 1-8 (A)

Early history of sound synthesis and the Cologne Studio, fundamentals of acoustics and digital audio, sound synthesis software and unit generators, introduction to SuperCollider

Part 2 Weeks 9-12 (A) & 1-4 (S)

Characteristics of real instruments, analysis-synthesis, Modulation: AM & FM synthesis, Sampling, Granular Synthesis, Musique Concrete and Soundscape

Part 3 Weeks 5-12 (S)

Digital filters: theory and implementation, complex numbers and z-plane, noise, reverberation and spatial audio, physical modeling synthesis, grain control, distortion