McGILL UNIVERSITY SCHULICH SCHOOL OF MUSIC

GRADUATE PLACEMENT EXAMINATIONS – MUSIC TECHNOLOGY

All students beginning graduate studies in Composition, Music Education, Music Technology and Theory are required to take placement examinations in order to determine that their academic preparation is sufficient. On the basis of the results of these examinations, incoming students may be required to take certain remedial courses in Music History, Theory or Technology and, depending on their area of specialization, other undergraduate preparatory courses as well. All of these then form an additional part of the students' program of study.

Students who are notified of their acceptance into graduate studies in Music are encouraged to prepare for the placement examinations by perusing the following general descriptions of the examinations. After a decision has been made on your admissibility to the graduate program and upon your acceptance of our offer of admission, these placement exam descriptions will be sent to you. The placement exams will be sent to you approximately one month after this date. You will have three weeks to complete and return them. You are not required to have an invigilator, but are expected to write these examinations unaided, without the use of text books and within the allocated time for each question. A list of books useful in preparation for the examinations can be found on page 3.

GENERAL DESCRIPTIONS

MUSIC TECHNOLOGY [Total duration of MUSIC TECHNOLOGY examinations: 10 hours]

Music Technology

Part 1 [2 hours]

-- Technological aspects (Non exhaustive list: MIDI, AES/EBU, File formats, Musical data delivery over the Internet, Software Environments for Music and Audio Production, Basics of Digital Audio, Number Systems).

Example questions:

1. What is the Nyquist frequency and why is it important for digital music?

2. What were the significances of the MIDI standard?

Part 2 [2 hours]

-- Acoustics and Musical Acoustics.

Example questions:

1. What is the difference between standing and traveling waves?

2. How does sound radiate from a clarinet?

Part 3 [2 hours]

-- Psychoacoustics

Example questions:

1. What acoustic parameters determine the pitch, timbre and loudness of a sound?

2. What is auditory masking?

3. What are the main principles of auditory scene analysis that affect the fusion of acoustic components into auditory events and the integration of successive events into auditory streams?

Part 4 [2 hours]

-- Computer Science (Algorithms, Data Structures, Real-Time Systems), Computer Science applied to Music (for instance software packages such as Max/MSP and MATLAB), Human-Computer Interaction.

Example questions:

1. Given any 12-tone row, write a program to generate its matrix.

2. Describe digital musical instruments.

3. What is a Hidden Markov Model and what is it commonly used for?

Part 5 [2 hours]

-- Sound Synthesis, Audio Processing, and Basics of Digital Signal Processing.

Example questions:

1. Approximately how many bytes are required to store two channels of 10 minutes of 16-bit 44.1kHz CD-quality audio?

2. Approximately how many operations are needed to FFT one channel of one second of 44.1kHz audio?

3. Slow moving amplitude modulation is also known as?

4. What is the main difference in the frequency-domain output of the ring modulation and the amplitude modulation?

5. What is the name of the commercially successfully synthesizer that made FM synthesis popular?

6. Approximately how much can we compress audio signals without losing any information?

7. Write Matlab code that defines the feedback comb filter in the figure (with M=6, b0 = 1, aM = 0.9) and plots its frequency response (3 lines should be sufficient).

8. Specify and substantiate at least two physical characteristics of vibrating guitar strings that are not accounted for by the one-dimensional wave equation.

SUPPLEMENTAL READING LIST

MUSIC TECHNOLOGY

Technological aspects:

Williams, D. B., & Webster, P. R. (2007). *Experiencing Music Technology: Software, Data, and Hardware* (3rd ed.). New York, Schirmer Books.

Pohlmann, K. C. (2011). *Principles of Digital Audio* (6th ed.) McGraw-Hill.

Acoustics, Psychoacoustics, and Musical Acoustics:

Roederer, J. G. (2008). *The Physics and Psychophysics of Music* (4th ed.). New York, Heidelberg: Springer Verlag.

Moore, B.C.J. (2012). *Introduction to the Psychology of Hearing* (6th ed.). San Diego, Academic Press.

Hall, D. E. (2001). *Musical Acoustics, An introduction* (3rd ed.). Belmont, CA: Wadsworth Publishing Company.

Benade, A. H. (1990). *Fundamentals of Musical Acoustics*. Dover Publications.

Computer Science and related topics:

Brassard G. & Bratley P. (1996). *Fundamentals of Algorithmics*. Upper Saddle River, NJ: Prentice-Hall.

Winkler, T. (1998) *Composing Interactive Music. Techniques and Ideas Using Max.* Cambridge, MA: The MIT Press. 368 pages.

Rowe, R. (2001). *Machine Musicianship*. Cambridge, MA: The MIT Press. Hardcover, 416 pages.

Sound Synthesis, Audio Processing, and Basics of Digital Signal Processing:

Roads, C. (1996). *Computer Music Tutorial*. Cambridge, MA: The MIT Press.

Dodge, C., & Jerse, T. A. (1997). *Computer Music: Synthesis, Composition, and Performance* (2nd ed.). New York, Schirmer Books.