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1 Introduction

This document describes the proposal for the Master of Arts degree granting program in Music Science and Technology.

1.1 Importance of Graduate-Level Program in Music Science and Technology

Music technology programs in academia began to surface in the 1970s, one of the most notable being CCRMA (Center for Computer Research in Music and Acoustics) at Stanford University perhaps best known for its contributions to music technology with innovations such as FM synthesis, physical modeling, and other groundbreaking research and active compositional activities. Since the 1970s and more recently for the majority of the top tier schools, music technology and computer music-based graduate programs have become commonplace in such schools as Brown University, Dartmouth College, Columbia University, Georgia Institute of Technology, Johns Hopkins University (Peabody Conservatory), MIT, Northwestern University, Princeton University, Rensselaer Polytechnic Institute, UCSD, Stanford University, University of Virginia, and University of Washington to name a few. The aforementioned schools offer Ph.D., D.M.A. and/or M.A. degrees and have been graduating unique, distinctive, and elite professionals who work in a variety of areas including academia, industry, and the arts.

The program at Tulane University is structured around interdisciplinary exploration of music, science, and technology. The two-year curriculum provides students exposure to the ins and outs of computer music through a number of core seminars offered within the program itself and also offers flexibility for the student to take courses in other departments such as the CCS (Center for Computational Science). The student’s research cumulates into a written master’s dissertation, which ranges from electroacoustic compositions of a variety of media, technical research in hardware and software, and theoretical writing in areas of computer music.

1.2 Career Opportunities Upon Completion of M.A. Program

Music-based Industry:
Composition, production, arranging, performance, sound engineering, audio-based journal/magazine editorship, sound design, etc.

Research-based Industry:
Software engineering (audio, information retrieval, audio compression, studio-based software, etc.), hardware engineering (digital audio equipment, musical controllers, etc.)
Arts:
Composition, performance, installations art, audio-video art, etc..

Academia:
Continuation in Ph.D./D.M.A. programs in Music Technology and Composition Professorship in Composition, Music Technology, Computer Science, and other relevant fields; technical director positions; audio engineers, etc.
2 Requirements and Direction of Program

The M.A. program in Music Science and Technology is structured around interdisciplinary and multidisciplinary research, study, and exploration. Interrelationships among music, technology, cognitive psychology, computer science, acoustics, music composition, and related disciplines will be the primary objective directed within a small, friendly, and intense environment for highly motivated students who wish to engage in creative and original research. Although the program will be housed, centered, and administered by the Music Department, graduate students, depending on interest, will be encouraged to engage in interdepartmental collaboration and activities. For example, a student may have 2nd readers for their Master’s thesis, take supplementary courses as needed, and solicit advice and expertise on projects by engineering faculty.

2.1 Requirements for Master of Arts in Music Science and Technology
Candidates for the M.A. degree in Music Science and Technology will complete at least 36 credits of coursework, write a Master’s thesis to be orally defended, and engage in concert production.

2.2 Coursework

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUSC 440/640</td>
<td>Music and Digital Signal Processing (3)</td>
<td>3 credits</td>
</tr>
<tr>
<td>MUSC 441/641</td>
<td>Music Performance Systems (3)</td>
<td>3 credits</td>
</tr>
<tr>
<td>MUSC 740</td>
<td>Musical Timbre: Multidimensional Analysis (3)</td>
<td>3 credits</td>
</tr>
<tr>
<td>MUSC 741</td>
<td>Seminar: Special Topics in Computer Music (3)</td>
<td>6 credits</td>
</tr>
<tr>
<td>MUSC 742</td>
<td>Directed Research I/II (2)</td>
<td>6 credits</td>
</tr>
<tr>
<td>MUSC 743</td>
<td>Analysis of Electronic and Computer Music Seminar (3)</td>
<td>3 credits</td>
</tr>
<tr>
<td>MUSC 744</td>
<td>Electroacoustic Music Composition</td>
<td>12 credits</td>
</tr>
<tr>
<td>MUSC 998</td>
<td>Master’s Research</td>
<td>36 credits</td>
</tr>
</tbody>
</table>

See appendix for details on courses.

2.3 Master’s Thesis
The Master’s thesis will include a detailed essay documenting technical, theoretical, or compositional research projects. Thesis advisors should normally be from the Music Department, but students may choose co-advisors or 2nd readers from outside departments approved by the principal advisor on a case-by-case basis.

2.4 Concert Production
Graduate students will produce at least one concert each term presenting original works. Each student will engage in producing, engineering, managing, and promoting the concert.
2.5 Entrance Requirements and Graduate Student Candidates
The ideal candidate will have a background in music and the sciences. However, this may not always be the case as it is not an easy task of finding such candidates as undergraduate curricula are not normally structured to produce such students. A case-by-case selection and consideration of each candidate has to be thoroughly conducted with an emphasis on portfolio of works (musical examples, research projects, critical writing examples, etc.). GRE scores must be submitted.

2.5.1 Graduate Student Candidates
Possible candidates may include students with concentration in backgrounds such as Music Composition/Performance, Computer Science, Engineering, Physics, Mathematics, Digital Media Arts (and Arts in general), and Communications. It is critical that candidates are highly self-motivated and eager to contribute to the field in Music Science and Technology. Collaboration with other students will be strongly encouraged. This will not be limited to specific projects but also to help foster an environment where students with strong technical background may help students with strong musical background and vice-versa.
3  Contact Information

Newcomb Music Department

Tae Hong Park (Assistant Professor in Music Department)
   216B Dixon Hall,
   Newcomb Music Department
   park@tulane.edu
   http://www.tulane.edu/~park
   504-247-1695 (office)
   504-304-2712 (home)

Program website
www.tulane.edu/~music/tmt
4. Appendix

A1. Core Music Science and Technology Courses

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MUSC 440/640</td>
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<td>3 credits</td>
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<td>Musical Timbre: Multidimensional Analysis (3)</td>
<td>3 credits</td>
</tr>
<tr>
<td>MUSC 741</td>
<td>Seminar: Special Topics in Computer Music (3)</td>
<td>3 credits</td>
</tr>
<tr>
<td>MUSC 742</td>
<td>Directed Research I/II (2)</td>
<td>4 credits</td>
</tr>
<tr>
<td>MUSC 743</td>
<td>Analysis of Electronic and Computer Music Seminar (3)</td>
<td>3 credits</td>
</tr>
<tr>
<td>MUSC 744</td>
<td>Electroacoustic Music Composition</td>
<td>12 credits</td>
</tr>
<tr>
<td>MUSC 998</td>
<td>Master’s Research</td>
<td>36 credits</td>
</tr>
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</table>

Additional Courses of Interest
Supplementary courses that MST graduate students may wish to take depending on specific interests.

<table>
<thead>
<tr>
<th>Course #</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSC 300/600</td>
<td>C++ Programming for Scientists and Engineers</td>
<td>3 credits</td>
</tr>
<tr>
<td>COSC 310/610</td>
<td>Data Visualization</td>
<td>3 credits</td>
</tr>
<tr>
<td>BMEN 606</td>
<td>Biomedical Acoustics</td>
<td>3 credits</td>
</tr>
</tbody>
</table>

A2. Description of Courses

MUSC 440/640 Music and Digital Signal Processing (3 credits)
One of the core courses for graduate students and advanced undergraduate students with permission from instructor. The aim of this course is to expose the student to the breadth and depth of signal processing in musical applications starting with basics and focusing on issues concerning sound and music (already in place).

MUSC 441/641 Music Performance Systems (3 credits)
One of the core courses for graduate students and advanced undergraduate students with permission from instructor. The student will learn about human computer interface issues with an emphasis on musical applications and controller design using sensors and microcontrollers (already in place).

MUSC 740 Musical Timbre: Multidimensional Analysis (3 credits)
This is a seminar that focuses on timbre analysis and computer techniques for spectral and temporal breakdown and salient feature extraction of timbral dimensions. The course will present psychoacoustic concepts relevant to timbre perception and history of timbre research including multi-dimensional scaling. Software implementation in Matlab/C/C++/Java and a look at automatic musical
instrument timbre recognition using various techniques including lazy learning and supervised as well unsupervised pattern recognition will be addressed.

MUSC 741 Seminar: Special Topics in Computer Music (3 credits)
This is an open-ended seminar. The topics of the seminar will be determined on the student’s interests during a particular year as well as allowing the instructor the flexibility to hold a seminar pertinent to current trends and issues. Some possible topics may include the following:

*Psychoacoustics and Music*
Psychoacoustics and Music is a graduate seminar in psychoacoustics with emphasis on musical sound. The student will consist of lectures which will deal various issues regarding how humans perceive (or do not perceive) sound objects, musical patterns, time, loudness, and timbre. We will begin the semester with the auditory system learn about physical limitations of the ears and work our way to more gray areas such ask gestalt theories, streaming, similarity measurements, and masking.

*Information Retrieval in Music*
This seminar will focus on the field of research concentrating in Information Retrieval for music. An introduction and review of signal processing techniques, spectral analysis, and temporal analysis techniques will start the course. Further into the semester topics such as fingerprinting, beat-tracking, tempo-analysis, musical genre classification, voice identification, musical timbre identification, and query-by-humming will be covered.

*Voice as musical material*
- The Voice: formants, noisiness, periodicity, resonance structures
- Voice CODECS, LPC

*Interactive musical systems*
- Max/MSP, Supercollider, Csound
- Acoustic instruments in conjunction with the computer
- Sonification and mapping
- HCI and performance issues

*Sound Synthesis and Focus on Physical Modeling*
- Waveguide
- Modal synthesis
- Spectral synthesis

*Compression Algorithms*
- Lossless and lossy algorithms
- MPEG, SAOL, LPC, etc.
Programming Languages in Music
- Languages: C/C++, Java, Matlab, …
- Protocols: MIDI, OSC
- Tools: Max/MSP, Supercollider, CSound

Machine Perception
- Timbre, algorithmic composition, control mapping, etc.
- NN, SOFM, BP, RBFN, EBFN etc.

Improvisation
- Computer-based performances: laptop performances
- Computers and instruments
- Instruments alone / custom instruments
- Tape and instruments
- Combinations of all of the above.

MUSC 742 Directed Research (2 credits)
Directed Research allows the student to work with any of the faculty members on a specific topic. This may be compositional, technical, theoretical, or any topic that adheres to music technology or composition. It would ideally be preliminary work towards a thesis topic. Cross departmental research if agreed upon by both parties will be encouraged.

MUSC 743 Analysis Electronic and Computer Music Seminar (3 credits)
This seminar will be structured around critical listening, music analysis, and group discussions. Students will analyze significant compositions that have shaped computer music today and also review the classics in the electronic music repertoire. The knowledge and technique for critique of electronic works will ultimately help the students in their own creative work.

MUSC 744 Electroacoustic Music Composition (3 credits)
Seminar to be taken each semester 4 times total – Fall and Spring. Each course will be taught on a rotating basis by faculty members: Professors B. Jazwinski, E. Shoot, T. H. Park. Composition seminars explore different compositional techniques, issues in aesthetics, and exercises allowing the students to get the opportunity to be exposed to diverse areas in composition encompassing acoustic, electronic, electroacoustic, and computer music.
A3. Master’s Program Course of Study
The curriculum has been designed to make the two years an intensive program of study to prepare the student for the next step in academia, industry, or the arts. First year students will be required to be in residence during the summer.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tbody>
<tr>
<td>First/Second</td>
<td>Composition</td>
<td>Composition</td>
<td>Musical Performance Sys. or Master’s Thesis</td>
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<tr>
<td></td>
<td>Music Analysis</td>
<td>Directed Research I</td>
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<tr>
<td></td>
<td>DSP and Music (odd years)</td>
<td>Musical Performance Sys. or Master’s Thesis</td>
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<tr>
<td>Second/First</td>
<td>Composition</td>
<td>Composition</td>
<td>Musical Performance Sys. or Master’s Thesis</td>
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<td></td>
<td>Directed Research III</td>
<td>Special topics</td>
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</tr>
<tr>
<td></td>
<td>Musical Timbre (even years)</td>
<td>Master’s Thesis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(even years)</td>
<td>Musical Performance Sys.</td>
<td>(odd years)</td>
</tr>
</tbody>
</table>
A4. Publications


