

APPROVED BY SENATE
05/01/2017



Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE: Proposal to Establish a New Degree, Bachelor of Science in Computer Science and Music (CS + Music), in the School of Music, College of Fine and Applied Arts

SPONSOR: Dr. Heinrich Taube, Professor of Music, School of Music, College of Fine and Applied Arts, 217-244-2684, taube@illinois.edu; Dr. Linda R. Moorhouse, Associate Director for Undergraduate Affairs, School of Music, College of Fine and Applied Arts, 217-244-4108, moorhouz@illinois.edu; Dr. Paris Smaragdis, Assistant Professor, Computer Science and ECE, 217-265-6893, paris@illinois

COLLEGE CONTACT: Linda Robbennolt, Associate Dean for Undergraduate Academic Affairs–Academic Programs, College of Fine and Applied Arts, 217-333-6061; weasel@illinois.edu

BRIEF DESCRIPTION: This is a proposal to establish a new music degree in the School of Music in the College of Fine and Applied Arts. The Bachelor of Science in Computer Science and Music (CS + Music) would be the first CS + X degree in the College of Fine and Applied Arts. The goal of this degree is to graduate two kinds of students: one who is focused on the sonic arts employing state-of-the-art technology, and the other a computer scientist with strong music/audio understanding who will advance the state of art in music and audio technology.

JUSTIFICATION: **The University of Illinois School of Music** has a long history in technological innovation. This prior work involved a strong interdisciplinary component and spanned multiple departments within the School. In the last few years however, these inter-departmental connections have become more difficult. As music technology becomes more sophisticated, there is real need to partner with an engineering department in order to offer our technology-oriented music students a strong foundation that will help them stay ahead of the competition. This proposed degree program will also help create a stronger connection between the School of Music and our many alumni in the digital media industry, broadening opportunities for our students.

The Computer Science (CS) Department at the University of Illinois at Urbana-Champaign is committed to spreading the understanding and application of computational methods in areas outside of science and engineering. This new major will pair the foundational study of computer science with the type of creativity and imagination that is prevalent in arts disciplines. Given the strong connection between music technology and major technological trends, both disciplines stand to gain from new perspectives and the incorporation of highly creative and passionate students.

The University of Illinois has historically been a forerunner in music and audio technology. As early as the 1920s, Professor of Electrical Engineering Joseph Tykociner was one of the first researchers placing sound on film. In a series of firsts in the 1950s, Professor Lejaren Hiller established the Experimental Music Studio, the first of its kind in the Western world. With Leonard Isaacson, he used the first computer built and owned by a US university, ILLIAC 1, to compose one of the first substantial pieces of music to be written algorithmically and with Robert A. Baker,

developed one of the first music composition computer languages. Many more important and influential music and audio developments took place at the University of Illinois at Urbana-Champaign, but inexplicably there was never an undergraduate program that fostered and advanced education on these subjects. We believe the proposed CS + Music program will fill that need and become an influential force in shaping audio and music technology today.

The University of Illinois School of Music is an accredited member of the National Association of Schools of Music (NASM). This national body conducts outside reviews of music programs and curriculum every ten years. The School of Music works within the curriculum framework of NASM on all of our music major and music minor programs in order to maintain accreditation. The proposed Bachelor of Science in Computer Science and Music (CS + Music) curriculum does not fit into one of our existing music degrees (Bachelor of Music, Bachelor of Music Education, Bachelor of Arts in Music). According to NASM personnel and guidelines, “the CS + Music curriculum is a liberal arts degree which best fits a Bachelor of Science (in music).” Their recommendation for our CS + Music degree as a Bachelor of Science (in music) rests on the fact that our CS + Music curriculum “has more than one-third of the curriculum devoted to math and science, far above and beyond the definition of a Bachelor of Arts (in music) degree curriculum.”

The new proposed degree and program will enable the University of Illinois to join innovators like Stanford and the University of Southern California, who have already begun integrating music technology education and CS. Stanford has CS + X programs that were implemented in Fall 2014, with its two first degrees in CS + Music and CS + English. **It should be noted that Stanford’s music-related patent royalties and proceeds from their iOS apps fully fund about 30 RAs from their equivalent graduate program.* The University of Southern California recently established the “USC Jimmy Iovine and Andre Young Academy for the Arts, Technology and the Business of Innovation.” This USC program has an even broader vision than others. It involves their business school as well, and places additional emphasis on the transformative impact of technological innovation on arts businesses. The USC program was established using a 70 million dollar gift by Iovine and Andre, who were highly successful in the music recording industry even before Apple bought their company for three billion dollars. Carnegie Mellon University, the University of Michigan, the University of Rochester and the University of Miami are all strong players newly active in the field, and we must take action now or lose our place among its leaders.

BUDGETARY AND STAFF IMPLICATIONS:

1) Resources

- a. How does the unit intend to financially support this proposal?

Any additional needs will be financed through the ca. \$5,000/year tuition differential that Engineering students normally incur. Students in the CS + Music major will follow the current arrangement for CS + X: each will be coded under ENG for tuition assessment. FAA and ENG have agreed to evenly split both the tuition differential and the majors fee for CS+Music students. Music and CS will use funds from the tuition differential to accommodate any increase in teaching loads. The School of Music will shoulder the responsibility of advising. Prospective students must be admitted to both Computer Science and Music in order to pursue this degree.

- b. How will the unit create capacity or surplus to appropriately resource this program?

Most of the core curricula are already being taught in CS and Music, so no additional funds should be necessary to offer the courses for the degree. In addition, Music has hired a new music technology faculty member. Prof. Paris Smaragdis (CS) and Prof.

Heinrich Taube (Music) and the School of Music will manage any new courses needed.

- c. Will the unit need to seek campus or other external resources?

No. Beyond the service of one faculty member in Computer Science, no additional resources will be sought.

- d. Please provide a letter of acknowledgment from the college that outlines the financial arrangements for the proposed program.

Please see attached letter from FAA Dean.

2) Resource Implications

- a. Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.

There will be no obvious impact on faculty resources beyond the need to use one faculty member in Computer Science to teach one course per year. Computer Science students will be able to take the CS + Music School of Music courses as well.

- b. Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units.

CS + Music students will be taking courses that already exist in Music, Computer Science, Math, and Electrical Engineering. Two new music courses (MUS 105, MUS 205) will be taught by existing faculty in the School of Music (Prof. Heinrich Taube). A new course in Audio Signal Processing will be under the CS rubric and will be taught by Prof. Paris Smaragdis. Initially we would enroll 1-10 freshmen a year in the new program, imposing no burden on any department. After a few years of operation we expect to admit 20-30 freshmen for peak enrollment. Since our CS + Music majors will need to be admitted by Computer Science, this works into their yearly threshold for new class admits.

The program was developed in continual consultation with its multiple stakeholders among the faculty and administration of the relevant units, including Professors Taube and Smaragdis, Dr. Leonard Pitt, Director of Undergraduate Programs and Associate Department Head in Computer Science; Dr. Linda Moorhouse, Associate Director for Undergraduate Affairs, School of Music, FAA; Linda Robbennolt, Associate Dean for Academic Affairs-Academic Programs, FAA; Paul Redman, Executive Assistant Dean for Administration, FAA; and several administrators from Engineering.

Please see attached letters of support from CS and ECE.

- c. Please address the impact on the University Library.

Please see attached letter from the University Library.

- d. Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.).

Existing facilities are adequate. Students of this program also will have access to the School of Engineering's existing infrastructure (e.g. EWS). This will meet the program's principal educational and research needs.

For new degree programs only:

- 3) Briefly describe how this program will support the University's mission, focus, and/or current priorities. Include specific objectives and measurable outcomes that demonstrate the program's consistency with and centrality to that mission.

This degree addresses two ongoing shifts. First, music (and art in general) increasingly relies on computing technologies. It is virtually impossible to experience contemporary music recordings that have not been somehow touched by a computer, whether at the creative phase, the production phase, or dissemination phase. Illinois has historically been at the forefront of technology research in the sonic arts (e.g. the Illiac Suite compositions, the EMS, sound on film, etc.), but has never had a degree program that can capitalize on this research strength. Second, computer science is increasingly paying attention to societal impact. This means that computing graduates need to be cognizant of the areas where they apply their skills (in this case, music and sound). The goal of this degree is to address these shifts by producing musicians who understand computing, and computer scientists who understand music and sound in order to best apply their technology skills to these fields. This supports the mission of our university by expanding knowledge, creating a new framework to seed modern artistic expression, and creating technological opportunities with wide societal appeal for both musicians and computer scientists. Interdisciplinary degrees like this can help us explore new teaching techniques and focus on research areas for which we don't currently have the necessary mass. Furthermore, as described in #4 below, music and audio are very active markets.

The primary objective of this degree is to produce artists and technologists who will shape the future of music and sound. These graduates will further solidify our position as a forward-looking university impacting the intersection of arts and technology.

- 4) Please provide an analysis of the market demand for this degree program. What market indicators are driving this proposal? What type of employment outlook should these graduates expect? What resources will be provided to assist students with job placement?

The goal of this degree is to graduate two kinds of students; one who is focused on the sonic arts employing state-of-the-art technology, and the other a computer scientist with strong music/audio understanding who will advance the state of art in music and audio technology. Market demand is especially strong and easy to quantify in content-creation fields. As modern music-making and its use of technology evolves, careers in education and content-creation will demand musicians who are technologically sophisticated. Graduates with a deep understanding of audio and computation can also be leaders in the fields of speech recognition, audio/speech communications, audio compression, etc. Consider the impact of music and audio technologies in the last few decades, such as the CD, the MP3, p2p music sharing, iTunes/iPod, Spotify, etc. These are all, independently, multi-billion dollar industries that have been shaping our daily lives and are powered by people with a deep understanding of both music and technology. There is high demand for such software engineers today, as evidenced by the activities of companies such as Apple, Google and Spotify, as well as many other highly-valuated startups. In addition, there is strong demand from the movie and music industry (e.g. Dolby, Sony, Hollywood studios) for technologists that can help incorporate new audio technologies in media production. Finally, there is a robust market for mobile apps for music creation.

- 5) If this is a proposed graduate program, please discuss the programs intended use of waivers. If the program is dependent on waivers, how will the unit compensate for lost tuition revenue?

N/A

DESIRED EFFECTIVE DATE: Fall 2018

STATEMENT FOR PROGRAMS OF STUDY CATALOG:

BS in CS + Music

Professor Jeffrey Magee, Director
School of Music
2040 Music Building, 1114 West Nevada, Urbana
(217) 244-6449
<http://music.illinois.edu/>

For the Degree of Bachelor of Science in Computer Science and Music (CS + Music)

The Bachelor of Science in Computer Science and Music (CS + Music) is designed for students who plan to pursue a career in music technology, as well as students who want to push the state-of-the-art in music composition and explore new avenues of expression. This degree will prepare students for advanced study at the graduate level for many existing programs in music and audio technology, as well as equip them with the proper skills to successfully join and lead a vibrant workforce centered around the creation and distribution of entertainment media through constantly evolving technological platforms.

The CS + Music curriculum provides a broad knowledge of the theory, design, and application of computer systems integrated with the theory, history, and application of music. The curriculum is formed around courses in music, mathematics, science, and computation. Advanced coursework includes either a senior thesis or a senior project. A minimum of 120 hours is required for graduation.

For admission requirements for the Bachelor of Science in CS + Music, please see the School of [Music's Admissions website](#) or contact the Music Admissions Office:

Music Admissions Office
School of Music
1114 W. Nevada Street
Urbana, IL 61801
Phone: (217) 244-7899
E-mail: musicadmissions@illinois.edu

Signatures:

Jeffrey Meyer
Unit Representative:

4/10/17
Date:

Jack Rohlfen
College Representative:

4-10-17
Date:

Graduate College Representative:

Date:

Council on Teacher Education Representative:

Date:

Appendix A:

BACHELOR OF SCIENCE in COMPUTER SCIENCE and MUSIC (CS + MUSIC)

Overview of Curricular Requirements

The curriculum requires a minimum of 120 hours for graduation and is organized as shown below. Students who wish to study voice or an instrument for credit are required to satisfy the instrumental or vocal qualifying audition designed for students taking applied lessons in the School of Music; credits earned in applied music beyond the performance studies keyboard requirement stated below are considered elective.

General Education Requirements

General Education Requirements	Hours
Composition I	4
Advanced Composition	3
Humanities and the Arts - <i>fulfilled by MUS 313 and MUS 314</i>	6
Cultural Studies: Western Comparative Culture(s) and Non-Western	3
Cultural Studies: Non-Western Culture(s)	3
Cultural Studies: U.S. Minority Culture(s)	3
Natural Sciences and Technology	6
Social and Behavioral Sciences	6
Quantitative Reasoning I and II – <i>fulfilled by CS 125 and CS 225</i>	6
Foreign Language	0-12
	40-52

CS + Music: Music Requirements

Course	Music Theory Core	Hours
MUS 101	Music Theory and Practice I	2
MUS 102	Music Theory and Practice II	2
MUS 201	Music Theory and Practice III	2
MUS 107	Musicianship I	2
MUS 108	Musicianship II	2
MUS 207	Musicianship III	2
MUS 208	Musicianship IV	1
	Musicology Core	
MUS 110	Introduction to Art Music–International Perspective	2
MUS 313	The History of Music I ¹	3
MUS 314	The History of Music II ¹	3
	Performance Studies Core ²	
MUS 172	Group Instruction in Piano for Music Majors I (performer)	2
MUS 173	Group Instruction in Piano for Music Majors II	2
	Other Required Music Courses	
MUS 105	Computation and Music I	2
MUS 205	Computation and Music II	2
MUS 299	Thesis Adv/UG Honors	2
MUS 404 or MUS 408	Contemporary Composition Techniques <i>or</i> Computer Music	3
MUS 407	Electroacoustic Techniques I	3
MUS 409	Electroacoustic Techniques II	2
MUS 400-level	Advanced music theory	3
MUS 400-level	Advanced music history	3
		45

CS + Music: Math and Science Requirements

Course	Engineering, Math and Computer Science Courses	Hours
CS 125	Intro to Computer Science ³	4
CS 126	Software Design Studio	3
CS 173	Discrete Structures	3
CS 225	Data Structures ³	4
CS 233	Computer Architecture	4
CS 241	System Programming	4
CS 361	Probability and Statistics for Computer Science ⁴	3
CS 374	Introduction to Algorithms & Models of Computation	4
CS 421	Programming Languages & Compilers	3
CS 498	Audio Signal Processing	3
ECE 402	Electronic Music Synthesis	3
MATH 220	Calculus I ⁵	5
MATH 231	Calculus II	4
MATH 225	Introductory Matrix Theory	2
		49

- 1 Completion of both MUS 313 and MUS 314 meets the general education requirement for Humanities and the Arts.
- 2 All students must demonstrate keyboard competency by examination when they matriculate or by enrolling in MUS 172 and/or MUS 173. It is possible to proficiency out of group piano courses through proficiency examination.
- 3 Completion of both CS 125 and CS 225 meets the general education requirement for Quantitative Reasoning I and Quantitative Reasoning II.
- 4 Students who are more interested in systems building can substitute CS 427 (Software Engineering I) for CS 361.
- 5 Students must take the ALEKS placement exam for course entry.

BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND MUSIC (BS in CS + Music — Sample 4-year plan)

Year 1		Hours	Year 2		Hours	Year 3		Hours	Year 4		Hours
FALL	MUS 101 (Music Theory & Practice I)	2	MUS 201 (Music Theory & Practice III)	2	MUS 313 (The History of Music I) ²	3	MUS 299 (Thesis Adv/UG Honors— Research)	1			
	MUS 107 (Musicianship I)	2	MUS 207 (Musicianship III)	2	MUS 407 (Electroacoustic Techniques I)	3	MUS 4xx (Advanced Music History course)	3			
	MUS 105 (Computation & Music I) ¹	2	MUS 110 (Introd Art Mus: Intl Perspective)	2	CS 241 (System Programming)	4	CS 374 (Intro to Algorithms & Models of Computation)	4			
	CS 125 (Intro to Computer Science) ²	4	MUS 172 (Group Piano I) ⁴	2	General Education Courses	6	ECE 402 (Electronic Music Synthesis)	3			
	MATH 220 (Calculus I) ³	5	CS 225 (Data Structures) ²	4			General Education Course	4			
	FAA 101	1	MATH 225 (Introductory Matrix Theory)	2							
	Semester Total	16	Semester Total	14	Semester Total	16	Semester Total	15			
SPRING	MUS 102 (Music Theory and Practice II)	2	MUS 208 (Musicianship IV)	1	MUS 314 (The History of Music II) ²	3	MUS 299 (Thesis/Adv UG Honors— Writing and Presentation)	1			
	MUS 108 (Musicianship II)	2	MUS 205 (Computation & Music II) ¹	2	MUS 409 (Electroacoustic Techniques II)	2	MUS 404 (Contemp Composition) or MUS 448 (Computer Music)	3			
	CS 126 (Software Design Studio)	3	MUS 173 (Group Piano II) ⁴	2	CS 361 (Probability & Statistics for CS) ⁵	3	MUS 4xx (Advanced Music Theory course)	3			
	CS 173 (Discrete Structures)	3	CS 233 (Computer Architecture)	4	CS 498 (Audio Signal Processing)	3	CS 421 (Programming Languages & Compilers)	3			
	MATH 231 (Calculus II)	4	General Education Courses	6	General Education Course	4	General Education Course	4			
	RHET 105	4									
	Semester Total	18	Semester Total	15	Semester Total	15	Semester Total	14			

¹ New Music Course

² General Education course plan includes credit for QRI, QR2 and HUM & ARTS with these required courses: CS 125, CS 225 and MUS 313, MUS 314.

³ Students must take the ALEKS placement exam for course entry.

⁴ It is possible to take a proficiency exam for Group Piano courses: MUS 172 and MUS 173.

⁵ Students who are more interested in systems building can substitute CS 427 (Software Engineering I) for CS 361.

Music courses + FAA 101
46 hours

CS Courses
35 hours

Math courses
11 hours

ECE course
3 hours

General Education Requirements (outside of courses in Footnote #2)
28 hours

V-18_March 2017

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

College of Fine and Applied Arts

Office of the Dean
100 Architecture Building
608 East Lorado Taft Drive
Champaign, Illinois 61820



17 November 2016

Senate Educational Policy Committee
University of Illinois
608 South Wright Street
Urbana, IL 61801

Dear Committee:

The College of Fine and Applied Arts acknowledges the School of Music's proposal to establish a new Bachelor of Science in Computer Science and Music (BS in CS + Music) degree program.

No additional external resources will be required by the School of Music to deliver this curriculum. Revenue generated through the campus budget model will be credited to the School of Music consistent with FAA's budgeting procedures.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kathleen Harleman', with a long horizontal flourish extending to the right.

Kathleen Harleman
Acting Dean

UNIVERSITY OF ILLINOIS
AT URBANA - CHAMPAIGN

University Library
Office of Dean of Libraries
and University Librarian
230 Main Library, MC-522
1408 West Gregory Drive
Urbana, IL 61801



March 28, 2016

Linda Robbennolt
Associate Dean, Academic Programs
College of Fine and Applied Arts
408 E Peabody Dr.
M/C 590

Dear Prof. Robbennolt:

Thank you for sending over the proposed curricular changes in the College of Fine and Applied Arts that you transmitted on March 24, 2016. Those proposals included:

- Proposal to Revise the Undergraduate Music Minor in the School of Music, College of Fine and Applied Arts
- Proposal to Establish a New Degree, Bachelor of Science in Computer Science and Music (CS+Music), in the School of Music, College of Fine and Applied Arts
- Proposal to Revise the Bachelor of Science in Architectural Studies (BSAS) in the School of Architecture, College of Fine and Applied Arts.
- Proposal to Revise the Master of Architecture (M.Arch) in the School of Architecture, College of Fine and Applied Arts.

Based upon the documents received, it is our belief that there will be no significant impact on collection development, instruction, or other operations.

If additional services or materials are required as the program develops, we will be happy to discuss those needs as they emerge.

Sincerely,



John P. Wilkin
Junita J. and Robert E. Simpson
Dean of Libraries and University Librarian

e-c: Kirstin Dougan
Melanie Emerson
Thomas Teper
John Wagstaff

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Computer Science
201 North Goodwin Avenue
Urbana, IL 61801-2302 USA



February 6, 2017

Linda Robbennolt
Associate Dean for Undergraduate Academic Affairs
Academic Programs, College of Fine and Applied Arts
University of Illinois

Dear Professor Robbennolt,

I am pleased to let you know that the Computer Science faculty enthusiastically approved the CS + Music proposal that we have been jointly working on during the last year, and is in full support of the new program. Based on the many overlaps outlined in the proposal we think that this is a very natural fit and an excellent opportunity for both CS and the School of Music, as well as for future students whose interests align with the program.

We have evaluated our current course offerings and how they might be affected by the influx of the anticipated CS+Music majors, and do not anticipate any problems in ensuring that they will have access. Moreover, the impact on course enrollments should be minimal, as these new majors will represent only a very small fraction relative to the current size of those courses. Finally, the CS department is in a growth phase, having added nine faculty (tenure track plus instructional) last year, and plan to hire another eight this year. The addition of these faculty should allow us to grow our course offerings where most needed.

Finally, as indicated in the proposal, any new resources needed (e.g. increase in advising, laboratory space, equipment, etc.) resulting from the new CS+Music (and other CS+ X) programs will be supported by the equal sharing of the differential tuition and the majors fee.

We look forward to partnering with you on this exciting new program.

Sincerely,

A handwritten signature in black ink, appearing to read 'Leonard Pitt', written over a horizontal line.

Leonard Pitt
Professor and Associate Head
Director of Undergraduate Programs
Department of Computer Science
University of Illinois. Urbana, IL 61801
Ph: 217-333-7505. Email pitt@illinois.edu

Cc: Andreas Cangellaris, Dean, College of Engineering
Martin Wong, Executive Associate Dean College of Engineering
Rob Rutenbar, Head, Department of Computer Science

From: "Kudeki, Erhan" <erhan@illinois.edu>
Date: Wednesday, March 1, 2017 at 6:03 PM
To: "Moorhouse, Linda" <moorhouz@illinois.edu>
Cc: "Kudeki, Erhan" <erhan@illinois.edu>, "Taube, Heinrich K" <taube@illinois.edu>, "Smaragdis, Paris" <paris@illinois.edu>, "Haken, Lippold" <l-haken@illinois.edu>
Subject: letter

Dear Linda,

I am writing to let you know that ECE will be happy to support the CS+Music program via its course offerings. I am hoping that the number of seats needed by CS+Music students will be manageable at least at the beginning and some adjustments can be made as needed if/when the program grows. ECE 402 in particular will be open to your students as your program gets going. Let me know if you need any further information about our support of the program.

Best regards,

Erhan Kudeki

Erhan Kudeki Tel: 217 265 0128 erhan@illinois.edu
Professor and Associate Head for Undergraduate Affairs
Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign
2080 ECEB, 306 N. Wright St., Urbana, IL 61801

UNIVERSITY OF ILLINOIS
AT URBANA - CHAMPAIGN

EP.17.80

Office of the Provost and Vice Chancellor for Academic
Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820



March 8, 2017

Bettina Francis, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Francis:

Enclosed is a copy of a proposal from the College of Fine and Applied Arts to establish a Bachelor of Science with the major in Computer Science and Music (CS + Music).

Sincerely,

A handwritten signature in cursive script, appearing to read 'Kathryn A. Martensen'.

Kathryn A. Martensen
Assistant Provost

Enclosures

c: L. Robbennolt
H. Taube
L. Moorhouse
P. Smaragdis
A. Edwards