Research Opportunities

Research participation by students in the program is strongly encouraged. Projects may be defined in ongoing areas of research in the University’s Music Research Lab including: empirical physical modeling of instruments for musical sound synthesis, automated music transcription, recognition and representation of musical expression, keyboard haptics, pipe organ acoustics, sound visualization tools for music pedagogy, and spatial audio. Students also may define MS projects on topics of their own choosing.

For Students with a non-EE background

Students with a background in another field of engineering, computer science, science or mathematics are also encouraged to apply. Interested students with undergraduate degrees in music or music and recording technology and background courses in science and mathematics through the sophomore level are encouraged to contact the program to discuss an appropriate bridging program to MS-level studies in ECE. Up to 3 ECE courses at the undergraduate level may be taken as part of the MS program of study.

The online application is available at:
http://www.ece.rochester.edu/html/graduate/grad_appn.html

To learn more about the research activities of the Music Research Lab visit:
http://smt.esm.rochester.edu/mrl/

Send email inquiries to: eegrinfo@ece.rochester.edu
Curriculum

The Program of study leading to the MSEE degree requires 30 credit hours of courses and research and may be completed in one calendar year. In Plan A, students take courses, conduct research and write a MS Thesis. In Plan B up to 6 credit hours of independent reading and research may be included in the program of study.

Typical Plan A Program (Thesis Option) *

Fall Term (14 credits)
ECE433 – Musical Acoustics (4 credits)
ECE446 – Digital Signal Processing (4 credits)
ECE479 – Audio Recording (2 credits)
ECE491 – Master’s Reading Course (4 credits)

Spring Term (12 credits)
ECE471 – Computational Models of Music (4 credits)
ECE472 – Audio and Music Signal Processing (4 credits)
ECE495 – Master’s Research in ECE (4 credits)
ECE495 – Master’s Research in ECE (4 credits)

Summer
ECE495 – Master’s Research in ECE (4 credits)

Total of MS Reading & Research credit hrs for the MS thesis must be between 6-12 credits

Typical Plan B Program (non-Thesis Option)

Fall Term (14 credits)
ECE433 – Musical Acoustics (4 credits)
ECE446 – Digital Signal Processing (4 credits)
ECE479 – Theory and Practice in Audio Recording (2 credits)
Elective Course (4 credits)

Spring Term (12 credits)
ECE471 – Computational Music (4 credits)
ECE472 – Audio and Music Signal Processing (4 credits)
Elective Course (4 credits)

Summer or the following Fall Term
ECE491 – Master’s Reading Course, ECE432 or other Elective Course

Elective courses may be selected in related fields of EE such as ECE440 - Random Processes, ECE432 - Acoustic Waves, Image Processing, Communications, Computer Architecture, Electronics and Integrated Circuits. Electives in Music and other fields of Science and Engineering may be included.

Course Descriptions

ECE433: Musical Acoustics - Engineering aspects of acoustics. Review of oscillators, vibratory motion, the acoustic wave equation, reflection and transmission, and radiation and reception of acoustic waves. Additional topics as time and interests allow, such as resonators, hearing and speech, architectural and environmental acoustics. (Fall)

ECE446: Digital Signal Processing - Review of discrete-time signals and systems, analysis and design of discrete-time signals and systems, including: difference equations, discrete-time filtering, z-transforms, A/D and D/A conversions, multi-rate signal processing, FIR and IIR filter design, the Discrete Fourier Transform (DFT), circular convolution, Fast Fourier Transform (FFT) algorithms, windowing, and classical spectral analysis. (Fall)

ECE471: Computational Music - Fundamentals of computational music including topics in modern music theory & music representation, encoding of music information, musical sound representation and compression, automated music transcription, human-computer music interfaces & music informatics. (Spring)

ECE472: Audio and Music Signal Processing - Acoustics and Digital Signal Processing techniques applied to the analysis and synthesis of musical sound. Topics include sampling, quantization and audio quality metrics, time-frequency analysis and sound representations, audio filter design and implementation, musical sound synthesis techniques including spectral-based synthesis and physical modeling - additional special topics based upon class interests. (Spring)

ECE479: Theory and Practice in Audio Recording - Aspects of audio recording techniques for non-music majors. Hands-on introduction to microphone techniques, recording hardware and software, digital editing, room acoustics, and mixing and mastering. The course assumes some technical knowledge of signal processing but emphasizes musical aspects of the recording process. Evaluation is based on class participation and a final project, either a recording session of a University Musical Ensemble, or research paper on a topic related to contemporary recording and sound. (Fall)

ECE432: Introduction to Acoustical Waves - Topics include the acoustic wave equation; plane, spherical, and cylindrical wave propagation, reflection and transmission at boundaries, normal modes, absorption and dispersion, radiation from points, spheres, cylinders, pistons, and arrays; diffraction; nonlinear acoustics.

ECE440: Introduction to Random Processes - Random signals & noise in linear systems for design & analysis of communication & signal processing systems. Topics in probability theory, random variables, vectors, & sequences (random walk, Martingales, ARMA model, Markov chains), processes (Poisson, Gaussian, Wiener, Markov), stationary and cyclostationary processes, process inputs to linear systems, ergodicity, filtering, linear estimation, bandlimited and bandpass processes.