ECE GRADUATE ORIENTATION

August 14, 2019
MS PROGRAM
The MS Program is designed to give you a **solid education in a specialized field**. In the first 1-2 semesters students primarily take courses to fulfill degree requirements. In the next 1-2 semesters, students focus on their **project/thesis**.

**Note:** The course workload is typically heavier than in college, the courses are more demanding and much more is expected from the students at the MS level.

Students choose one of two options depending on educational and professional goals:

**Project path (non-thesis):**
- Students collaborate with industry partners in projects, perform a research project, do an internship project or work in a relevant project.
- Concludes with a Project Report and technical discussion and or presentation.

**Research path (thesis):**
- Students work on industrial or academic research.
- Concludes with a Thesis and final oral defense.

**Different paths**

**Same diploma**
# MS non-thesis Requirements

## MS Project Path (Non-Thesis): Minimum 30 credits*

<table>
<thead>
<tr>
<th>Letter-graded graduate courses</th>
<th>Minimum 24 credits</th>
<th>ECE Graduate Courses: Minimum 15 credits ***</th>
</tr>
</thead>
<tbody>
<tr>
<td>*** ECE courses numbered at 5000 &amp; above are considered graduate level. ECE courses numbered at 6000 &amp; above are considered advanced level excluding ECE 6070.</td>
<td></td>
<td>Advanced ECE Graduate Courses Minimum 6 credits ***</td>
</tr>
<tr>
<td>ECE 7080 Ethics and Professionalism</td>
<td>1 credit</td>
<td>ECE 6070 (Project Management Course) Mandatory; does not count as an advanced course</td>
</tr>
<tr>
<td>Individual Studies</td>
<td>Maximum 5 credits **</td>
<td>Courses in a related field Maximum of 9 credits such as engineering, biological sciences, physics, math, chemistry, business, economics, ACCAD and statistics.</td>
</tr>
<tr>
<td>MS Non-Thesis Exam</td>
<td>Project requirements</td>
<td>Mandatory for those admitted Autumn 2015 and after.**</td>
</tr>
</tbody>
</table>

* Submit an advisor-approved MS plan of study to the ECE Program Coordinator by the end of the first semester.

** Ohio State graduates who passed ECE 3080 are automatically exempt, and the Individual Studies maximum increases by 1 credit.

Note that before starting the Non-Thesis Exam projects, students need advisor approval. In addition, students may be required to submit a one-page project proposal to their advisor for approval.
### MS Research Path Option (Thesis): Minimum 30 credits*

<table>
<thead>
<tr>
<th>Letter-graded graduate courses</th>
<th>Minimum 18 credits</th>
<th>ECE Graduate Courses</th>
<th>Minimum 9 credits ***</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 7080 Ethics and Professionalism</td>
<td>1 credit</td>
<td>Advanced ECE Graduate Courses</td>
<td>Minimum 6 credits ***</td>
</tr>
<tr>
<td>ECE 6999 Thesis Research</td>
<td>At least 10 credits</td>
<td>Courses in a related field</td>
<td>Maximum of 9 credits such as engineering, biological sciences, physics, math, chemistry, business, economics, ACCAD, statistics</td>
</tr>
<tr>
<td>Individual Studies (ECE 6193)</td>
<td>Maximum 1 credit**</td>
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</tr>
<tr>
<td>MS Thesis Exam</td>
<td>Thesis requirements</td>
<td></td>
<td>Thesis and oral examination</td>
</tr>
</tbody>
</table>

* Submit an advisor-approved MS plan of study to the ECE Program Coordinator by the end of the first semester.

** Ohio State graduates who passed ECE 3080 are automatically exempt, and the Individual Studies maximum increases by 1 credit.
PLAN OF STUDY

• MS Students need to have their plan of study approved by their advisor by the end of their first semester;

• The plan of study can be changed multiple times, upon approval of student’s advisor (column reserved for changes);

• If a student changes advisor, either the new advisor must approve the existing plan of study or a new approved plan of study must be submitted with the change of advisor form;

• For graduation clearance, the MS plan of study needs to be on file in the ECE office and match the courses actually taken.
<table>
<thead>
<tr>
<th>Term &amp; Year</th>
<th>Course #</th>
<th>Credits</th>
<th>Changes</th>
<th>Course #</th>
<th>Credits</th>
<th>Changes</th>
<th>Course #</th>
<th>Credits</th>
<th>Changes</th>
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</thead>
<tbody>
<tr>
<td>Admit</td>
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</tbody>
</table>

**M.S. Non-Thesis Option or Project Path Checklist**
- 30 or more graduate credits with a GPA of 3.0 or better, of which
  - At least 24 credits must be letter-graded graduate level courses (No S/U), of which
    - At least 15 credits must be letter-graded ECE graduate courses, one of which is
      - ECE 6870 (Project Management) taken within first 2 semesters. Does not count as advanced
    - At least 9 credits must be ECE 6000 or above (advanced level) completed at OSU.
      - ECE 6070 (Project Management) does not count as an advanced requirement
      - A maximum of 6 credits are allowed in a related field (such as engineering, biological sciences, physics, math, chemistry, business, economics, & ACCAD)
      - ECE 7060 (Ethics & Professionalism) 1 credit. Mandatory for those admitted autumn 2016 or after. OSU graduates that have passed ECE 5080 are automatically exempt and the individual study maximum increases by 1 credit.
      - A maximum of 6 credits of Individual Study (ECE 6102) is permitted
      - Satisfactory final written exam approved by faculty committee

**M.S. Thesis Option or Research Path Checklist**
- 30 or more graduate credits with a GPA of 3.0 or better, of which
  - At least 10 credits of thesis research credit (ECE 5880)
  - At least 20 credits of graduate course work, of which
    - At least 18 credits are letter-graded graduate level courses (no S/U), of which
    - At least 9 credits are ECE courses, of which
      - At least 6 credits are ECE 6000 level or above (advanced level) completed at OSU.
      - Maximum of 6 credits are allowed in a related field (such as engineering, biological sciences, physics, math, chemistry, business, economics, & ACCAD)
      - ECE 7060 (Ethics & Professionalism) 1 credit. Mandatory for those admitted autumn 2015 or after. OSU graduates that have passed ECE 5080 are automatically exempt and the individual study maximum increases by 1 credit.
      - A maximum of 6 credits of Individual Study (ECE 6102) is permitted
      - Satisfactory final oral exam and thesis approval by faculty committee
Example 1

Typically students take 3-4 courses per Semester

<table>
<thead>
<tr>
<th>First Term</th>
<th>Second Term</th>
<th>Spring 2020</th>
<th>Summer 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course #</strong></td>
<td><strong>Credits</strong></td>
<td><strong>Changes</strong></td>
<td><strong>Course #</strong></td>
</tr>
<tr>
<td>Fall 2019</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4 ECE courses (12 credits)</td>
<td>graduate, letter graded</td>
<td>3 ECE courses (9 credits)</td>
<td>graduate, letter graded</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td><strong>SUB TOTAL CREDITS:</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Fourth Term</th>
<th>Fifth Term</th>
<th>Sixth Term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course #</strong></td>
<td><strong>Credits</strong></td>
<td><strong>Changes</strong></td>
</tr>
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<tr>
<td></td>
<td><strong>SUB TOTAL CREDITS:</strong></td>
<td></td>
</tr>
</tbody>
</table>

Remember that you might have to take one or more English courses on top of the 30 credit hours requirement
### Example of Workload

#### Example 2

<table>
<thead>
<tr>
<th>First Term</th>
<th>Second Term</th>
<th>Spring 2020</th>
<th>Summer 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course #</strong></td>
<td><strong>Credits</strong></td>
<td><strong>Course #</strong></td>
<td><strong>Credits</strong></td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>3 ECE courses (9 credits)</td>
<td></td>
<td>2 ECE courses (6 credits)</td>
<td></td>
</tr>
<tr>
<td>graduate, letter graded</td>
<td></td>
<td>graduate, letter graded</td>
<td></td>
</tr>
<tr>
<td>EDUTL 5902 (3 credits)</td>
<td></td>
<td>1 MAE course (3 credits)</td>
<td></td>
</tr>
<tr>
<td>English Course</td>
<td></td>
<td>graduate, letter graded</td>
<td></td>
</tr>
<tr>
<td>Ethics course (1 credit)</td>
<td></td>
<td>S/U graded</td>
<td></td>
</tr>
</tbody>
</table>

**Independent Study (5 credits)**
work on your MS Project (S/U graded)

<table>
<thead>
<tr>
<th>Fourth Term</th>
<th>Fifth Term</th>
<th>Sixth Term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course #</strong></td>
<td><strong>Credits</strong></td>
<td><strong>Course #</strong></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2 ECE courses (6 credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>graduate, letter graded</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SUB TOTAL CREDITS:**

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MS Check-In/Plan Submission

- **Discuss** MS Plan of Study with academic advisor and got **approval**
- **Submit** the Advisor-approved MS Plan of Study through a scheduled **15-minute appointment** with Ms. Beth Bucher through **online calendar** [https://go.osu.edu/bucher_9_cal](https://go.osu.edu/bucher_9_cal) according to the following schedule:

<table>
<thead>
<tr>
<th>Last Family Name begins with...</th>
<th>Approved MS Plan of Study Due By:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-H</td>
<td>Aug. 26 – Sep. 27</td>
</tr>
<tr>
<td>I-R</td>
<td>Sep. 30 – Oct. 25</td>
</tr>
<tr>
<td>S-Z</td>
<td>Oct. 25 – Nov. 22</td>
</tr>
</tbody>
</table>

- The plan of study can be changed multiple times, upon approval of student’s advisor (column reserved for changes);
- If a student changes advisor, either the new advisor must approve the existing plan of study or a new approved plan of study must be submitted with the change of advisor form;
- **For graduation clearance, the MS plan of study needs to be on file in the ECE office and match the courses actually taken**
Project Management Course (ECE 6070) is mandatory for all students in MS Project Path

Course Goals
- Learn principles of project management
- Apply project management tools and processes to Electrical and Computer Engineering problems
- Integrate technical aspects of Electrical and Computer Engineering with management tools to successfully complete projects in the Industry framework

Course Topics
- General principles of Project Management
- Project Management process and tools
- Team Culture and project communications
- Strategic Issues in Project Management, risk and crisis management
- Practical considerations/best practices in implementing PM in the Industry
- Case studies in Electrical and Computer Engineering
- Application of Project Management to Electrical and Computer Engineering Projects
- Project Documentation and reporting
Students in the MS Project Path have to work on a project

### OBJECTIVES
- Apply technical concepts learned in class
- Encourage independent thinking and strengthen problem solving capabilities

### TYPES OF PROJECTS
- Project in research areas in the department
- Work done during an internship
- Any relevant project in the student curriculum area
- Extending project from course

- Students must submit a 1-page project proposal to their advisor and get approval
- Students receive credit for work done in projects through independent study credit (up to 5 hours depending on amount/relevance of work, development of skills, outcomes)
- For their final exam, students are required to:
  - Write a project report and discuss it with advisor (mandatory)
  - Deliver a presentation/demo (optional – to the advisor’s discretion)
Integrated Project-Based Learning Experience

• Balance technical and non-technical aspects of Project Management, Implementation, and Reporting, in-line with industry standards

• Sequential/complementary approach with minimal overlapping, but flexible according to specific cases
PROJECT PATH (NON-THESIS)

- **COMMITTEE**: at least two Graduate Faculty members (including the student’s advisor); you can ask Prof. Fiorentini or Prof. Irem Eryilmaz to be your second committee member if you don’t have one.

- **REQUIREMENT**: project report (mandatory) and presentation/demo (advisor’s discretion).

- **DEADLINES**: Before starting your project, you have to submit a 1-page project proposal to your advisor to get your project approved. Reports (and/or slides) have to be turned in to the committee members **AT LEAST 10 days before the graduate school exam deadline**.
  
  After having revised your report, the committee members might ask you to apply changes to your report for it to be considered acceptable.

- **REPORT**: is private, nobody without permission, but the committee members, will see it.

https://gradsch.osu.edu/calendar/graduation
RESEARCH PATH (THESIS)

- COMMITTEE: at least two Graduate Faculty members (including the student’s advisor); you can ask Prof. Fiorentini or Prof. Villarroel to be your second committee member if you don’t have one.

- REQUIREMENT: thesis and oral exam.

- DEADLINES: The first complete draft of the thesis has to be turned in to the committee members AT LEAST two weeks before the oral exam; The oral exam has to be schedule before the graduate school exam deadline. The final version of the thesis (which takes into account the committee members’ suggestions) has to be turned in to the graduate school by the deadline.

- THESIS: is public (uploaded on the OhioLINK).

https://gradsch.osu.edu/calendar/graduation
Other Critical Deadlines

<table>
<thead>
<tr>
<th>Autumn 2019 Calendar</th>
<th>Autumn Semester 14 Weeks (8/20 - 12/4)</th>
<th>First Session 7 Weeks (8/20 - 10/7)</th>
<th>Second Session 7 Weeks (10/14 - 12/4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Day of Classes</td>
<td>Tuesday, August 20, 2019</td>
<td>Tuesday, August 20, 2019</td>
<td>Monday, October 14, 2019</td>
</tr>
<tr>
<td>Last Day 100% Refund Period</td>
<td>Friday, August 23, 2019</td>
<td>Friday, August 23, 2019</td>
<td>Friday, October 18, 2019</td>
</tr>
</tbody>
</table>

https://registrar.osu.edu/registration/Important_dates/AU18_important_dates.pdf

<table>
<thead>
<tr>
<th>Adding / Dropping Courses</th>
<th>Autumn Semester 14 Weeks (8/20 - 12/4)</th>
<th>First Session 7 Weeks (8/20 - 10/7)</th>
<th>Second Session 7 Weeks (10/14 - 12/4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last day to add course using online registration</td>
<td>Friday, August 23, 2019</td>
<td>Friday, August 23, 2019</td>
<td>Friday, October 18, 2019</td>
</tr>
<tr>
<td>Last day to add a course without a petition</td>
<td>Friday, August 30, 2019</td>
<td>Friday, August 30, 2019</td>
<td>Friday, October 25, 2019</td>
</tr>
<tr>
<td>Last date to drop a course without receiving a “W” on record</td>
<td>Friday, September 13, 2019</td>
<td>Friday, August 30, 2019</td>
<td>Friday, October 25, 2019</td>
</tr>
<tr>
<td>Last date to drop a course using online registration</td>
<td>Friday, September 13, 2019</td>
<td>Friday, August 30, 2019</td>
<td>Friday, October 25, 2019</td>
</tr>
<tr>
<td>Last date to drop a course without petitioning</td>
<td>Friday, October 25, 2019</td>
<td>Friday, September 20, 2019</td>
<td>Friday, November 15, 2019</td>
</tr>
</tbody>
</table>
SAMPLE PROJECTS
Team-oriented, multi-disciplinary engineering approach to build a tool to detect the presence of certain anomalies in the region between the subsurface fly ash and the terrain surface and classify, profile, locate, and visualize these anomalies.

Radar-Based Identification of Cover Anomalies at Closed Coal Combustion Product Disposal Sites

- Radar Systems
- Image Processing
- Aerial/Ground Vehicle System Integration
- GPR Development
- Signal Processing & Algorithm Development
- Antenna Systems

Potential Benefits:
- OSU Faculty/Industry Experts mentoring
- Prevent exposure of people, animals, plants, and environment to fly ash
- Detect presence/location, classify type/profile of anomalies, and provide a visualization map
- Integrate Ground Penetrating Radar with a vehicular platform

Source: Lambot et al., "Measuring Soil Surface Water Content Using Full-Wave Inversion of Off-Ground GPR Data," Universite Catholique de Louvain
A multi-disciplinary engineering approach to model, simulate, design, optimize, and measure return loss and coupling measurements of a sixteen-patch antenna array to be adopted in a 24-GHz automotive radar system.

**Approach**
- Designed a two-patch antenna operating at 24.1 GHz with a 200 MHz bandwidth.
- Developed an eight-patch antenna model, based on the two-patch model, using ten transformers to get an antenna $Z_{\text{in}} = 100$ Ω.
- Developed/optimized a model and measured a prototype of a sixteen-patch antenna, operating at 24.1 GHz, with 17 dBi gain, 250 MHz bandwidth, and antenna $Z_{\text{in}} = 50$ Ω.
Airborne Soil Moisture Mapping
A Lincoln-Buckeye Works MS Capstone Project

Team-oriented, multi-disciplinary engineering approach to build an airborne radiometer on fixed-wing and rotorcraft platforms, demonstrate in-flight data collection and mapping, and formulate a startup business plan.

Top-notch mentors
- OSU ECE/MAE faculty
- MIT-LL mentors
- Agricultural Engineering experts
- UAV product development firm
- Experienced business people
- Potential users

Potential Benefits
- Identify dry/wet/flooded areas
- Reduce soil under/over-irrigation
- Improve water management
- Cost-savings
- Increase crop yield
- Foundation for 100+ applications
- Spin-off opportunities

Structural / Aerodynamic Integrity & Payload Design

Business & Marketing

Conformal Antennas & Arrays

Microwave Radiometry

Airborne Soil Moisture Mapping

Signal Processing & Algorithm Development

Microcontroller Programming & Data Handling

Signal Detection & A/D Conversion

Electrical & Computer Engineering

Mechanical & Aerospace Engineering

The Ohio State University
Department of Electrical and Computer Engineering
Crop Health Monitoring and Early Disease Detection

An InFACT Discovery Theme Program

Team-oriented, multi-disciplinary engineering/agricultural/plant pathology approach for crop monitoring and early detection of diseases using airborne multi-spectral/hyper-spectral cameras, developing image/data processing algorithms for mapping and generation of action plans.
Polarimetric MIMO Radar
A Lincoln-Buckeye Works MS Capstone Project

Team-oriented, inter-disciplinary approach to build a software-defined radio, 2-Tx/2-Rx MIMO array with simultaneous polarimetry radar system, demonstrate in dismount measurements and quantify polarimetry/MIMO tradeoffs

Top-notch mentors
• OSU ECE/ESL faculty and researchers
• MIT-LL mentors
• Potential users

Potential Benefits
• Investigate/implement new technologies
• Improve orthogonal waveforms for simultaneous polarimetry
• Reduce data acquisition time
• Locate jamming/interference sources
• Foundation for real-time beamforming and multistatic coherent measurements on mobile and aerial platforms
• Future high-tech job opportunities
Smart Wheelchair

- Environmental Sensors
- Healthcare Sensors
- Wearables
- Localization (GPS, Beacon)
- Image Processing
- Cellular Network
- Web Application
- API
- IoT
Area of Focus

- Electronics
- Embedded System
- Machine Learning
- Robotics
- Image Processing
- Power Management