A named option is a formally documented sub-major within an academic major program. Named options serve as a convenient way to distinguish a distinct curriculum or delivery format within a major. A named option is NOT a new degree or major. Authorization by the Board of Regents to deliver an academic program is at the degree/major level.

This form is to be used in concert with the Policy Guidelines for Named Options within Academic Majors. Complete the form and save as a Microsoft Word document.

1. **Overview**
   1.1. Named Option: Signal Processing and Machine Learning
   1.2. Academic Major: Electrical Engineering
   1.3. Home Department: Electrical and Computer Engineering
   1.4. School/college: Engineering, School of
   1.5. Partner department(s)/units/schools/colleges: Type names of partner units, if any, here.
   1.6. Chair of the Major (name, title, email): John Booske, Chair, jhbooske@wisc.edu
   1.7. Primary faculty or staff contact for the proposal (name, title, email): Rebecca Willett, Associate Professor of ECE, willett@discovery.wisc.edu
   1.8. Primary school/college dean’s office contact (name, title, email): Jake Blanchard, Executive Associate Dean, jake.blanchard@wisc.edu
   1.9. Briefly describe the type and purpose of the named option.
       We propose a non-pooled tuition program for a Master of Science degree. Such program requires that students be enrolled in a distinctly identifiable program of study, and the named option provides the flexibility needed to implement and support this program.
       What prints on the diploma: Master of Science-Electrical Engineering
   
   1.10. Date form completed: 9/15/2016

2. **Approval Implementation and Expectations for Review**
   2.1. School/College Approval Date: 10/19/2016
   2.2. GFEC Approval Date (graduate level named options only): Click here to enter a date.
   2.3. UAPC Approval Date: Click here to enter a date.
   2.4. Expected first term of student enrollment (typically the first fall after UAPC approval): Fall 2017
   2.5. Year of three year progress report to GFEC (3 years after first student enrollment; graduate level named options only): 2020
   2.6. Year of first program review (5 years after first student enrollment): 2022-23
   2.7. Are all academic programs in the home department up to date for program review? Yes
       APIR will provide a list of programs and most recent review date if needed.
If no, program reviews need to be completed before a new proposal is advanced at campus level (GFEC and UAPC). Please provide and information related to plans for completion of program reviews:
Type an explanation here. (1000 word limit)

3. Background/Rationale
3.1. How does the named option relate to the major and to other named options in the major, if relevant?
Signal Processing and Machine Learning is one of the major disciplines in Electrical and Computer Engineering. There is one other named option in ECE (in power engineering). These sub-fields of electrical engineering are quite distinct and would not be expected to compete for students in any way.

3.2. What is the purpose of the named option? How does the named option contribute to the mission of the sponsoring unit?
The purpose of the named option is to provide a Master of Science program which is course-based and condensed/accelerated (3 sessions) The named option contributes significantly to the mission of the sponsoring unit (Department of Electrical and Computer Engineering) in the following aspects: increase the number of master-level graduate students without exceeding our capacity for instruction and advising; enhance the reputation of the Department and UW internationally.

3.3. What is the evidence that there is a student demand for the named option?
A MOU in progress between Tsinghua University (China) and UW, which will provide students for the named option for the Department of Electrical and Computer Engineering.

4. Curriculum
4.1. Delivery modality:
Face-to-face

4.2. Provide a complete list of named option requirements.
Students are required to complete 30 credits of course work in Signal Processing and Machine Learning and related areas. Specific approved courses in this area are listed in the attached document.
Program requirements should provide content that leads to the completion of major learning goals. See section 5 Assessment.

4.3. ☒ Attach a full curriculum including all required and elective courses.

4.4. ☐ For undergraduate named options, attach a four year roadmap.
Named options for undergraduate majors will have requirements totaling 120 credits and students should be able to complete the degree/major within four academic years.

4.5. ☒ For graduate named options, attach a chart outlining minimum degree requirements and elements for satisfactory progress.
Master's level programs will include at least 30 credits of requirements. Doctoral level programs will include at least 51 credits of requirements.

Checklist for Verification of Curricular Policy Requirements *
You will have an opportunity to provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed in the text box that follows the check list, below.
☒ Courses are offered on a regular basis.
☒ Courses have enrollment capacity for students in the named option.
☐ All courses required for the named option are fully approved.
☒ Units must maintain Named Option requirements so that they are up-to-date; all curriculum changes must be approved through the appropriate school/college academic planning council (APC) or curriculum committee. The school/college APC or curriculum committee will notify the Office of the Registrar and the Graduate School (graduate

Named Option Proposal Form v 5-2-16
level named options only) about approved curricular changes to the named option. Typically, any changes in requirements will be effective no sooner than the fall semester after approval.

*Provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed.
Provide explanation for Curricular Policy Requirements that have not been affirmed here.

5. **Assessment**

5.1. ☒ Attach a program assessment plan when submitting this proposal.

*Assessment plans for a named option should be integrated with the assessment plan for the major. See the **Basic Assessment Plan** for instruction and accompanying template. The Basic Assessment Plan and Template are minimum expectations for this information. Programs that have developed plans that exceed what is specified in the basic plan may provide that information.*

5.2. Provide a summary of the program assessment plan, including learning goals for the major and any additional learning goals that are specific for the named option, key methods and assessment approaches, and how assessment information will be reviewed and acted on.

**Student Learning Goals:**
1. Demonstrate a strong understanding of mathematical, scientific, and engineering principles in the field
2. Demonstrate an ability to formulate, analyze, and independently solve advanced engineering problems
3. Apply the relevant scientific and technological advancements, techniques, and engineering tools to address these problems

**Method for assessing learning:**
The student and his/her academic advisor will select one specific MS course (from a list of assessment-eligible courses) from which the assessment data will be collected. The instructor of the assessment-eligible course will review the applicable work (course-specific) and complete the College's learning goals checklist before the end of the semester.

**Plan for review of the assessment information:**
The GPAC will lead a discussion and review of the assessment data at a faculty meeting once a year and report the program assessment results – both the data summary and any recommendations -- to the Dean's Office. The Dean's Office will present all program assessment reports to the College Academic Planning Council (APC).

*The assessment summary should highlight how the named option is included in the overall assessment plan for the major. The named option must adhere to all learning goals for the major and may also have additional learning goals that are specific for the named option.*

6. **Overlap and Related Programs**

6.1. Specify any other degree/majors, named options, or certificates that may not be earned in combination with this named option.

Students will not be permitted to earn any other named option offered by ECE. In addition, they will not be permitted to earn the MS EE (without a named option).

7. **Admissions & Enrollment**

7.1. **For graduate programs proposing a named option with admissions requirements that are distinct from the major with no named option,** explain the admissions criteria and process. The same admissions criteria and process will be used for both the named option and the major.

7.2. What is the projected annual enrollment in the named option? Initially 10
7.3. What is the maximum enrollment (using existing instructional and student resources)? 25
7.4. What are the contingency plans for supporting enrollments higher than the stated maximum enrollment? Additional lecturers and professors of practice will be hired, with funding provided by this program.

Checklist for Verification of Admission Policy Requirements for Undergraduate Named Options*
You will have an opportunity to provide explanation and rationale for any Admission Policy Requirements that have not been affirmed in the text box that follows the checklist.
☐ Named option admission requirements are consistent with admission requirements for the major with no named option, if the major has any admission requirements beyond admission to the University. Admission limits should be related to interest or aptitude for the content and not based solely on a high GPA cutoff
☐ The named option will be declared and canceled using the e-Declaration process in the student information system.
☐ Undergraduates will not be advised to declare or remain enrolled in a named option if it will extend their time to graduation. Undergraduate students are to be discouraged from earning more than one named option that represents an area of curricular emphasis within the major.

*Provide explanation and rationale for any Admission Policy Requirements that have not been affirmed in the above checklist.
Type explanations for Admission Policy Requirements not affirmed here.

8. Advising
8.1. List name(s) of major and named option advisor(s) with title and departmental affiliation(s).
   Major: Electrical Engineering
   Named option advisor(s): Rebecca Willett, Robert Nowak, John Gubner, Barry Van Veen, Yu Hen Hu, Laurent Lessard, William Sethares, Akbar Sayeed, Po-Ling Loh, Varun Jog, Dimitris Papailiopoulos, B. Ross Barmish, Nigel Boston

8.2. Describe how there will be sufficient advising and academic support for all students in the major (both the existing major’s students and the new students that will be served by the named option).
The Signal Processing and Machine Learning program has 13 faculty who can advise graduate students and teach courses.

8.3. ☒ Confirm that major and named option advisor(s) have been consulted and reviewed this proposal.

9. Governance & Faculty
9.1. ☒ The named option must be governed by the same department or academic unit that oversees the major. Any sub-committee governing the named option must report to the faculty governance committee for the major.
   9.1.1. If a sub-committee governs the named option, describe procedures including how faculty are identified and provisions for transitions in the committee.
   N/A

9.2. List core faculty and staff with title and departmental affiliation(s).
   Rebecca Willett, Associate Professor, ECE
   Robert Nowak, Professor, ECE
   John Gubner, Professor, ECE
   Barry Van Veen, Professor, ECE
   Yu Hen Hu, Professor, ECE
   Laurent Lessard, Assistant Professor, ECE
   William Sethares, Professor, ECE
   Akbar Sayeed, Professor, ECE
   Po-Ling Loh, Assistant Professor, ECE
   Varun Jog, Assistant Professor, ECE
10. Fiscal Structure and Ongoing Commitment

10.1. Provide an overview of plans for funding the named option including but not limited to program administration, instructional/curricular delivery, technology needs, and program assessment.

All expenses will be covered by program revenue. Since the program is delivered in a face-to-face format, the costs related to delivery and technology are minimal and difficult to quantify. Assessment will be addressed within Civil and Environmental Engineering using the same processes to be employed for existing majors. These processes are being developed now.

10.2. How will the named option impact staffing needs beyond the immediate program? How are those needs being met?

We envision hiring one or two full time staff members to assist with admissions, advising, and administration of this program. These will be shared across several named options, so the costs to each individual program will be minimal. Additional TAs and graders may be required to assist with individual courses. In some cases, new courses will be created and those costs will be borne by that program. This will require sufficient enrollment to justify the costs and will not occur within the first year. As staffing needs grow to support enrollment, tuition revenue will be used to fund that staff expansion.

*If there is no change in staffing, please describe how the duties of current employees will evolve to support this named option.*

10.3. For named options supported using non-pooled tuition, provide a fiscal annual summary including planned enrollment, estimated paid tuition, instructional costs, and estimated excess tuition available for reinvestment in keeping with the separate guidelines for non-pooled programs.

See attached.

10.4. For graduate programs supported using pooled tuition, provide a plan for how new graduate students will be funded.

N/A

**Required attachments**

- Cover letter from the Dean of the school/college that will be the home of the named option
  *When a proposal for a new named option is forwarded for approval, it will have a cover letter to the provost from the supporting dean.*
- Supporting letters/memos
  *Proposals must be accompanied by letters or memos submitted by the chair or director of other academic units that have overlapping interest. These notes may comment on shared resources, competition for students or other ways in which the programs will interact surrounding the named option. This will include departments/schools/colleges, share a student audience, represent a closely related area of study, have overlapping faculty, or have program names that are similar.*
- Full curriculum including all required and elective courses
- For undergraduate named options, attach a four year roadmap.
- For graduate named options, attach a [chart outlining minimum degree requirements and elements for satisfactory progress](https://kb.wisc.edu/vesta/page.php?id=59300).
- Assessment plan

Named options supported using non-pooled tuition must attach:

- Core Criteria Checklist
- Additional Requirements Checklist

*See the current Non-pooled Program Requirements Process document posted at https://kb.wisc.edu/vesta/page.php?id=59300*
Curriculum for UW Master of Science Degree Program
Department of Electrical and Computer Engineering
M.S. Electrical Engineering
Option: Signal Processing and Machine Learning

Credits Requirement: 30

Suggested Course Credit Allocation for Tsinghua students:

- Fall Semester 14 Credits
- Spring Semester 13 Credits
- Summer Session 3 Credits

Named Option: Signal Processing and Machine Learning
Proposed Curriculum for Department of Electrical and Computer Engineering

Named Option: Signal Processing and Machine Learning

~ Mandatory Coursework ~

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 600</td>
<td>Graduate Seminar</td>
<td>2 cr.</td>
</tr>
<tr>
<td>ECE ---</td>
<td>A minimum of 22 credits from the below list of Signal Processing</td>
<td>22-28 cr.</td>
</tr>
<tr>
<td></td>
<td>and Machine Learning courses</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Up to 6 credits may be taken from any Engineering course at the 500 level or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>above; thesis or independent study credits would not be allowed. At least 15</td>
<td>0-6 cr.</td>
</tr>
<tr>
<td></td>
<td>credits must be from graduate level courses.</td>
<td></td>
</tr>
</tbody>
</table>

~ Approved Signal Processing and Machine Learning Courses ~

(* = currently offered every year; S = spring, F = fall offering)

**Fall offerings**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>* ECE 431</td>
<td>Digital Signal Processing (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 436</td>
<td>Communication Systems I (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 524</td>
<td>Introduction to Optimization (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 532</td>
<td>Theory and Applications of Pattern Recognition (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 533</td>
<td>Image Processing (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 539</td>
<td>Introduction to Artificial Neural Network and Fuzzy Systems (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 717</td>
<td>Linear Systems (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 729</td>
<td>Theory of Information Processing and Transmission (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 730</td>
<td>Modern Probability Theory and Stochastic Processes (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 901</td>
<td>Special Topics (if approved by program director / advisor) (S/F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* EPD 611/612</td>
<td>Technical Project Management (F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 6xx</td>
<td>Systems, Information, Learning, and Optimization (S/F)</td>
<td>1 cr.</td>
</tr>
</tbody>
</table>

**Spring offerings**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 437</td>
<td>Communication Systems II (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 524</td>
<td>Introduction to Optimization (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 719</td>
<td>Optimal Systems (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 735</td>
<td>Signal Synthesis and Recovery Techniques (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 736</td>
<td>Wireless Communications (every other spring)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 738</td>
<td>Advanced Digital Image Processing (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 761</td>
<td>Advanced Machine Learning (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 830</td>
<td>Estimation and Decision Theory (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* ECE 901</td>
<td>Special Topics (if approved by program director / advisor) (S/F)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>* EPD 617</td>
<td>Communicating Technical Information (S)</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ECE 6xx</td>
<td>Systems, Information, Learning, and Optimization (proposed new course) (S/F)</td>
<td>1 cr.</td>
</tr>
</tbody>
</table>
Summer offerings

ECE 697 Directed Project in Signal Processing and Machine Learning (proposed new course) 3 cr.

~ ECE 697 ~

We will develop a new 3-credit course, tentatively number ECE 697, called “Directed Project in Signal Processing and Machine Learning”, to be offered during 8-week summer sessions.

- Prereq: students must have completed at least 21 credit hours at UW-Madison among the above courses before enrolling.
- At the beginning of the summer each student will present a proposed topic to research over the summer. Fellow students and faculty will make suggestions, and faculty will make final approval.
- During the summer session, the students will work on their proposed projects.
- The class will meet once per week for 2 hours. Students will give progress reports and get feedback from faculty and fellow students.
- At the end of the summer, there will be a poster session at which each student will present their results.
- Students will be required to submit a final report.
- PhD student TAs will assist in mentoring students and guiding projects

~ ECE 6xx ~

We will develop a new 1-credit course, tentatively number ECE 6xx, called “Systems, Information, Learning, and Optimization” (SILO), to be offered during the fall and spring semesters. In this course, students will be required to attend the weekly SILO seminar series (http://silo.ece.wisc.edu/web/), whose seminar topics are intimately related to the program theme of “Signal Processing and Machine Learning”. In addition, students will be expected to read a related research paper and write a review of that paper following each seminar.