Top of Form

* **Department\***





* **Program Name:\***

Robotics (MS)

* **Status:\***
* **Provide a brief summary of the proposed program and describe the rationale:\***

The widespread availability of increasingly more capable and miniaturized, yet inexpensive off-the-shelf computational and sensing devices, the explosive increase in available data, in conjunction with the advancement and resurgence of algorithmic techniques, has lead to a surge in interest and a boom in robotic applications, ranging from drones, to automated vehicles, to autonomous driving. This interdisciplinary Master of Science in Robotics (MSR) program is answering the societal, government, and industry need for specialized education in this field. By emphasizing both theory, as well as critical engineering implementation aspects of robotics, the MSR program is designed to meet the needs of both professionals seeking advanced training, as well as scholars who want to start an exploration of the field through structured, guided instruction. Upon completion of the MSR program, a graduate is expected to have basic knowledge of both robotics fundamentals from different engineering disciplines and some skills associated with the development and deployment of robotic devices in real-world environments. The MSR program is flexible enough to be completed in 18 months, and it can incorporate research, or specific supervised project-based activities in the curriculum. These are some of the features that can make it attractive to local industry or government organizations interested in investing in improving the skills of their workforce, and for recruiting graduates of this program.

The program builds on some of the unique strengths, resources, and expertise that can be identified across the UD campus, to offer a higher education and professional training opportunity that cannot be easily replicated in the mid-Atlantic region. Students will be introduced to robotics from a cyber-physical system perspective, through a curriculum that integrates dynamics, control, sensing, computation, software design, optimization, and machine learning. Concurrently, students will be exposed to implementation challenges of turning theory and algorithms into a functional system that is robust enough to be deployed and be functional under real-world conditions. In fact, one of the unique aspects of the MSR program is in leveraging the campus-wide facilities, expertise, and existing faculty collaborations, to expose its students within the normal curriculum, to aspects of implementation and utilization of robotic systems in air, land, and sea.

The proposed is a dual-track program, with one track being a course-based, non-thesis engineering masters degree, which allows for its students to interact with a partnering external organization, public or private, to experience workplace project-based activities for academic credit under the supervision of faculty participating in the program. This is made possible through the Graduate Student-Industry Partnership (GSIP)mechanism created within the Department of Mechanical Engineering, that utilizes graduate-level independent study over a one or two semester period. The second track is thesis-based, substituting 6 credit hours of course-work for a masters thesis.

The degree thus requires the completion of a total of 30 academic credit hours, 6 of which can be thesis credits, and which can be accomplished in as little as 1 1/2 years (18 months) with appropriate course-load. The MSR program’s curriculum consists of a required core of six (6) courses and four (4). The latter are selected from an approved list of graduate courses and are designed to provide the opportunity for specialization in particular academic subareas such as control, estimation, optimization, or machine learning.

A course sequence that can make up such a meaningful two-year robotics curriculum plan can already be put together with courses that are currently offered, or are scheduled to be offered on a regular basis in the very near future, by existing faculty. The aforementioned areas are also among the ones that can be made immediately available currently. With the anticipated growth of the participating units, and the commitment of the University in continuing recruitment in the field, it is expected that the concentration options will increase through the addition of more technical elective courses.

 L**ist only New Courses that are being currently submitted for this program:**

MEEG677, MEEG877, MEEG698, MEEG894, MEEG895

* **List any courses from outside departments being utilized in the curriculum:\***

CISC621, CISC681, CISC684, CISC642 and MAST632

* **Resolution:\***

WHEREAS, there is no graduate program with specialization in robotics in the state of Delaware, at the time where there is growing demand by domestic and international students for training in this particular area

WHEREAS, similar graduate (masters) programs in other universities nationally have been growing rapidly

WHEREAS, there is a sustained and increasing need for workforce development, demonstrated by industry and government organizations both in the mid-Atlantic region and nationally

WHEREAS, the University is positioned to carve a unique niche in this area being one of the very few institutions with existing infrastructure that allows deployment, testing, and demonstration of robotic devices in air, land, and sea.

WHEREAS, there is an existing network of already collaborating faculty across campus who can contribute to the function and growth of this program

WHEREAS, the Masters in Science in Robotics program is aligned with the mission of the University in terms of disseminating scientific knowledge for the benefit of society, and will contribute to increasing the visibility of the University as premier graduate education institution

RESOLVED, that the Faculty Senate recommends provisional approval of the establishment of a new Master of Science in Robotics.

* **Prospective Curriculum:\***
  + **CISC - 621 - Algorithm Design and Analysis (3cr.)**
  + **CISC - 642 - Introduction to Computer Vision (3cr.)**
  + **CISC - 681 - Artificial Intelligence (3cr.)**
  + **CISC - 684 - Introduction to Machine Learning (3cr.)**
  + **MAST - 632 - Environmental Field Robotics (4cr.)**
  + **MEEG - 620 - Intermediate Dynamics (3cr.)**
  + **MEEG - 621 - Linear Systems (3cr.)**
  + **MEEG - 671 - Introduction to Robotics (3cr.)**
  + **MEEG - 829 - Applied Nonlinear Control (3cr.)**