M.S. Handbook

INTELLIGENT SYSTEMS ENGINEERING

2018-2019

Graduate Studies Office
INTELLIGENT SYSTEMS ENGINEERING | 700 N WOODLAWN – 4TH FLOOR

Master of Science in Intelligent Systems Engineering

2018-19 Handbook

1 INTRODUCTION

Indiana University established the School of Informatics, Computing, and Engineering as a place where innovative multidisciplinary programs could thrive, a program where students can integrate technological skills and computer science methods with diverse disciplines. The School announced a new Doctor of Philosophy (Ph.D.) degree program in Intelligent Systems Engineering beginning in the fall of 2016 and offered on the Bloomington (IUB) campus. The Master of Science in Intelligent Systems Engineering degree was added in Fall 2018.

The Master of Science in Intelligent Systems Engineering follows the policies described in this document. The policies and procedures contained within this handbook are subject to change or revision at any time. In any case where current university policy differs from the following statements, university policy takes precedence. Please see the Intelligent Systems Engineering Graduate Studies Office (ISEGSO) for all student service needs.

2 PROGRAM DESCRIPTION

The M.S. and Accelerated MS in Intelligent Systems Engineering focuses on a modern set of engineering topics, namely those that involve intelligent systems, as realized with embedded computing components combined with sophisticated data interpretation.

This program will train students in the practical engineering of systems with an emphasis on hands-on designing, building and simulating systems. Graduates will be prepared with this core set of workforce-aligned skills and will be in high demand for careers in industry, research and academia.

3 AREAS OF RESEARCH (TRACKS)

The M.S. in Intelligent Systems Engineering is offered in six areas: Bioengineering; Computer Engineering; Cyber-Physical Systems; Environmental Engineering; Molecular and Nanoscale Engineering; and Neuroengineering and a non-track of Intelligent Systems.

Bioengineering is a broad field that combines scientific knowledge in the life sciences, computing, and engineering practices to solve problems spanning biology, medicine, environmental remediation, and more. Bioengineering builds on existing IU Bloomington

strengths in experimental biology, gene editing, microfluidics, biotransport, biophysics, multiscale computational modeling, and informatics—in order to train the next generation of computing-driven bioengineers.

Computer Engineering relates to building computing systems of various scales or building an Internet of Things (IoT) device. It relates to hardware and low-level software, such as device drivers. Within CE, students can mix and match courses to tailor the program toward building big data or deep learning analysis systems, high performance computing systems or the engineering of specialized computing devices.

Cyber-Physical Systems Engineering focuses on systems that interact with the physical world directly in some way. CPS is about the entire system including high-level software. Since it is cyber physical, it often emphasizes small or embedded devices. This includes robotics as well as sensor-rich environments like smart homes, smart cars, and smart cities. In all of these cases, the intelligence comes from computing devices. This track could also focus on bio-sensors.

Environmental Engineering develops a strong foundation of practices and challenges by exploring how engineered systems promote better predictions about water quality, climate, and atmospheric conditions. Environmental Engineering will cover fundamental principles of these and other areas to examine unique challenges and opportunities stemming from data analytics, Internet of Things and modern computing.

Molecular and Nanoscale Engineering integrates concepts from electrical and materials engineering with nanoscience to prepare students to work with cyber-physical systems or other responsive, intelligent systems that include nanoscale building blocks. Modeling and simulation of nanostructured assemblies, functional nanoparticles, and soft nanosystems is an integral part of this emerging field. Students will take courses that train them in both experimental and computational aspects of nanoengineering and can pursue their interest in sensing technologies, energy devices, nanomedicine, materials discovery, and other areas of study.

Neuroengineering is the discipline that studies, enhances, monitors, heals and replicates the nervous system—the principal system of our body that makes us intelligent. Neuroengineers have the unique opportunity to link theories of the mind and application to build intelligent machines and software. Advances in the field will bring about parts for damaged nervous systems, new devices to read brain function, and smart machines to accomplish tasks. As well, microscale devices that couple the nervous systems with physical systems can lead to new cognitive development as well as computations that underlie memory systems.

4 PROGRAM OF STUDY – TRADITIONAL MS

The Master of Science in Intelligent Systems Engineering requires a total of 30 credits and a 3.0 GPA upon completion. Students must take 15 credits of graduate level ISE courses (including any joint listed with other university programs). Requirements can also be found in the SICE Bulletin listed under ISE MS.

Pre-requisites: Students in this program need to have a solid foundation in STEM coursework; specifically, they should have experience in the following:

- Programming language (examples: C++, C, Java, Python);
- Calculus I & II; and
- Statistics.

I. Core Courses (7 credit hours)

Compulsory Course (1 credit hour)
ENGR-E500 Introduction to Intelligent Systems Engineering

Track Introductions (6 credit hours)
Select two—one of these two courses must be the introduction to the student's chosen track and the other one can be chosen freely:
E501 Introduction to Computer Engineering
E502 Introduction to Cyberphysical Systems
E503 Introduction to Intelligent Systems
E504 Introduction to Bioengineering
E505 Introduction to Nanoengineering
E506 Introduction to Neuroengineering
E507 Introduction to Environmental Engineering

II. Math Methods (up to 6 credits)
Select two—or contact the GSO for a Math Methods Waiver:
MATH M511/M512 Real Variable I & II
MATH M513/M514 Complex Variables I & II
MATH M540/M541 PDEs I & II
MATH M544/M545 ODEs I & II
MATH M571/M572 Numerical Methods I & II
MATH M671/M672 Numerical Differential and Integral Equations I & II

III. Computing Tools (up to 3 credits)

Select up to three 1 credit hour courses—or contact the GSO for a Computing Tools Waiver:
INFO D590 Data Science Onramp
CSCI B573 Scientific Computing
CSCI B673 Advanced Scientific Computing
CSCI B649 Cloud Computing for Data Intensive Sciences

IV. Track Core (6 or more credits)

Students are required to take two courses from their area of study as approved by their advisor.

V. Engineering Electives (up to 10 credits)

The remaining credits needed to meet the 30-credit degree total may be taken from the ISE electives.

Tracks: Upon admission to the program, students must choose a track to study: bioengineering, computer engineering, cyberphysical systems, environmental engineering, intelligent systems, nanoscale and molecular engineering, or neuroengineering.

Paradigms: Upon admission to the program, students must choose a paradigm for their studies: coursework, internship, project, and/or research.

Transfer of credit: A maximum of 8 graduate level credits from other universities and used to satisfy the 30 credit requirement with the permission of the advisor. These courses may not have been used to meet the requirements for another degree, and must have been completed with a grade of "B" (3.0) or better

5 PROGRAM OF STUDY – ACCELERATED MS

The Master of Science in Intelligent Systems Engineering requires a total of 30 credits and a 3.0 GPA upon completion. Students must take 15 credits of graduate level ISE courses (including any joint listed with other university programs).

Students accepted into the accelerated program can use 12 credits of graduate courses on both their Bachelor's and their Master's plans of study. These courses must satisfy both degree requirements.

Pre-requisites: Students in this program need to have a solid foundation in STEM coursework; specifically, they should have experience in the following:

- Programming language (examples: C++, C, Java, Python);
- Calculus I & II; and
- Statistics.

I. Core Courses (7 credit hours)

Compulsory Course (1 credit hour)
ENGR-E500 Introduction to Intelligent Systems Engineering

Track Introductions (6 credit hours)

Select two—one of these two courses must be the introduction to the student's chosen track and the other one can be chosen freely:
E501 Introduction to Computer Engineering
E502 Introduction to Cyberphysical Systems
E503 Introduction to Intelligent Systems
E504 Introduction to Bioengineering
E505 Introduction to Nanoengineering
E506 Introduction to Neuroengineering
E507 Introduction to Environmental Engineering

II. Math Methods (up to 6 credits)

Select two—or contact the GSO for a Math Methods Waiver:
MATH M511/M512 Real Variable I & II
MATH M513/M514 Complex Variables I & II
MATH M540/M541 PDEs I & II
MATH M544/M545 ODEs I & II
MATH M571/M572 Numerical Methods I & II
MATH M671/M672 Numerical Differential and Integral Equations I & II

III. Computing Tools (up to 3 credits)

Select up to three 1 credit hour courses—or contact the GSO for a Computing Tools Waiver:
INFO D590 Data Science Onramp
CSCI B573 Scientific Computing
CSCI B673 Advanced Scientific Computing
CSCI B649 Cloud Computing for Data Intensive Sciences

IV. Track Core (6 or more credits)

Students are required to take two courses from their area of study as approved by their advisor.

V. Engineering Electives (up to 10 credits)

The remaining credits needed to meet the 30-credit degree total may be taken from the ISE electives.

Tracks: Upon admission to the program, students must choose a track to study: bioengineering, computer engineering, cyberphysical systems, environmental engineering, intelligent systems, nanoscale and molecular engineering, or neuroengineering.

Paradigms: Upon admission to the program, students must choose a paradigm for their studies: coursework, internship, project, and/or research.

Transfer of credit: A maximum of 8 graduate level credits from other universities and used to satisfy the 30 credit requirement with the permission of the advisor. These courses may not have been used to meet the requirements for another degree, and must have been completed with a grade of "B" (3.0) or better.

6 VALUES

We expect students to abide by the spirit as well as the requirements of the *Code of Student Rights, Responsibilities, and Conduct* (see: http://www.indiana.edu/~code/). This applies to scholarship, any role you may have as an Associate Instructor, relations with colleagues, relations with students, and compliance with academic standards with respect to academic ethics. In particular, if you are not familiar with the concept and best practices to avoid any hint of plagiarism in American universities, please become familiar with these standards before you arrive at the University. The University has provided a series of documents describing the behaviors, ideals, and goals for Indiana University.

7 ACADEMIC PERFORMANCE

Graduate students must remain in good standing throughout their graduate studies. This means that students are making satisfactory progress towards the completion of their graduate degree. All ISE MS students must maintain an average of 3.0 (B) or above. All grades lower than a (C) will not be counted for credit towards the degree.

An ISE MS student may be placed on academic probation for the following reasons:

- The GPA falls below 3.0.
- Satisfactory progress is not being made towards the degree as determined by ISE faculty or the ISE MS Director in the evaluation of the student's work.
- Failure to fulfill requirements which were stipulated at the time of admission, including English exams or required language training for international students.

When a student is put on Academic Probation, a recommendation will be given to the student to improve his/her academic standing with deadlines set. The student's performance is evaluated again at those deadlines to determine if improvements have been made and goals have been met. If performance does not improve, the student may not be allowed to continue in the program.

8 OTHER ACADEMIC POLICIES AND PROCEDURES

Advising

Students admitted to the M.S. Program are assigned an **advisor** who may be consulted for advice. The Chair of Intelligent Systems Engineering or an assigned faculty advisor are available for general consultation.

Credit earned in Non-Degree Status

Not more than 9 hours of graduate credit completed as a non-degree student may be credited toward a School of Informatics graduate degree. Deficiency courses do not apply to the 9 credit hours.

Graduation and Degree Conferral

Graduation instructions are sent out prior to the end of the students last term. Students will need to follow the directions provided via email by the ISEGSO. Students will be asked to submit their Program of Study listing all courses that have been completed, including grades for each course, and the overall GPA. This information should be submitted along with the application to graduate to the ISEGSO via email at jsegrad@indiana.edu.

Time Requirements
All requirements for the M.S. degrees must be met within five consecutive calendar years from the date of completion of the first credited (i.e., nondeficiency) course.

Revalidation of Courses

Normally, a course may not be counted toward degree requirements if it has been completed more than five years prior to the awarding of the degree for master's students. The advisor may recommend to the dean that course work taken prior to the deadline be revalidated if it can be demonstrated that the knowledge contained in the course(s) remains current. Currency of knowledge may be demonstrated by (a) passing an examination specifically on the material covered by the course; (b) passing a more advanced course in the same subject area; (c) passing a comprehensive examination in which the student demonstrates substantial knowledge of the content of the course; or (d) publishing scholarly research demonstrating knowledge of the content of the course.

Courses taken while an undergraduate and counted toward the requirements of a baccalaureate degree may not also be counted toward a graduate degree.

9 INFORMATION FOR INTERNATIONAL STUDENTS

The Office of International Services (OIS) OIS is your comprehensive resource for all matters related to international study. Students can find detailed information about OIS and their services by visiting their website.

Maintaining Immigration Status Full-time Status
International students should note that SEVIS regulations are stringent about having a full course load, and that it's essential to check with International Services well in advance of any event that might affect visa status (e.g., dropping a course), to avoid the risk of deportation for being out of status. Check OIS for links to information on staying in status, to be sure that you are aware of the current policies.

Completion dates for visa purposes
International students are considered to have completed their degrees as soon as they have completed the degree requirements, regardless of whether they have filed for the degree. Consequently, it is

essential to make sure that post-graduation visa arrangements are in place before completing the requirements. International Services is expert on these rules. Please refer to OIS for rules.

Optional Practical Training

Optional Practical Training (OPT) is employment related to your major field of study prior to or shortly after graduating. The date of graduation is normally the end of the semester in which you take the last courses needed for the degree, regardless of whether you will receive an incomplete in one of these courses. Even if you have an incomplete that prevents receiving your degree, you should expect the OPT to be processed using the normal completion date for your last courses (the last day of finals). Refer to the OIS website for detailed information regarding OPT. Please copy –the isegrad@indiana.edu email address for with this OIS related communication.