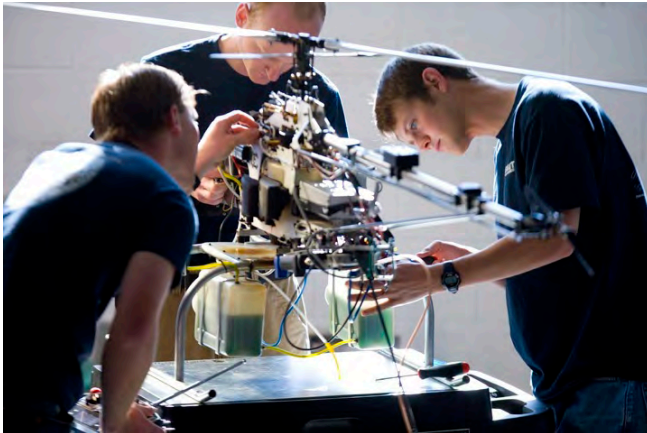


Robotics and Intelligent Autonomous Systems M.S.



Contact Information

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Faculty

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Robotics and Intelligent Autonomous Systems

The Master of Science in Robotics and Intelligent Autonomous Systems (RIAS) is an interdisciplinary, research-oriented degree in an emerging technical area. Students in the program will be required to take courses in computer science, computer engineering, electrical engineering and mechanical engineering. The primary objective of the RIAS program is to give students a basic understanding of the mechanical, electrical and computing systems required to participate in advanced mobile intelligent robotics applications.

The program covers the essentials of robotics, artificial intelligence, control, communications, sensors and signal processing. Students have the

opportunity to gain advanced knowledge in focus areas such as pattern recognition, computer vision, nonlinear control, digital signal processing, and communications. Graduates of this program should have a variety of career options in industrial applications, defense, homeland security, space exploration, or they can pursue study of a more advanced degree. The design and development of intelligent autonomous systems capable of interacting with the environment to complete complex tasks is a rare skill and the discipline is an emerging field.

General Background

Ideally, the entering student will normally have completed a four year degree (B.S.) in either computer engineering, computer science, electrical engineering or mechanical engineering or a closely related field of study. However, any capable and highly motivated student interested in this program is encouraged to apply regardless of academic background. This masters degree is a multidisciplinary degree and it is not expected that students will have the background in all the disciplines that are involved in the program. Leveling courses are offered to help the student gain skills to be successful in the academic areas outside their undergraduate training. Credit by examination is available. In the case of deficits in background, the student may be admitted on a probationary status while they make up missing course work.

Mathematics Background

- Year of Calculus (Calculus I and II)
- One semester of Multivariate Calculus (Calculus III)
- One semester of Differential Equations
- One semester of probability and statistics is suggested but not required.

Physics Background

- Two semesters of calculus based physics are suggested but not required

Programming Background

- Introductory programming course

Exams

- TOEFL – required for international students
- GRE – recommended but not required

The candidate who qualifies for the degree must satisfy the following requirements:

1. A minimum of 30 credits is required.
2. A minimum of 6 credits of CSC 798, Master’s Thesis, and 24 credits of course work is required.
3. The twenty four credits course work is divided into core and specialization courses.
 - a. Completion of the 15 credits of core courses. See listing below.
 - b. A minimum of 9 credits of specialization courses taken from one of the four specialization areas: Computer Engineering, Computer Science, Electrical Engineering or Mechanical Engineering. Each master’s specialization course is typically 3 credits, however some may be 4 credits. Courses for each specialization are listed below.
4. The student must participate in one of the RIAS team projects.
5. The student must pass an oral course work examination in the last semester of study. Additional information on the examination is found in the Graduate Handbook, which can be accessed through the RIAS website by clicking on Graduate Handbook.

A satisfactory thesis based on individual research. The student must present a formal defense of his or her thesis research.

Language Requirements

1. Students whose native language is not English are generally required to take the Test Of English as a Foreign Language (TOEFL).
2. Graduate students with a TOEFL score below 560 are required to attend a remedial course in English.
3. There is no foreign language requirement for the M.S. in RIAS degree.

Curriculum Leveling

Incoming students are not expected to have multiple undergraduate degrees. To address missing pre-requisites for core courses, two “leveling” courses are offered to help prepare students and act as prerequisites for the core classes. These courses do not count toward the 30 required credits. The two leveling courses are EE 505 Survey of Circuits and Systems and CSC 505 Survey of Data Structures and Algorithms.

Students who have taken the equivalent of EE 220, EE 221 and EE 311 will not need to take EE 505.

Students who have taken the equivalent of CSC 250, CSC 300 and CSC 372 will not need CSC 505.

We anticipate that students will need to take at least one leveling course. The student's advisor will determine which leveling courses are needed and advise the student accordingly.

Core Curriculum (Total of 15 credits):

CSC/CENG 515	Robotics
CSC 547	Artificial Intelligence
CSC/CENG 516	Introduction to Autonomous Systems
EE 552	Robotic Controls
EE 618	Sensors and Signal Processing

Computer Science Specialization (complete at least 9 credits):

CSC 564	Image Processing/Computer Vision
CSC 549	Pattern Recognition
CENG 544	Communications/Networking
CSC 533	Graphics
CSC 521	Graphical User Interfaces
CS 510	Parallel Computing

Computer Engineering Specialization (complete at least 9 credits):

CENG 544	Communications/Networking
CENG 547	Embedded and Real Time Computer Systems
CENG 420	Digital Signal Processing

EE 624	Advanced Digital Signal Processing
EE 643	Advanced Digital Systems
CSC 564	Image Processing/Computer Vision
CSC 549	Pattern Recognition

Electrical Specialization (complete at least 9 credits):

CENG 544	Communications/Networking
EE 651	Digital Controls
EE 652	Non-linear Controls
CENG 420	Digital Signal Processing
EE 624	Advanced Digital Signal Processing
EE 643	Advanced Digital Systems

Mechanical Engineering Specialization (complete at least 9 credits):

ME 623	Advanced Mechanical Vibrations
ME 68	Advanced Mechanical System Control
EE 651	Digital Controls
EE 652	Non-linear Controls
ME 722	Advanced Mechanical Design
ME 781	Robotics

Sample Program of Study

First Year

Fall Semester		
CSC 515	Robotics	3
Leveling		3
Specialization		3
TOTAL		9

Spring Semester

CSC 516	Intro to Autonomous Systems	3
CSC 547	Artificial Intelligence	3
Specialization		3
TOTAL		9

Second Year

Fall Semester		
EE 552	Robotic Controls	3

Thesis research	3
Specialization	3
TOTAL	9

Spring Semester

EE 618	Sensors and Signal Processing	3
Thesis research		3
TOTAL		6

Note: There is room in the current course rotation for two leveling or background courses without having to extend the time of the degree or overload in hours.

Research Areas and Resources

Robotics and Intelligent Autonomous Systems offers a very extensive and diverse base of research areas. These areas include but are not limited to pattern recognition; computer vision and perception; navigation and localization; embedded systems and digital design; digital and nonlinear control; digital signal processing and sensor fusion; communications; manufacturing; and advanced materials and micromachines. School of Mines has a variety of computing platforms, labs and manufacturing facilities available. Resources include PC/Linux labs, Robotics Labs, Embedded Systems lab, general purpose electronics test labs, Neural Networks and Controls Lab, Micromechanics lab, and the Center for Excellence for Advanced Manufacturing and Production (CAMP). The institution encourages its students to use the facilities in the creative and efficient solution of scientific and engineering problems.

DEFINITIONS OF ABBREVIATIONS USED IN COURSE DESCRIPTIONS

Abbreviation Definition

AES Sciences	Atmospheric and Environmental
ANTH	Anthropology
ART	Art
ARTH	Art History
ATM	Atmospheric Sciences
BIOL	Biology
BME	Biomedical Engineering
CBE	Chemical and Biological Engineering
CEE Engineering	Civil and Environmental
CENG	Computer Engineering
CHEM	Chemistry
CM	Construction Management
CP	Career Planning
CSC	Computer Science
EE	Electrical Engineering
EM	Engineering Mechanics
ENGL	English
ENGM	Engineering Management
ENVE	Environmental Engineering
EXCH	Student Exchange - International
GE	General Engineering
GEOE	Geological Engineering
GEOG	Geography
GEOL	Geology
GER	German
GES	General Engineering and Science
HIST	History
HUM	Humanities
IENG	Industrial Engineering
IS	Interdisciplinary Sciences
MATH	Mathematics
ME	Mechanical Engineering
MEM	Mining Engineering and Management
MES	Materials Engineering and Science
MET	Metallurgical Engineering
MSL	Military Science
MUAP	Applied Music
MUEN	Music Ensemble
MUS	Music

NANO	Nanoscience and Nanoengineering
PALE	Paleontology
PE	Physical Education
PHIL	Philosophy
PHYS	Physics
POLS	Political Science
PSYC	Psychology
SOC	Sociology
SPAN	Spanish
SPCM	Speech

Courses above 400 level are normally reserved for graduate studies; however, in some cases, undergraduate students may take graduate level courses.

Students must receive a passing grade of “D” or better for any prerequisite course unless specifically stated.

Black Hills State University offers courses in accounting, business administration, economics, entrepreneurship, and religion.