Luddy School of Informatics, Computing and Engineering

Welcome to the Luddy School of Informatics, Computing and Engineering!

The Luddy School of Informatics, Computing and Engineering prepares students to meet the continuing demand for information technology professionals who know how to grow and adapt to this environment of rapid technological change.

Informatics is focused on the best applications of technologies and emphasizes the social and psychological aspects of information technology. Some have called informatics "technology with a human face." Informatics prepares professionals to use information technology to solve problems in a variety of settings. The degrees emphasize the development of new uses for technologies, always keeping in mind the needs of people and the best and most appropriate uses for technology.

Informatics, Computing and Engineering students have:

- a technical understanding of how computing systems and programs operate
- an ability to adapt/assess and apply new trends in information technology (IT)
- well-developed problem-solving skills
- experience working on a team, such as those formed for the senior capstone experience
- well-developed communications skills to clearly convey solutions and observations to others
- an understanding of social and ethical principles as they relate to IT issues
- the ability to create 3-D animations to help explain surgery to patients
- accelerated drug discovery through information technology
- developed computer applications to manage disaster relief
- explored human interactions with computers, mobile devices, and robots

Informatics is all of this - and so much more. Harnessing the power and possibility of technology, Informatics turns data and information into knowledge that people can use every day. In the world of information and technology, it's the bridge to all things useful. Informatics is the future.

Degrees from the Luddy School of Informatics, Computing and Engineering are unique because they involve students in learning how information technology relates to a traditional discipline in the sciences, liberal arts, or professions. Students of Informatics learn to solve real problems that directly impact our lives and the lives of those around us. They use their technology and problem solving skills to make a difference in the world. For students interested in a career with infinite potential, Informatics stands out as a strong, flexible and dynamic field of study.

The undergraduate curriculum looks at information technology from a balanced perspective. It includes a technical core in the areas of mathematical foundations, distributed information, human-computer interaction, social/organization informatics, and media arts and science. In addition to knowledge of core informatics and of informatics in the context of a traditional discipline, students must take a set of general-education courses to ensure that they can communicate clearly in both written and spoken English, read effectively, and reason quantitatively. They must be able to raise and rationally debate ethical concerns suggested by information technologies and their interactions with other people. Students also must have some knowledge of the world and its peoples, and their cultural, artistic, and scientific achievements. To this end, the general-education requirement exposes students to the arts and humanities, social and historical studies, and the natural sciences.

Graduate program curricula apply information technology to a specific domain. Graduate students in the Luddy School of Informatics, Computing and Engineering study under faculty who are leaders in the areas of bioinformatics, health informatics, human-computer interaction, library science and media arts and science. Students in the Luddy School of Informatics, Computing and Engineering's graduate programs also learn from a community of fellow student visionaries, with classmates who come from all over the world and across disciplines to advance informatics research and build life-long careers.

The Luddy School of Informatics, Computing and Engineering offers a variety of educational programs to meet a variety of needs in the evolving world of information technology:

- Bachelor of Science in Applied Data and Information Science
- Bachelor of Arts in Artificial Intelligence
- Bachelor of Science in Biomedical Informatics
- Bachelor of Computer Science
- Bachelor of Science in Data Science
- Bachelor of Science in Health Information Management
- Bachelor of Science in Informatics
- Bachelor of Science degree in Media Arts and Science
- Informatics and Media Arts and Science double major to learn to be a Full-Stack Developer
- Minors and Certificates
    - 3D Graphics and Animation Minor
    - Computer Science Minor
    - Digital Humanities Minor
    - Game Design and Development Minor
    - Informatics Minor
    - Studio Art and Technology Minor
    - Video Production Minor
    - Applied Computer Science Certificate
    - Applied Data Science Certificate
    - Applied Information Science/Data Studies Certificate
    - Artificial Intelligence Certificate
    - Human-Computer Interaction Certificate
    - Legal Informatics Certificate
    - Medical Coding Certificate
    - Multi-device Development (Online Bootcamp) Certificate

  - Network Security Certificate
  - Software Bots for Cognitive Automation Certificate
  - Studio Art and Technology Minor
  - Virtual Production Certificate
  - Post-Baccalaureate Certificate in Health Information Management

- Master of Library Science - with options for dual degrees in History (M.A.), Philanthropic Studies (M.A.), Health Informatics (M.A.), Law (J.D.), Public Management (certificate) and Nonprofit Management Certificate.
- Master of Science degrees in Applied Data Science, Bioinformatics, Computer Science, Computer Science (Software Engineering), Crisis Informatics (Applied Data Science), Health Informatics, Human-Computer Interaction, Sports Analytics (Applied Data Science) and User Experience Design (Applied Data Science).
- Graduate certificates in Archives Management, Clinical Informatics, Dental Informatics, Health Information Security, Human-Compter Interaction and School Library Certificate.

The Luddy School of Informatics, Computing and Engineering also offers the following innovative, accelerated 5-year B.S./M.S. degree programs in the following areas:

- B.A. Artificial Intelligence + M.S. Applied Date Science
- B.S. Data Science + M.S. Applied Data Science
- B.S. Data Science + Master's in Library and Information Science
- B.S. Computer Science + M.S. Applied Data Science
- B.S. Computer Science + M.S. Computer Science
- B.S. Health Information Management + M.S. Health Informatics
- B.S. Informatics + M.S. Applied Data Science
- B.S. Informatics + M.S. Bioinformatics
- B.S. Informatics + M.S. Health Informatics
- B.S. Informatics + M.S. Human-Computer Interaction
- B.S. Informatics + Master of Jurisprudence
- B.S. Mathematics + M.S. Applied Data Science
- B.S. Media Arts & Science + M.S. Human-Computer Interaction
- B.S. Media Arts & Science + M.S. Master's in Library and Information Science
- B.S. Biology + M.S. Bioinformatics
- B.S. Biomedical Informatics + M.S. Bioinformatics
- B.S. Biomedical Informatics + M.S. Health Informatics
- B.S. Health Sciences + M.S. Health Informatics
- B.S. Nursing + M.S. Health Informatics
- B.S. Sports Management + M.S. Applied Data Science with a specialization in Sports Analytics

Last Updated: 3/2025

Contact Information

Contact Information

Luddy School of Informatics, Computing, and Engineering 535 W. Michigan Street
Indianapolis, IN 46202Phone:
317-278-4636LuddyIN@iu.edu

Parking

Visitors can park in the IU Indianapolis Gateway Garage located across the street.

Front Desk & Student Services
IT 400

Department of Biomedical Engineering and Informatics
IT 475G

Department of Computer Science
IT 317

Department of Human-Centered Computing
IT 593

Department of Library and Information Science
IT 552

Last updated: 4/2025

Overview

Mission, Vision, and Values

Our mission
Across a broad range of applications, we unite the full breadth of computing, information science, and technology to lead education and research forward, and enhance the well-being of humanity.

Our vision
To be an unstoppable force for society-centered scientific and technological innovation.

Our values
The following fundamental principles guide our actions as we pursue technical excellence for positive societal impact:

Society-centered science and technology We keep humanity firmly at the center of our approach and understand the human benefits and consequences of our work.

Thought leadership: We strive to become national thought leaders and advance the thinking and understanding of our disciplines.

Excellence and integrity: We hold ourselves to the highest standards of scholarly principles and distinction.

Belongingness: We proactively address barriers to create inclusive experiences and promote systems where everyone has an equal chance at success.

Teamwork and transparency: We enhance collaboration knowing that our whole is more impactful than its parts.

The IU Luddy School of Informatics, Computing, and Engineering, continues to be completely unique in composition, intellectual breadth, and mission. With a twenty-first century sensibility, the Luddy School integrates computing, social science, and information systems design in unique ways.

The Luddy School of Informatics, Computing, and Engineering fosters a broad and interdisciplinary view of informatics and uses this view to explore and expand knowledge in informatics education and research. Along with the many schools and departments located on the Indiana University Indianapolis urban campus, The Luddy School of Informatics, Computing, and Engineering is firmly committed to a welcoming environment, a diverse faculty and student body, and to efforts which support Indiana's economic development.

Together with The School of Informatics, Computing, and Engineering at IU Bloomington, The Luddy School of Informatics, Computing, and Engineering aims to lead the nation in creating a new, broad and interdisciplinary view of informatics and uses this viewpoint as the foundation for their strategic focus areas:

Student Success and Opportunity

Luddy commits to setting the gold standard in teaching and learning. We embrace a culture of technical excellence and will continuously improve our teaching to meet the evolving needs of society. We will provide a diverse student population with opportunities to apply their knowledge to real-world challenges and ensure every student's success is our success.

Transformative Research and Creativity

Luddy will pursue innovative and transformative research and creative activity as
a crucial societal and economic outcome of academic excellence. We will draw upon and integrate the strengths of our unique array of socio-technical disciplines to propel societal goals.

Service to Our State and Beyond

Luddy will leverage its expertise and capabilities to serve communities across our state, improving the lives of Hoosiers, strengthening cultural and economic vitality, and pursuing innovation and knowledge that improve the human condition.

School Culture and Operations

Luddy will strengthen the ways we work and collaborate with one another, as well as the underlying systems and structures that support us, to ensure the conditions for our success.

Education and Research

The Luddy School of Informatics, Computing, and Engineering's primary emphasis is in education and research, offering a broad array of B.S., M.S., and Ph.D., programs and a research agenda that emphasizes the breadth of informatics as an interdisciplinary field of study. The School is at the forefront of innovation in education and provides an informatics curriculum which focuses on computing and information technology, while giving equal attention to the complex interactions of technology, individuals, and society. Students of Informatics learn skills which allow them to use computing to solve real human problems in areas such as healthcare, education, poverty, security, and the environment.

Equally important is the fact that Informatics maintains a strong focus on the human use of computing. For example, informatics students build new computing tools and applications while studying how people interact with those technologies and how those technologies shape our relationships, our organizations, and our community. Informatics is a professional school which goes beyond the study of technology in and of itself, to identify, define, and address information problems in a range of disciplines with a variety of technologies and methodologies.

The Luddy School of Informatics, Computing, and Engineering also conducts research in a wide range of computing and informatics foundations, applications, and their implications. The Luddy School of Informatics, Computing, and Engineering brings a unique perspective that combines information science with a deep understanding of domain-specific areas of research, such as the biological, health, and life sciences, medical and biomedical sciences, cognitive and social sciences, media arts and science, the law and legal domains, business, and human-computer interaction design and usability engineering.

Economic Development and Entrepreneurship

The Luddy School of Informatics, Computing, and Engineering is also deeply engaged in the area of economic development and entrepreneurship. In addition to its primary mission in education and research, The Luddy School of Informatics, Computing, and Engineering trains well-equipped graduates for a wide range of computing and information technology occupations by placing a special emphasis on:

1. partnering with information technology businesses to address their professional needs in the state of Indiana, and
2. supporting a culture of entrepreneurship for its students, faculty and alumni.

Diversity

The Luddy School of Informatics, Computing, and Engineering also fosters an inclusive educational and research culture and environment by:

1. attracting women and under-represented minorities who have a wide range of intellectual interests, talents, and professional goals, and
2. achieving national recognition as an exemplar for diversity.

Last updated: 4/2025

Applied Data Science

Applied Data Science M.S. Admissions

Requirements

- A bachelor's degree
- Overall GPA of 3.0 or higher on a 4.0 scale
- Graduate Record Exam (GRE) optional for masters' students
- Calculus and linear algebra

- Programming

Online Application

Complete and submit the IU Indianapolis Graduate Online Application form. Choose *Informatics* as your Academic Program and *Applied Data Science M.S.* as your Academic Plan. Indicate one of the following subplans:

- Applied Data Science
- Sports Analytics
- User Experience Design

All documents requested below must be uploaded electronically as PDFs with the online application. Do not mail or email any supporting materials to the Luddy School of Informatics, Computing, and Engineering.

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadline.

Resume

Submit a resume or curriculum vitae (CV) listing your education, work experience, research, honors and awards, and mathematical, statistical, and computer programming experience.

Personal Statement

Submit a 500–750-word personal statement in your own words indicating

- Why you're applying to the M.S. in Applied Data Science program
- Your post-graduation career plans

Transcripts

Submit all transcript(s) and/or academic documents for every institution of higher education you attended. If a transcript is not in English, upload an English translation certified by the college issuing the transcript.

All transcripts and/or academic documents uploaded with the online application are considered unofficial. Your unofficial transcript will be used for application review and admission. If you are admitted, you must submit your official hard copy transcripts directly to the IU Indianapolis Graduate School after you arrive on campus. If you are currently finishing your bachelor's degree, you must submit a document that certifies the awarding of the degree.

We do not require transcripts from Indiana University campuses.

References

Submit three references from academic instructors and/or employers. To submit references, you will enter contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.

TOEFL or IELTS

Submit proof of English proficiency if your native language is not English. This requirement may be waived if you are a citizen of the United States or a country where English is the official language for higher education, are completing your bachelor's or master's degree in the United States or a country that is predominately English speaking.

On-Campus Programs (except Computer Science)

90 TOEFL, 7.0 IELTS, or 130 Duolingo

On-Campus Computer Science Program

80 TOEFL, 6.5 IELTS, or 115 Duolingo

100% Online Programs:

100 TOEFL or 7.5 IELTS

Upload a copy of your test score results in the *Documents Section* (under *Test Score Report* upload option) on the online application. TOEFL test results may also be sent through ETS to IU Indianapolis school code 1325.

Last updated: 3/2024

Bioinformatics

Bioinformatics

Students are expected to have an introductory background in computing or biology. Our faculty will help you select courses that build on your experience and elevate your skills—integrating informatics, computer science, information systems, math, biology, and related areas.

Promising applicants lacking competencies necessary for admission may be allowed to take courses that will satisfy those requirements, as determined by Luddy School of Informatics, Computing, and Engineering faculty. Those courses, however, would not count towards degree or certificate completion.

Prerequisites

- Minimum of a Bachelor's degree *(with demonstrated technical skills)*
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) scores from within the past five years if you are seeking direct financial assistance (such as an assistantship or fellowship) from the Luddy School of Informatics, Computing, and Engineering. A GRE score is not required to submit your FAFSA or to seek other federal or private financial assistance opportunities.

Students holding a bachelor's degree in computer science or a related field from an accredited four-year collegiate institution must have completed all or part of the prerequisite courses listed below:

- K322 Genetics and Molecular Biology and K324 Cell Biology or BIOL 507 Molecular Biology

Students holding a bachelor's degree in life sciences or a related field from an accredited four-year collegiate institution must have completed all or part of the prerequisite courses listed below:

- Programming in C, C++, or Java (3 credits)
- Programming/Database (3 credits) (e.g. N510 Web-Database Concepts)
- Statistics (3 credits) (e.g. SPEA K300 or PSY B305)

How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required

materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
Luddy School of Informatics, Computing, and Engineering
535 W. Michigan Street, IT 421
Indianapolis, IN 46202

1. Complete and submit the IU Indianapolis Graduate Online Application form. Paper applications are not accepted.
2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
    - Why you're applying to the program
    - Your post-graduation career plans
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
6. The Graduate Record Examination (GRE) is optional for masters' students.
7. Submit English language proficiency exam score (International and non-native English speaking students only – see instructions below).

Special Instructions for International Students and Non-native English Speakers
Submit proof of English proficiency if your native language is not English. This requirement may be waived if you are a citizen of the United States or a country where English is the official language for higher education, are completing your bachelor's or master's degree in the United States or a country that is predominately English speaking.

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On-Campus Computer Science Program

80 TOEFL, 6.5 IELTS, or 115 Duolingo

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Last updated: 3/2024

Computer Science
Computer Science

Courses in

- Calculus
- Linear algebra
- Statistics or probability theory
- Programming
- Data structures
- Discrete structures or discrete mathematics

- Minimum of a Bachelor's degree *(with demonstrated technical skills)*
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) optional for masters' applicants

How to Apply
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3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
    - Why you're applying to the program
    - Your post-graduation career plans
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
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On-Campus Computer Science Program

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Last updated: 3/2024

Human-Computer Interaction

Human-Computer Interaction

Successful applicants to our **Master of Science program in Human-Computer Interaction** must have a strong background in computing and information technology. You should be able to demonstrate the skills and knowledge required of the undergraduate Informatics degree.

Promising applicants lacking competencies necessary for admission may be allowed to take courses that will satisfy those requirements, as determined by Luddy School of Informatics, Computing, and Engineering faculty. Those courses, however, would not count towards degree or certificate completion.

Prerequisites

- Minimum of a Bachelor's degree *(with demonstrated technical skills)*
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) is optional for masters' students.

Successful applicants will have a foundation of core knowledge and skills (from either past education or work experience) in one or more of the following proficiency areas:

Successful applicants should have knowledge and skills in **one or more** of the following areas:

Programming

Proficiency in:

- One or more programming languages (e.g., C, C++, Java, Javascript, or Python)
- Programming methodologies, such as system design and architectures or problem and algorithm analysis
- Other computing knowledge, such as artificial intelligence and database administration

Design

Proficiency with:Principles and processes of visual communication, industrial design, digital media

- Knowledge and application of 3D animation or modeling tools
- Design methodologies for 2D and 3D product development
- Conceptual modeling, prototyping, and product delivery
- Fundamental concepts of visual communication (e.g., page design/layout)
- Design principles, typography, and color theory
- Application of digital authoring tools for Web or interface design

Social Sciences

Coursework in:

- Psychology (general, cognitive, and behavioral)
- Sociology and anthropology (ethnography)
- Cross-cultural psychology and communication, information management, or information and library science
- Business, product strategy, management, marketing, and related areas
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How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
Luddy School of Informatics, Computing, and Engineering
535 W. Michigan Street, IT 421
Indianapolis, IN 46202

1. Complete and submit the IU Indianapolis Graduate Online Application form. Paper applications are not accepted. Choose "M.S. Informatics" and Human-Computer Interaction in the "Academic Interest" section.
2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
   - Why you're applying to the program
   - Your post-graduation career plans
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
6. Submit English language proficiency exam score (International and non-native English speaking students only – see instructions below).

Special Instructions for International Students and Non-native English Speaker

Submit proof of English proficiency if your native language is not English. This requirement may be waived if you are a citizen of the United States or a country where English is the official language for higher education, are completing your bachelor's or master's degree in the United States or a country that is predominately English speaking.

On-Campus Programs (except Computer Science)

90 TOEFL, 7.0 IELTS, or 130 Duolingo

On-Campus Computer Science Program

80 TOEFL, 6.5 IELTS, or 115 Duolingo

100% Online Programs:

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Last updated: 3/2024

Health Informatics

Health Informatics

Promising applicants lacking competencies necessary for admission to our **Master of Science in Health Informatics** program may be allowed to take courses that will satisfy those requirements, as determined by Luddy School of Informatics, Computing, and Engineering and Computing faculty. Those courses, however, would not count towards degree or certificate completion. Successful applicants will have:

- Strong background in one or more of the following:
  - Biochemistry
  - Biology
  - Computer science
  - Engineering
  - Health information management
  - Mathematics
  - Nursing
  - Physics
  - Statistics
- Successful coursework (or equivalent) in:
  - Computer programming (e.g., C, C++, Java, Javascript, or Python)
  - Databases
  - Medical terminology
  - Human anatomy and physiology

Prerequisites

- Minimum of a Bachelor's degree in computer science, engineering, biology, biochemistry, nursing, mathematics, statistics, physics, health information administration, or other similar or health-related discipline.
- Successful coursework (or equivalent) in programming (i.e. C, C++, Java or equivalent), databases, medical terminology, human anatomy and physiology.
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) not required for masters' students

How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
Luddy School of Informatics, Computing, and Engineering
535 W. Michigan Street, IT 421
Indianapolis, IN 46202

1. Complete and submit the IU Indianapolis Graduate Online Application form. Paper applications are not accepted. Choose "M.S. Informatics" and Health Informatics in the "Academic Interest" section.
2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
   - Why you're applying to the program
   - Your post-graduation career plans
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
6. Submit English language proficiency exam score (International and non-native English speaking students only – see instructions below).

Special Instructions for International Students and Non-native English Speaker

Submit proof of English proficiency if your native language is not English. This requirement may be waived if you are a citizen of the United States or a country where English is the official language for higher education, are completing your bachelor's or master's degree in the United States or a country that is predominately English speaking.

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On-Campus Computer Science Program

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Last updated: 3/2024

Master's Program Admissions

Master's Program Admissions

Applications for all graduate certificate and **M.S. programs** must be received by **January 15 (early action), March 1 (international students) and May 1 (domestic students) for fall admission** and **August 1 (international students) and October 1 (domestic students) for spring admission**.

Applications for admission to the **M.L.I.S. program** must be received by **June 1 for fall admission, November 15 for spring admission** and by **March 1 for summer admission**.

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Last updated: 3/2024

Library and Information Science

Library and Information Science (M.L.I.S.)

The Department of Library and Information Science welcomes applications to our **Masters of Library and Information Science** program from individuals interested in entering the library and information professions. Applicants to the Indianapolis program bring a range of backgrounds to their graduate education, through both their prior education and work experience. Applications from those who have been in the work force and from recent graduates are equally desirable.

Admission Requirements

Bachelor's Degree Students holding a bachelor's degree from regionally accredited four-year collegiate institutions are eligible to apply for admission. Applicants in the final year of their undergraduate program may apply and be granted admission conditional upon being awarded the bachelor's degree.

- Minimum undergraduate GPA of 3.0 on a 4.0 scale or 3.2 in the latest graduate degree or representative graduate hours.
- GRE scores are required for applicants not meeting minimum GPA requirements.
- **How to Apply**

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Have transcripts sent directly to:

Department of Library and Information Science
Luddy School of Informatics, Computing, and Engineering
535 West Michigan Street, IT 419
Indianapolis, IN 46202

1. Complete and submit the IU Indianapolis Graduate Online Application form. Paper applications are not accepted.
2. Submit a 750 – 1500 word personal statement. Your personal statement should indicate the following:
    - In what manner do you see yourself as a future library/information leader in your future organization and community?
    - What examples can you provide that illustrate how you work as a constructive member of a team to solve problems?
    - Provide your perspective on or experiences with technology in information services.
3. Submit official transcripts from all post-secondary colleges and universities (graduate and undergraduate), except for Indiana University campuses.
4. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
5. If necessary, complete the Graduate Record Examination (GRE) and ensure that IU Indianapolis receives your score report. The IU Indianapolis and MLIS program codes are listed above. The Luddy School of Informatics, Computing, and Engineering school code for the GRE is 1325 – enter this code on the exam's answer sheets.
6. For international and non-native English speaking students, submit English language proficiency exam score (see below).

Special Instructions for International Students and Non-native English Speakers

Submit proof of English proficiency if your native language is not English. This requirement may be waived if you are a citizen of the United States or a country where English is the official language for higher education, are completing your bachelor's or master's degree in the United States or a country that is predominately English speaking.

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On-Campus Computer Science Program

80 TOEFL, 6.5 IELTS, or 115 Duolingo

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Last updated: 3/2024

Bioinformatics

Bioinformatics

Successful applicants to our **Ph.D. program in Bioinformatics** must have a strong background in computing, information technology, and biology. You should be able to demonstrate the skills and knowledge required of the undergraduate Informatics degree.

Promising applicants lacking competencies necessary for admission may be allowed to take courses that will satisfy those requirements, as determined by Luddy School of Informatics, Computing, and Engineering faculty. Those

courses, however, would not count towards degree or certificate completion.

Prerequisites

- Minimum of a Bachelor's degree *(with demonstrated technical skills)*
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) scores from within the past five years.

- Students may test out of these.

  For students with a biology background:

  - INFO-B 573 Programming for Chem/Life Science

  For students with a computing background:

  - K322 Genetics and Molecular Biology and K324 Cell Biology or
  - BIOL 507 Molecular Biology

How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
Luddy School of Informatics, Computing, and Engineering
535 W. Michigan Street, IT 419

1. Complete and submit the online application form here. Paper applications are not accepted. Choose "Ph.D. Informatics" and "Informatics" in the "Academic Interest" section. Be sure to indicate on your personal statement your intended area of specialization.
2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
   - Why you're applying to the program
   - Your post-graduation career plans
   - Your intended area of specialization
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
6. Complete the Graduate Record Examination (GRE) and ensure that IU Indianapolis receives your score report from the GRE exam board. The Luddy School of Informatics, Computing, and Engineering school code for the GRE is 1325 – enter this code on the exam's answer sheets.
7. Submit English language proficiency exam score (International and non-native English speaking students only – see instructions below).

Special Instructions for International Students and Non-native English Speaker

Submit proof of English proficiency if your native language is not English. This requirement may be waived if you are a citizen of the United States or a country where English is the official language for higher education, are completing your bachelor's or master's degree in the United States or a country that is predominately English speaking.

On-Campus Programs (except Computer Science)

90 TOEFL, 7.0 IELTS, or 130 Duolingo

On-Campus Computer Science Program

80 TOEFL, 6.5 IELTS, or 115 Duolingo

Upload a copy of your test score results in the *Documents Section* (under *Test Score Report* upload option) on the online application. TOEFL test results may also be sent through ETS to IU Indianapolis school code 1325.

Last updated: 3/2024

Computer Science

Computer Science

The prepares graduates to develop and evaluate novel approaches to collecting, organizing, managing, and extracting knowledge and insights from massive, complex, heterogeneous datasets. Graduates will learn to define and investigate relevant research problems in data science.

Prerequisites

- A bachelor's degree; master's preferred
- Overall GPA of 3.5 or higher on a 4.0 scale
- A course in multivariate calculus, linear algebra, and statistics or probability theory
- A course in programming, data structures, machine organization, and discrete structures or discrete mathematics

How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
Luddy School of Informatics, Computing, and Engineering
535 W. Michigan Street, IT 419
Indianapolis, IN 46202

1. Complete and submit the online application form at this link: https://graduate.iupui.edu/admissions/apply.html. Paper applications are not accepted. Be sure to indicate on your personal statement your intended area of specialization.

2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
    - Why you're applying to the program
    - Your post-graduation career plans
    - Your intended area of specialization
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
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Last updated: 3/2024

Human-Computer Interaction

Human-Computer Interaction

Successful applicants to our Ph.D. program in **Human-Computer Interaction** must have a strong background in computing and information technology. You should be able to demonstrate the skills and knowledge required of the undergraduate Informatics degree.

Promising applicants lacking competencies necessary for admission may be allowed to take courses that will satisfy those requirements, as determined by Luddy School of Informatics, Computing, and Engineering faculty. Those courses, however, would not count towards degree or certificate completion.

Prerequisites

- Minimum of a Bachelor's degree *(with demonstrated technical skills)*
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) scores from within the past five years if you are seeking direct financial assistance (such as an assistantship or fellowship) from the School of Informatics and Computing. A GRE score is not required to submit your FAFSA or to seek other federal or private financial assistance opportunities.

Successful applicants will have a foundation of core knowledge and skills (from either past education or work experience) in one or more of the following proficiency areas:

Successful applicants for the graduate degrees in Human-Computer Interaction will have knowledge and skills (from either past education or work experience) in **one or more** of the following proficiency areas:

Programming

Proficiency in programming/scripting, including:

- One or more languages (e.g., JavaScript, Java, C++, Python)
- A basic understanding of programming methodologies, such as system design and architectures or problem and algorithm analysis
- Other computing knowledge, such as artificial intelligence and database administration

Design

Proficiency with the principles and processes of visual communication, industrial design, digital media, or other disciplines using design theory and practice, including:

- Knowledge and application of 3D animation and/or modeling tools
- Design methodologies for 2D and 3D product development
- Conceptual modeling, prototyping, and product delivery
- Fundamental concepts of visual communication (e.g., page design/layout)
- Design principles, typography and color theory
- Knowledge and application of a range of digital (vector and raster) authoring tools for Web or interface design

Social Sciences

Coursework in one or more of the following areas:

- Psychology (general, cognitive, and behavioral)
- Sociology and anthropology (ethnography)
- Cross-cultural psychology and communication, information management, and/or information and library science
- Business, product strategy, management, marketing and related areas.

How to Apply

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    - Why you’re applying to the program
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Last updated: 3/2024

Health Informatics

Health Informatics

Promising applicants to the **Ph.D. in Health Informatics program** lacking competencies necessary for admission may be allowed to take courses that will satisfy those requirements, as determined by Luddy School of Informatics, Computing, and Engineering faculty. Those courses, however, would not count towards degree or certificate completion.

Prerequisites

- Minimum of a Bachelor’s degree in computer science, engineering, biology, biochemistry, nursing, mathematics, statistics, physics, health information administration, or other similar or health-related discipline.
- Successful coursework (or equivalent) in programming (i.e. C, C++, Java or equivalent), databases, medical terminology, human anatomy and physiology.
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) scores from within the past five years.

How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
Luddy School of Informatics, Computing, and Engineering
535 W. Michigan Street, IT 419
Indianapolis, IN 46202

1. Complete and submit the online application form at this link: https://graduate.iupui.edu/admissions/apply.html. Paper applications are not accepted. Choose “Ph.D. Informatics” and “Informatics” in the “Academic Interest” section. Be sure to indicate on your personal statement your intended area of specialization.
2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
    - Why you’re applying to the program
    - Your post-graduation career plans
    - Your intended area of specialization
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*

5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
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On-Campus Computer Science Program

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Last updated: 3/2024

PhD Programs

Ph.D. Programs Admission

Applicants to the **Ph.D. program** are only eligible for fall admission and must submit applications by **January 15**.

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated. Specific application details are available at the program/degree links in the left navigation bar.

Last updated: 04/24/2017

Data Science

Data Science

The prepares graduates to develop and evaluate novel approaches to collecting, organizing, managing, and extracting knowledge and insights from massive, complex, heterogeneous datasets. Graduates will learn to define and investigate relevant research problems in data science.

Prerequisites

- Minimum of a Bachelor's degree in a related social science, health, data science or computing discipline computer science.
- Successful coursework (or equivalent) in programming (i.e. C++, HTML/JavaScript, JAVA, Python or equivalent),programming methodologies, systems knowledge such as artificial intelligence and database administration.
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) scores from within the past five years.

How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
Luddy School of Informatics, Computing, and Engineering
535 W. Michigan Street, IT 419
Indianapolis, IN 46202

1. Complete and submit the online application form at this link: https://graduate.iupui.edu/admissions/apply.html. Paper applications are not accepted. Choose "Ph.D. Informatics" and "Informatics" in the "Academic Interest" section. Be sure to indicate on your personal statement your intended area of specialization.
2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
    - Why you're applying to the program
    - Your post-graduation career plans
    - Your intended area of specialization
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
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your bachelor's or master's degree in the United States or a country that is predominately English speaking.

On-Campus Programs (except Computer Science)

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On-Campus Computer Science Program

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Last updated: 3/2024

Health Informatics

Health Informatics

Promising applicants to the **Ph.D. in Health Informatics program** lacking competencies necessary for admission may be allowed to take courses that will satisfy those requirements, as determined by Luddy School of Informatics, Computing, and Engineering faculty. Those courses, however, would not count towards degree or certificate completion.

Prerequisites

- Minimum of a Bachelor's degree in computer science, engineering, biology, biochemistry, nursing, mathematics, statistics, physics, health information administration, or other similar or health-related discipline.
- Successful coursework (or equivalent) in programming (i.e. C, C++, Java or equivalent), databases, medical terminology, human anatomy and physiology.
- Minimum Overall GPA: 3.0 *(4.0 point scale)*
- Graduate Record Exam (GRE) scores from within the past five years.

How to Apply

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Submit a resume, transcripts, a personal statement, and letters of recommendation to:

Graduate Admissions Committee
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2. Submit a resume listing your education, work, research, honors/awards and computer programming experience. This may be attached to your online application or sent separately.
3. Submit a personal statement (visit the IU Writing Center for instructions on how to write such a statement). This may be attached to your online application or sent separately. Your personal statement should indicate the following:
   - Why you're applying to the program
   - Your post-graduation career plans
   - Your intended area of specialization
4. Submit all official transcripts from previous colleges and universities. *NOTE: we do not require transcripts from Indiana University campuses.*
5. Submit three references from academic instructors and/or employers. To submit references, you will input contact information for each person on your electronic application. The reference will receive a form via email to fill out and submit electronically.
6. Complete the Graduate Record Examination (GRE) and ensure that IU Indianapolis receives your score report from the GRE exam board. The Luddy School of Informatics, Computing, and Engineering school code for the GRE is 1325 – enter this code on the exam's answer sheets.
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Last updated: 3/2024

Graduate Admissions

Graduate Admissions

Applications for all graduate certificates are **May 1** for fall admission and **November 1** for spring admission. For **M.S. programs** applications must be received by **January 15 (early action)** and **March 1 for fall admission (international students**) and **May 1** (**domestic students**) **August 1 (international students)** and **October 1 (domestic students) for spring admission**.

Applications for admission to the **M.L.I.S. program** must be received by **June 1 for fall admission, November 15 for spring admission** and by **March 1 for summer admission**.

Applicants to the **Ph.D. program** are only eligible for fall admission and must submit applications by **January 8** for Data Science and **January 15** for all other Ph.D. programs.

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated.

Last updated: 3/2024

Admission

How to Apply: Current IU Indianapolis Students
If you are an IU Indianapolis student not currently enrolled in the Luddy School of Informatics, Computing, and Engineering, but would like to pursue an Applied Data and Information Science, Artificial Intelligence, Biomedical Informatics, Health Information Management, Informatics, Media Arts and Science, or the Full Stack Development (Informatics + Media Arts and Science) degrees, please schedule an appointment to speak with one of our advisors who can help evaluate your situation and guide you through the process.

Current Luddy School of Informatics, Computing, and Engineering Students
If you would like to change your major within the Luddy School of Informatics, Computing, and Engineering, please schedule a time to meet with your advisor to discuss your options.

Updated 4/2022

Admission

How to Apply: B.S. Health Information Administration Admissions
Students may begin the HIA Professional Program in either the fall or spring semester. Students must have all of their pre-requisite courses completed prior to starting the professional program and apply during the semester prior to their anticipated start date. Completed applications should be emailed directly to the Academic Advisor, Julie Reagan at jdreagan@iupui.edu.

Admissions Requirements and Standards
Completion of all required prerequisite courses with a grade of C or higher (C- grades are not acceptable).

A minimum IU cumulative GPA of 2.5 or higher is needed. You may complete the “Petition for Exceptional Consideration” found on the HIA application if you do not meet this requirement but still feel equipped to succeed in the HIA program. Students who seek exceptional consideration may be asked to schedule an interview. You will be contacted if this is necessary.

Note: Students looking to begin work towards the Health Information Administration degree and who have not yet been admitted to IU Indianapolis or the Luddy School of Informatics, Computing, and Engineering should choose the appropriate category from the menu provided here to find out how to apply.

Note for transfer students: Transfer students who have completed HIA professional program prerequisites through another institution must first apply and be admitted to IU Indianapolis before being considered for admission in the professional program.

Admission

How to Apply: High School and First-Time College Students
You’ll actually apply for admission online through the IU Indianapolis Office of Admissions. We encourage you to apply for **direct admission**, which allows you to enter IU Indianapolis as a Luddy School of Informatics, Computing, and Engineering student your very first semester. To pursue direct admission, you must list your intended major or certificate on your IU Indianapolis admissions application and meet eligibility criteria.

Another option is to start in IU Indianapolis’ University College, where you’ll begin taking courses, declare your major and then certify into the Luddy School of Informatics, Computing, and Engineering early in your college career. To certifiy into the Luddy School of Informatics, Computing, and Engineering from University College, you will need to have achieved the following: 2.5 gpa, 12 credits of completed coursework and a grade of C-or higher in the following courses; LIS-S201 (Applied Data and Information Science majors), AIS 10000 (Artificial Intelligence majors), INFO-I201 (Biomedical Informatics), HIM-M108 (Health Information Management majors), INFO-I101 (Informatics majors) and NEWM-N100 (Media Arts and Science majors).

But that doesn’t stop you from immediately joining one of our student groups, meeting with our advisors and becoming part of the informatics community.

Visit IU Indianapolis’ Office of Admissions to begin your application or click here to check application status.

Requirements
Please make sure to review IU Indianapolis’ admission requirements through the Office of Admissions.

For **direct admission** into the Luddy School of Informatics, Computing, and Engineering, we're looking for students with:

- Competitive grades and class rank
- All high school and first-time college students will have the option to apply without submitting test scores
- For direct admission into these majors, gpa requirements are as follows: Applied Data and Information Science, 3.0 gpa, Artificial Intelligence, 3.0 gpa, Biomedical Informatics, 3.0 gpa, Computer Science, 3.0 gpa, Health and Information Management, 3.0 gpa, Informatics, 3.0 gpa and Media Arts and Science, 3.0.

Updated 4/2025

Admission

Undergraduate Admissions

We want to do everything we can to make becoming part of the Luddy School of Informatics, Computing, and Engineering family as simple and convenient as possible. Please choose the category below that applies to you to learn more about the admissions process.

- High School or First-time College Students
- Transfer Students
- Returning Students
- International Students

- Current IU Indianapolis Students

Deadlines for undergradutate admission applications can be found at IU Indianapolis' Office of Undergraduate Admissions.

Graduate Admissions
Applications for all graduate certificate and **M.S. programs** must be received by **January 15 (early action)**, **March 1 for fall admission(international students) and May 1(domestic students)** and **August 15 (international students) and November 1 (domestic students) for spring admission**.

Applications for admission to the **M.L.I.S. program** must be received by **June 1 for fall admission, November 15 for spring admission** and by **March 1 for summer admission**.

Applicants to the **Ph.D. program** eligible for fall admission must submit applications by **January 15** for Bioinformatics, Computer Science, Data Science, Health Informatics, Human-Computer Interaction and Information Science. Applicants wanting spring admission must submit applications by **August 15** for Bioinformatics, Computer Science, Data Science and Health Informatics.

The Graduate Admissions Committee will not review applications until the application fee and all required materials are completed and received by the deadlines indicated. Specific application details for each graduate program are available in the links located on the left navigation bar.

Last updated: 3/2025

Admission

How to Apply: International Students
International students wishing to enroll at the Luddy School of Informatics, Computing, and Engineering must first apply through the Office of International Affairs.

Further information about international admissions, including details about the many scholarships available to international students, are available through the Office of International Affairs. They offer a wealth of information in multiple languages, including Spanish, Portuguese, Arabic and Chinese.

Requirements
The Office of International Affairs maintains its own requirements for international students seeking admission to IU Indianapolis. Please visit their site to review those requirements, including English proficiency standards and what academic records and immigration documentation you will need to provide.

Updated 4/2025

Admission

How to Apply: Returning Students
Welcome home! No matter how long you've been away, it's never too late to finish your education.

If less than two semesters have passed since you left (with the exception of summer terms), please contact your academic advisor.

If you haven't enrolled in IU Indianapolis courses for one year or more, you will need to reapply (admission fee waived) through the IU Indianapolis Office of Admissions. Please refer to IU Indianapolis' dates and deadlines for returning students prior to applying for admission.

If you are a previous student of the Luddy School of Informatics, Computing, and Engineering applying for readmission, please be aware of potential curricula changes. If you've been gone less than two years, you will return to your original program curriculum. If it's been two or more years, you will be readmitted under the current curriculum.

Returning students new to the Luddy School of Informatics, Computing, and Engineering are invited to apply for admission.

Requirements
Returning students are assessed on a case-by-case basis depending upon past credits, transcripts and desired course of study. If you've been away from IU Indianapolis for two or more semesters, we encourage you to complete the reapplication process so that your situation can be reviewed by the IU Indianapolis Office of Admissions and the Luddy School of Informatics, Computing, and Engineering.

Updated 4/2025

Admission

How to Apply: Transfer Students
So you want to transfer to IU Indianapolis and the Luddy School of Informatics, Computing, and Engineering? We have to say, you've made an excellent choice!

The IU Indianapolis Office of Admissions' Transfer Central will tell you all you need to know.

- If you are transferring from another campus of Indiana University, please review the intercampus transfer process.
- If you are transferring from a college or university other than Indiana University, follow these important instructions.
- If you are an IU Indianapolis student wishing to change majors, please see the current IU Indianapolis Students page.

TransferIN is a good source to determine how your credits may transfer to IU Indianapolis from other Indiana schools, or you may contact one of our advisors. And don't forget to review IU Indianapolis' Transfer Credit Policy.

Transfer Student Information Sessions
We strongly encourage any prospective transfer students from ANY undergraduate program/school (including IU Indianapolis) to attend one of our regularly scheduled transfer student information sessions. Our advisors will provide a comprehensive overview of the transfer process for the Luddy School of Informatics, Computing, and Engineering, including how your existing credits fit into our program curricula and what courses we recommend you take in future semesters.

Check out our undergraduate "Visit Us" page for upcoming dates and to sign up.

Requirements
Your application will be evaluated by the IU Indianapolis Office of Admissions according to IU Indianapolis'

transfer admission requirements. It will then be forwarded to the Luddy School of Informatics, Computing, and Engineering for review, at which point one of our advisors will contact you for a consultation and recommendations.

Updated 4/2022

Graduate Academic Regulations

Graduate Academic Regulations

In addition to the many topics covered below, students enrolled in the Luddy School of Informatics, Computing, and Engineering's graduate programs are encouraged to review the Graduate Academic Policies found at SOIC Graduate Academic Policies.

Applicability of Degree Requirements
Students may choose to complete either the specific degree requirements published in the appropriate bulletin at the time of entry into the university or those in the bulletin current at the time of graduation.

Residency Requirements
The campus at which a student is admitted will certify and award the degree.

Intercampus Transfer
Students enrolled in the School of Informatics at any campus of Indiana University may transfer to the School of Informatics on another campus, provided they are in good standing. However, international students may need to pay a processing fee.

Transfer of Credit
A maximum of 9 credit hours of graduate course work with grades of B (3.0) or higher may be transferred from other accredited colleges and universities and applied to the Luddy School of Informatics, Computing, and Engineering degree programs. The transfer must be approved by the dean, and is not an automatic occurrence.

Revalidation
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.

Grading System
A minimum of a B (3.0) average in graduate work is required for continuance in graduate study. Courses completed with grades below C (2.0) are not counted toward degree requirements, but such grades will be counted in calculating a student's grade point average. Note that no work may be transferred from another institution unless the grade is B (3.0) or higher.

Incomplete
A grade of Incomplete may be given only if the completed portion of a student's work is of passing quality. It is the responsibility of the student to satisfy the requirements of that course within one calendar year from the date on which the Incomplete is recorded. The student is expected to finish all necessary work in time for the instructor to assign a regular grade before the expiration of this time period. If the student is unable to do so, it is the student's responsibility to notify the instructor of the course and the graduate advisor within the year to request an extension of time. Every overdue Incomplete will be changed to a grade of F after one calendar year.

Withdrawals
Because deadlines for withdrawal from courses may vary by campus and/or school, students should check with the current campus Schedule of Classes to verify deadlines and procedures.

Course Waivers
Requests for waivers of specific courses or requirements on the basis of previous course work are to be submitted in writing to the dean.

Credit Earned in Nondegree Status
A maximum of 9 hours of graduate credit completed as a nondegree student may be credited toward a Luddy School of Informatics, Computing, and Engineering graduate degree. Deficiency courses do not apply to the 9 credit hours.

Academic Standing
Students are considered to be in good standing during any semester in which their academic grade point average is at least 3.0 (B) for both their last semester's course work and for the cumulative average of all course work completed. Only courses with grades of B- (2.7) or above may be counted toward degree requirements. However, grades below C are used in computing the cumulative grade point average, even if a course is repeated and a higher grade is earned.

Academic Probation
Students are placed on probation following a semester in which their graduate cumulative or semester grade point average falls below 3.0. Students on probation are required to attain an average of at least 3.0 for all graduate course work completed by the end of the next semester of full-time enrollment or its equivalent (9 credit hours). Failure to do so is cause for dismissal.

Academic Integrity
Academic integrity requires that students take credit only for their own ideas and efforts. Misconduct, including cheating, fabrication, plagiarism, interference, or facilitating academic dishonesty, is prohibited because it undermines the bonds of trust and cooperation among members of this community and between us and those who may depend on our knowledge and integrity. Complete details are contained in the Indiana University Code of Student Rights, Responsibilities and Conduct.

Thesis
Depending on particular degree requirements, students will complete either a capstone project or a thesis under the guidance of an advisor. More details are given in the appropriate section for each program.

Degree Conferral
For all students seeking a master's degree, an application for the degree must be filed with the Luddy School of Informatics, Computing, and Engineering at least 60 days before the date anticipated for degree conferral. All degree requirements must be completed at least 30 days prior to the date of expected degree conferral, including submission of the bound copies of the master's thesis (if required for degree).

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

Last updated: 4/2022

Academic Policies & Procedures

Absences

From Final Examinations
Students are required to adhere to the policies regarding final examinations as published in the *Schedule of Classes*.

From Scheduled Classes
Illness or equivalent distress is the only acceptable excuse for absence from class. Other absences must be explained to the satisfaction of the instructor, who will decide whether omitted work may be made up.

Degree Application
Candidates for graduation must file an application with the school by June 15 for December graduation and November 1 for May and February 1 for June or August graduation. Credits for all course work, except that of the current semester, must be recorded on the candidate's Indiana University transcript at least one month prior to the date of graduation.

Residency Requirement for Degree Purposes

The institution maintains structures or practices that ensure the coherence and quality of the programs for which it awards a degree. Typically institutions will require that at minimum 30 of the 120 credits earned for the bachelor's degree and 15 of the 60 credits for the associate's degree be credits earned at the institution itself, through arrangements with other accredited institutions, or through contractual relationships approved by the Commission. Any variation from the typical minima must be explained and justified.

Statute of Limitations
Candidates for the bachelor's degree in informatics have the right to complete the degree requirements specified by the bulletin in effect at the time they entered Indiana University, provided that the required courses are available and that no more than eight calendar years have elapsed since the date of entry.

Grading Policies
The Luddy School of Informatics, Computing, and Engineering follows the official grading system of Indiana University described in the front of this bulletin.
Additionally, all undergraduate Luddy School of Informatics, Computing, and Engineering students must earn a grade of C- or higher in all courses, including major, minor, and electives. The exception being for Health Information Management BS students and Medical Coding students taking HIM-M courses, the minimum grade will remain a C for those courses. Students earning lower than these requirements must meet with their academic advisor prior to the next semester's registration to discuss retaking courses.

Incomplete Grades

A grade of incomplete may be given only if the completed porition of a student's work is of passing quality. It is the responsibility of the student to satisfy the requirements of that course within one calendar year from the date on which the in complete is recorded. The student is expected to finish all necessary work in time for the instructor to assign a regular grade before the expiration of this time period. If the student is unable to do so, it is the student's responsibility to notify the instructor of the course and the graduate advisor within the year to request an extension of time. Every overdue incomplete will be changed to a grade of F after one calendar year.

A student who has received a grade of incomplete (I) should not register for the course a second time, but should arrange with the instructor to have the incomplete (I) changed to a letter grade upon completion of all requirements.

Additional Semester Policy Information

For additional policy information, please access post Auto W.

Pass/Fail

During an undergraduate program, students in the Luddy School of Informatics, Computing, and Engineering in good standing (not on probation) may enroll in up to a maximum of eight university elective courses to be taken with a grade of P (pass) or F (fail). Students may take up to two Pass/Fail courses during an academic year. The procedure for declaring this option may be found in the Schedule of Classes. A grade of P is not counted in the grade point average; a grade of F is included. Grades of P cannot be changed to any other letter grade.

Probation/Dismissal/Readmission for Undergraduate Students of the IU School of Informatics and Computing

Academic Warning
A student whose semester (fall or spring) grade point average (GPA) falls below a 2.0, but whose cumulative GPA is a 2.0 or higher will be placed on academic warning. An advising hold will be placed on the student's record and the student will be required to meet with their academic advisor prior to registration.

Academic Probation
A student whose cumulative grade point average (CGPA) falls below a 2.0 or has two consecutive semesters (fall and spring) with a GPA below a 2.0 will be placed on probation for the subsequent semester. A probation hold will be placed on the student's record and the student will be required to meet with their academic advisor prior to registration. Probation will be removed if the cumulative GPA reaches 2.0 or higher or if the semester GPA reaches 2.0 or higher, if the cumulative GPA is already at 2.0 or higher.

Dismissal
A student on probation who has completed a minimum of 12 IU GPA hours is subject to dismissal upon failing to attain a GPA of at least 2.0 in any two consecutive semesters (fall and spring) and the student's cumulative IU GPA is below 2.0.

First--#Semester Student Dismissal
A first--#semester student who has attempted a minimum of 12 IU GPA hours is subject to dismissal upon failing to attain a GPA of at least 1.0 in the student's first semester in the Luddy School of Informatics, Computing, and Engineering.

Readmission
Students who are dismissed for the first time must sit out for a minimum of one regular (fall or spring) semester and petition by the established deadlines to be eligible for readmission. Students dismissed two or more times must remain out of school for two regular (fall and spring) semesters and petition by the established deadlines to be eligible for readmission. Readmitted students may only begin in either the fall or spring semester.

Grade Replacement
The Grade Replacement Policy is available only to undergraduate students. It may be exercised for a maximum of 15 credit hours, no more than two times for a given course, with each attempted replacement counting toward the 15 credit hour limit. Any grade may be replaced with the last grade earned for the course, as long as the most recent grade is equal to or higher than the grade being replaced. The replaced grade will then be excluded from the cumulative grade point average. However, the course listing and the replaced grade will remain on the student's academic record with an "X" notation indicating that the grade is excluded from the cumulative grade point average.

The policy became effective beginning with the fall 1996 semester, and any courses being used to replace an earlier grade must have been taken in the fall of 1996 or later. Grades previously granted FX will be honored and will count toward the 15 credit hour limit. Once invoked, a student may not subsequently request reversal of the grade replacement granted for a given course. Also, this policy is not available for graduate students or students seeking any second undergraduate degree. Please see your academic advisor to discuss grade replacement and obtain a form. For more information about the policy, click here.

Last updated: 4/2022

Applied Computer Science Certificate

Applied Computer Science Certificate

Requirements

Prerequisites

MATH-I 241 or MATH-M 220 Calculus for Data Science I

MATH-I 242 or MATH-M 230 Calculus for Data Science II

PBHL-B 302 Biostatistics for Informatics or PBHL-B 280 Biostatistics for Data Science

Required courses

Choose one:

CSCI-C 200 Introduction to Computers and Programming

CSCI-C 155 Problem-solving and Programming I

CSCI-A 204 Introduction to Programming

Choose one

CSCI-C 212 Introduction to Software System

CSCI-C 255 Problem-solving and Programming II

Choose one:

CSCI-C 241 Discrete Structures for Computer Science

CSCI-C 251 Foundations of Digital Computing

MATH-M 347 Discrete Mathematics

CSCI-C 343 Data Structures

CSCI-C 243 Introduction to Data Structures

CSCI-C 310 Data Structures

Choose one:

MATH-I 243 Linear Algebra for Data Science (Prerequisites: MATH-I 153 College Algebra and MATH-I 154 Trigonometry or MATH-I 159 Precalculus)

MATH-I 159 Precalculus

MATH-M 301 Linear Algebra and Applications

MATH-M 303 Linear Algebra for Undergraduates

Last updated: 4/2025uate/social-work-phd.shtml

Applied Data Science Certificate

Applied Data Science Certificate

You'll learn to develop data-driven solutions, allowing us to better understand ourselves, our communities, and the global market. Unlocking the power of data enables us to run businesses more efficiently, make groundbreaking scientific discoveries, and promote the common good.

When you earn the applied data science certificate you will develop mathematical and technological skills to analyze data sets, leading to valuable knowledge. You'll also learn about the societal implications of data work, including privacy and surveillance.

Certificate Requirements

Required Courses (24 cr.)

- LIS-S 202 Data Organization and Representation (3 cr.)
- INFO-I 415 Introduction to Statistical Learning (3 cr.)
- Statistics: PBHL-B 302 (or alternative ECON-E 270 Introduction to Statistical Theory in Economics and Business (3 cr.), PBHL-B 300 Introduction to Biostatistics (3 cr.), SPEA-K 300 Statistical Techniques (3 cr.), STAT 30100 Elementary Statistical Methods 1 (3 cr.), or STAT 35000 Introduction to Statistics (3 cr.))
- Programming course: INFO-B 210 Information Infrastructure I (4 cr.) (or alternative or CSCI-A 204 Intro to Programming or CSCI 23000 Computing I)

- Database course: INFO-I 308 Information Representation (3 cr.) (or alternative or CSCI-N 211 Introduction to Databases (3 cr.) or CSCI 44300 Database Systems (3 cr.)

Choose three from this list:

- INFO-I 418 Deep Learning Neural Networks (3 cr.)
- INFO-I 428 Web Mining (3 cr.)
- INFO-B 443 Natural Language Processing (3 cr.)
- NEWM-N 328 Visualizing Information (3 cr.)
- INFO-I 416 Cloud Computing for Data Science (3 cr.)

A C- or higher is required for all courses. Students must maintain a 2.0 GPA.

Last updated: 3/2025

Applied Info Data Science Certificate

Applied Information Science/Data Studies Certificate

You can learn to understand and manage the data we create, consume, and interact with daily, when you earn an Applied Information Science/Data Studies Certificate from Indiana University through the Luddy School of Informatics, Computing and Engineering in Indianapolis.

Can't wait to get started? You have the option to earn this 18-hour certificate entirely online, through our quick and affordable Online Data Boot Camp. This is a convenient option for recent high school graduates and adult learners.

Unlike other boot camp programs, you can apply every credit you earn with this certificate toward a bachelor's degree.

Certificate Requirements (18 cr.)

- LIS-S 201 Foundations of Data Studies
- LIS-S 202 Data Organization and Representation
- LIS-S 301 Data Policy and Governance
- LIS-S 305 Data Curation and Management
- INFO-I 308 Information Representation *****
- INFO-I 415 Introduction to Statistical Learning *****

Note: All courses are asynchronous, except those denoted with ***** have synchronous labs.

Students must earn a C- or higher in each course and maintain a 2.0 GPA to graduate with the Data Studies certificate. All required courses are available online.

last updated: 3/2025

Artificial Intelligence Certificate

Artifical Intelligence Certificate

Artificial intelligence is part of our lives—the devices we use, the homes we live in, the places we work and play. Whether we're online to shop, or apply for a job … getting something delivered, or getting directions on our phones … AI is involved almost every step of the way.

More and more jobs demand an understanding of this process. Even if you don't envision working in AI, you're likely to use algorithms or results produced by artificial intelligence in a variety of careers.

Open to those without a computing background – Students in non-computing majors, such as liberal arts, can earn the Certificate in AI without taking additional prerequisites.

Required Courses:

- **AII -I 100** Introduction to Artificial Intelligence – **3 credit hours**
- **AII-I 200** Introduction to Data Science – **3 credit hours**
- **AII-I 300** Collaborative Human-AI Systems What to expect – **3 credit hours**
- **One programming course** – **4 credit hours**. Select from:
  - CSCI-C 200 Introduction to Computers and Programming I (Python)
  - CSCI-A 204 Introduction to Programming I (Python)
  - CSCI 23000 Computing I (Python)
  - INFO-B 210 Information Infrastructure I (Python)

Electives:

One AI elective, selected from the list below – **3 credit hours.**
NOTE: Eight of the courses listed require **no prerequisite** outside your certificate coursework:

- INFO-B 443 Natural Language Processing (3 cr.) *****
- INFO-I 220 Software Bots for Cognitive Automation (3 cr.)
- INFO-I 319 Cognitive Automation and Bots Development (3 cr.) *****
- INFO-I 419 Enterprise Cognitive Automation (3 cr.) *****
- INFO-I 308 Information Representation (3 cr.)
- INFO-I 340 Collaborative Human–AI Systems (3 cr.)
- INFO-I 415 Introduction to Statistical Learning (3 cr.) *****
- INFO-I 416 Applied Cloud Computing (3 cr.) *****
- INFO-I 418 Deep Learning Neural Networks (3 cr.)*
- INFO-I 421 Applications of Data Mining (3 cr.) *****
- INFO-I 428 Web Mining (3 cr.)
- INFO-I 459 Media and Technology Entrepreneurship (3 cr.)
- INFO-I 467 Internet-of-Things Interface Design for Business Innovation (3 cr.) *****
- INFO-I 483 Conversational User Interfaces: Experience Design and Applications (3 cr.)
- INFO-I 496 Artificial Intelligence Professional Practice 1 (3 cr.)
- NEWM-N 328 Visualizing Information (3 cr.)

* Prerequisites to this course are outside the certificate coursework.

A minimum grade of C- is required for any course to be counted toward the certificate.

last updated: 3/2025

Human-Computer Interaction Certificate

Human-Computer Interaction Certificate

Human-computer interaction focuses on the user experience. It's the branch of informatics charged with

developing technology that's empowering, inherently usable, and socially relevant.

Human-centered computing draws from the human and the machine sides of the equation. Computer graphics, operating systems, and development strategies are all relevant. So are communication theory, graphic and industrial design disciplines, linguistics, social sciences, cognitive psychology, and user satisfaction.

Certificate Requirements
The Undergraduate Certificate in Human-Computer Interaction (HCI) is a 15-credit-hour program allowing students to become certified in the fundamental theory and application of human-computer interaction.

- INFO-I 270 Introduction to HCI Principles & Practices(May count towards the Social Sciences General Education Requirement)
- INFO-I 275 Introduction to HCI Theory (May count towards the Social Sciences General Education Requirement)
- INFO-I 300 Human-Computer Interaction
- NEWM-N 450 Usability Principles for New Media Interfaces

Choose one:

- NEWM-N 328 Visualizing Information
- INFO-I 467 Internet-of-Things Interface Design for Business Innovation
- INFO-I 480 Experience Design and Evaluation of Ubiquitous Computing
- INFO-I 481 Experience Design and Evaluation of Access Technologies (online option available)
- INFO-I 482 Assistive Technology (online option available)
- INFO-I 483 Conversational User Interfaces: Experience Design and Applications (online option available)

Students must earn a C- or higher in each course and maintain a 2.0 GPA to graduate.

Last updated: 3/2024

Undergraduate Certificate Programs

Undergraduate Certificate Programs

Prior to each semester's enrollment, a faculty member or an academic advisor provides academic counseling for each student in the Luddy School of Informatics, Computing and Engineering. Although academic counseling is intended to provide effective guidance, students are responsible for planning their own programs and for meeting the following degree requirements for graduation.

Students are advised to read bulletin descriptions of all courses selected, paying careful attention to conditions concerning awarding of credit.

The Luddy School of Informatics, Computing and Engineering offers the following undergraduate certificates:

- Applied Computer Science Certificate
- Applied Data Science
- Applied Information Science
- Artificial Intelligence
- Human-Computer Interaction
- Legal Informatics
- Medical Coding
- Multi-Device Development
- Network Security
- Software Bots for Cognitive Automation
- Post Baccalaureate Certificate in Health Information Management
- Virtual Production

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Legal Informatics Certificate

Legal Informatics Certificate

Legal Informatics has been described as "the study of the application of information technologies to the field of law and the use of these technologies by legal professionals." Therefore, the focus of the Certificate in Legal Informatics is on the effective use of cutting-edge technology in the study and practice of law. Legal informatics also includes the law related to technology, such as intellectual property law, and security. All of the courses for the Certificate in Legal Informatics are offered online.

Certificate Requirements
The following five (5) courses comprise the Certificate in Legal Informatics, for a total of 15 credit hours:

- INFO I330 Legal and Social Informatics of Security (3 cr.)
- INFO I350 Foundations in Legal Informatics (3 cr.)
- INFO I410 Electronic Discovery (3 cr.)
- INFO I470 Litigation Support Systems and Courtroom Presentation (3 cr.)
- NEWM N480 Technology and the Law (3 cr.)

Students who complete all five courses as part of their undergraduate degree will earn a Certificate in Legal Informatics. Students can also earn the Certificate in Legal Informatics as a free-standing certificate. Students must earn a C- or higher in all five courses in order to qualify for the Certificate in Legal Informatics.

Last updated: 3/2025

Medical Coding Certificate

Medical Coding Certificate

The Medical Coding Certificate is a 28-credit-hour program focusing on pathophysiology, pharmacology, coding, medical reimbursement and basic concepts of health information and is designed to better prepare you to sit for industry standard certifications.

The curriculum includes a unique professional practicum component that integrates classroom instruction with applied, technical experience in an actual healthcare facility.

Credit earned for the certificate may be applied toward a bachelor's degree in Health Information Management (application and acceptance into the HIM program required). Graduates are also eligible to seek the Certified Coding Associate (CCA) credential offered by the American Health Information Management Association (AHIMA).

Admission and Requirements
Prospective students must first be admitted to IU Indianapolis as an undergraduate student. You must also acquire knowledge of anatomy, physiology and database design through the completion of designated prerequisites with a minimum grade of C (2.0). Students must achieve a minimum cumulative G.P.A. of 2.5 to begin courses.

Prerequisites (12 cr.)
- BIOL N207 Physiology for Health Care Management (3 cr.)
- BIOL N211 Anatomy for Health Care Management (3 cr.)
- HIM M110 Computer Concepts for Health Information (3 cr.)
- HIM M330 Medical Terminology (3 cr.)

Required Courses (28 cr.)
- HIM M325 Healthcare Information Requirements and Standards (3 cr.)
- LIS-S301 Data Policy and Governance (3 cr.)
- HIM M350 Pathophysiology & Pharmacology for HIM I (3 cr.)
- HIM M355 ICD-10-CM/PCS Coding (3 cr.)
- HIM M351 Pathophysiology & Pharmacology for HIM II (3 cr.)
- HIM M358 CPT Coding (3 cr.)
- HIM M345 Medicine, Law, and ROI (3 cr.)
- HIM M470 Healthcare Reimbursement Systems (3 cr.)
- HIM M457 Practicum in Medical Coding (4 cr.)

Last updated: 3/2025

Multi Device Development Certificate

Multi-Device Development Certificate (also referred to as Full Stack Development certificate)

You know mobile devices are integral to our lives. In just 16 weeks, you can be developing mobile and desktop applications when you earn a Multi-Device Development certificate from Indiana University through our school.

Our boot camp-style program equips you with the skills for an entry-level job creating client-side websites and web and mobile applications. It's ideal for recent high school graduates and adult learners.

This 18-credit-hour certificate is quick and affordable … and you can earn it entirely online. Also, unlike other boot camp programs**, every credit you earn with this certificate can apply toward a bachelor's degree**.

Certificate Requirements (18 cr.)

Required Courses

- NEWM-N 115 Introduction to Multi-Device Web Development
- NEWM-N 215 Intermediate Multi-Device Web Development
- NEWM-N 220 Media Application Development
- NEWM-N 315 Advanced Multi-Device Web Development
- NEWM-N 320 Intermediate Media Application Development
- NEWM-N 322 Dynamic Data Applications
- NEWM-N 423 Database Development for Mobile Applications

Our **16-week intensive boot camp** gets you into the job market fast. You can earn your certificate in desktop and mobile device development entirely online, making it easy to fit into your schedule.

You should expect to spend 3-5 hours per day on coursework during the boot camp experience.

Your first 4 weeks

NEWM-N 115 Intermediate Multi-Device Web Development
Work with content management systems and gain insights into Web publishing, and how to prepare, manage, and organize media online.

Weeks 5-8

NEWM-N 215 Intermediate Multi-Device Web Development
Work with content management systems and gain insights into Web publishing, and how to prepare, manage, and organize media online.

Weeks 9-10

NEWM-N 315 Advanced Multi-Device Web Development
In these two weeks you'll delve into advanced creation, publication, and management of media-rich, interactive publications for online distribution.

Weeks 11-12

NEWM-N 320 Intermediate Media Application Development
Explore intermediate-level skills for design of interactive multimedia applications for desktop and mobile devices. Use industry-standard tools to create applications emphasizing animation and interactivity.

Weeks 13-14

NEWM-N 322 Dynamic Data Applications
You'll immerse yourself in the techniques of creating multi-media applications.

Weeks 15-16

NEWM-N 423 Database Development for Mobile Applications
Your final two weeks will cover the development of mobile applications, and methods for securely storing and retrieving data.

A C- or higher is required for all courses. Students must maintain a 2.0 GPA.

Last updated: 3/2025

Network Security Certificate

Network Security Certificate

The Network Security Certificate (NSC) provides information assurance and security education and training to students and professionals.

Information assurance and security professionals are responsible for the policies and technologies used to safeguard the information systems infrastructure of a company.

The NSC covers the foundational aspects of security as well as the latest and most relevant developments in information assurance. It is designed for the professional as well as the student who has a background in network and systems administration.

This certificate is a valuable security-focused companion to current vendor-based certifications and has direct correlation to the CISSP and Security+ certification standards. Completion of the NSC will provide students with a solid foundation in security techniques and prepare participants to work in the information assurance and network security fields.

Certificate Requirements (20 credits)

Select one two-course programming sequence (8 cr.):

• CSCI-C 155 Problem Solving and Programming I and CSCI-C 255 Problem Solving and Programming II

• CSCI-C 200 Introduction to Computers and Programming and CSCI-C 212 Introduction to Software Systems

CSCI-A 204 Introduction to Programming and CSCI-A 205 Computer Programming

Select one data structures course (3 cr.):

CSCI-C 310 Data Structures – Python OR CSCI-C 343 Data Structures – Java

Operating Systems (3 cr)
• CSCI-C 435 Operating Systems

Select two additional courses (6 cr.):
• CSCI-B 430 Security for Networked Systems
• CSCI-C 437 Computer Security
• CSCI-B 438 Fundamentals of Computer Networks
• CSCI-B 470 Wireless and Mobile Security
• CSCI-B 477 Security Engineering

A minimum grade of C- is required for any course to be counted toward the certificate.

last updated: 3/2025

Post Bacc Health Information Management Certificate

Post Baccalaureate Certificate in Health Information Management

Expand your options by earning Indiana University's Post-Baccalaureate Certificate in Health Information Management (HIM). You could qualify to enter the profession in as few as 27 credit hours, depending on your educational background and work experience.

The HIM program at IU is one of the first and longest running in the nation, with more than 90% of its graduates hired in the profession.

Certificate Requirements

The length of the program depends on your prior coursework and experience. The **certificate's requirements are 66 credit hours**.

However, if you have a bachelor's degree in the biological or health sciences, or are enrolled in a health-related dual degree, **you could finish this certificate in as few as two semesters** (27 credit hours minimum).

Required Courses

- BIOL-N 207 Physiology for Healthcare Management (online)
- BIOL-N 211 Anatomy for Healthcare Management (online)
- HIM-M 110 Computer Concepts for Health Information (online and on campus)
- HIM-M 200 Database Design for Health Information Management (online and on campus)
- HIM-M 220 Healthcare Informatics for Decision Support (online and on campus)
- HIM-M 275 Cultural Competence in Healthcare Communication (online and on campus)
- HIM-M 325 Healthcare Information Requirements and Standards I (online and on campus)
- HIM-M 330 Medical Terminology (online and on campus)
- HIM-M 345 Healthcare Law, Ethics, and Information Release (online and on campus)
- HIM-M 350 Pathophysiology and Pharmacology for HIM I (online and on campus)
- HIM-M 351 Pathophysiology and Pharmacology for HIM II (online and on campus)
- HIM-M 355 ICD-10-CM/PCS Coding (online and on campus)
- HIM-M 358 CPT Coding (online and on campus)
- HIM-M 370 Health Information Management (online and on campus)
- HIM-M 400 Health Information Research and Analysis Methods (online and on campus)
- HIM-M 420 Health Information Project Management (online and on campus)
- HIM-M 425 Quantitative Analysis of Health Information (online and on campus)
- HIM-M 462 Healthcare Quality Improvement (online and on campus)
- HIM-M 470 Healthcare Reimbursement Systems (online and on campus)
- HIM-M 475 Health Information Technology (online and on campus)
- HIM-M 490 RHIA Exam Preparation (online and on campus)
  Choose one:

- PBHL-B 301 Biostatistics for Health Information Management or
- PBHL-B 302 Biostatistics for Informatics

A C- or higher is required for all courses. Students must maintain a 2.0 GPA.

Last updated: 3/2025

Software Bots Certificate

Software Bots for Cognitive Automation Certificate

Machine learning and artificial intelligence are transforming industries, and common tasks like processing invoices and screening job applicants. Seize the opportunities these rapidly evolving technologies are creating.

Our Software Bots for Cognitive Automation certificate online and prepare to join the AI workforce and qualify for technology careers in sectors including:

- Retail
- Health care
- Banking and finance
- Logistics
- Manufacturing
- Agriculture

Certificate Requirements (16 cr.)

You'll take five online classes to earn your 16-credit Software Bots for Cognitive Automation Undergraduate Certificate.

Core Courses

1. Python Programming: CSCI-A 201 Intro to Programming I or INFO-B 210 Information Infrastructure I
2. **INFO-I 220** Social Impact of Bots and Automation
3. **INFO-I 319** Cognitive Automation and Bots Development
4. **INFO-I 419** Enterprise Cognitive Automation
5. **Approved Elective**

Select one:

- AII 20000 Introduction to Data Science (3 cr.)
- CSCI-A 202 Introduction to Programming II (4 cr.)
- CSCI-N 211 Introduction to Databases (3 cr.)
- HIM-M 200 Database Design for Health Information Management (3 cr.)
- INFO-B 443 Natural Language Processing (3 cr.)
- INFO-I 223 Data Fluency (3 cr.)
- INFO-I 308 Information Representation (3 cr.)
- INFO-I 340 Collaborative Human–AI Systems (3 cr.)
- INFO-I 428 Web Mining (3 cr.)
- INFO-I 459 Media and Technology Entrepreneurship (3 cr.)
- INFO-I 483 Conversational User Interfaces: Experience Design and Applications (3 cr.)
- INFO-I 496 Artificial Intelligence Professional Practice 1 (3 cr.)
- NEWM-N328 Visualizing Information (3 cr.)

A minimum grade of C- is required for any course to be counted toward the certificate.

last updated: 3/2025

Virtual Production Certificate

Virtual Production Certificate

Virtual production empowers filmmakers, actors, and animators across multiple locations to collaborate in real time. They create together by using software tools to combine live-action footage with computer-generated graphics.

Virtual production has become integral to filmmaking. Studios need talent with a solid understanding of this new field in digital cinema.

Gain in-demand skills by earning our undergraduate certificate in virtual production. You'll learn the software and equipment used to create virtual sets and reactive backgrounds in real time.

Certificate Requirements (18 cr.)

You earn our 18-credit-hour undergraduate certificate in virtual production by taking the following courses over two years:

- NEWM-N 230 Introduction to Game Design and Development
- NEWM-N 243 Introduction to 3D
- NEWM-N 253Introduction to Digital Video
- NEWM-N 330 Intermediate Game Design and Development
- NEWM-N 356 Lighting and Field Production
- NEWM-N 458 Beyond the Frame: New Forms of Video Production

A minimum grade of C- is required for any course to be counted toward the certificate.

last updated: 3/2025

Artificial Intelligence

Students earning a **Bachelor of Arts in Artificial Intelligence** will focus on:

- Human-centered computing
- Computational process automation
- Societal impact of AI
- Applied data science

This degree prepares you for careers in which AI technologies are integrated and evaluated for human interaction and compliance, such as user experience (UX) engineer; AI assistant developer; applied AI/NLP (natural language processing) developer; and bot developer.

Degree Requirements (120 credits)

AI Core (52 cr.)

- INFO-I 100 First Year Experience (on campus only, 1 cr.)
- AII-I 100 Introduction to Artificial Intelligence (3 cr.)
- AII-I 200 Introduction to Data Science (3 cr.)
- INFO-I 201 Mathematical Foundations of Informatics (4 cr.)
- INFO-I 202 Social Informatics (3 cr., GE: Social Sciences)
- INFO-B 210 Information Infrastructure I (on campus, 4 cr.) or CSCI-C 200 (on campus, 4 cr.) or CSCI-A 204 Introduction to Programming (online, 4 cr.)

- INFO-B 211 Information Infrastructure II (on campus, 4 cr.) or CSCI-A 205 Computer Programming (online, 4 cr.)
- INFO-I 220 Social Impact of Bots and Automation (3 cr.)
- AII-I 300 Collaborative Human–AI Systems (3 cr.)
- LIS-S 302 Data and Society (3 cr.) or LIS-S 404 Surveillance Studies (3 cr.)
- PBHL-B 302 Biostatistics for Informatics (3 cr.) or PBHL-B 304 Biostatistics for Health Data Scientists: A Computational Approach (3 cr.)
- INFO-I 303 Organization Informatics (3 cr.)
- CSCI-C 310 Data Structures – Python (3 cr.)
- INFO-I 308 Information Representation (3 cr.)
- INFO-I 319 Cognitive Automation and Bots Development (3 cr.)
- INFO-I 419 Enterprise Cognitive Automation (3 cr.)
- INFO-B 443 Natural Language Processing (3 cr.)

Technical Writing (3 cr.)

Choose one

- ENG-W 230 Writing in the Sciences (3 cr.)
- ENG-W 231 Professional Writing Skills (3 cr.)
- ENG-W 270 Argumentative Writing (3 cr.)

Mathematics and Statistics (9 cr.)

- MATH-I 153 College Algebra (on campus, 3 cr.) or MATH-M 125 Precalculus Mathematics (online, 3 cr.)
- MATH-I 154 Trigonometry (on campus, 3 cr.) or MATH-M 126 Trigonometric Functions (online, 3 cr.)
- MATH-I 243 Linear Algebra for Data Science (on campus, 3 cr.) or MATH-M 303 Linear Algebra (online, 3 cr.)

General Education (35 cr.)

- Core Communication (6 cr.)
- Analytic Reasoning (9 cr.)
  Fulfilled by the Mathematics and Statistics requirement
- Cultural Understanding (8 cr.)
  - One of the following: Demonstrated 200-level world language proficiency, a 200-level world language course, or a first-year world language sequence (131 and 132)
- Life and Physical Sciences (6 cr.)
- Social Sciences (3 cr.)
  - INFO-I 270 Introduction to Human-Computer Interaction Principles and Practices (3 cr.) recommended
- Arts and Humanities (3 cr.)

Career Planning (2 cr.)

- NEWM-N 299 Career Readiness (2 cr.)

Experiential Learning (3 cr.)

Choose one

- INFO-I 491 Capstone Project Internship (3 cr.)
- INFO-I 492 Senior Thesis (3 cr.)
- INFO-I 493 Senior Thesis (3 cr.)
- INFO-I 496 Artificial Intelligence Professional Practice 1 (3 cr.)
- INFO-I 497 Artificial Intelligence Professional Practice 2 (3 cr.)

AI Selectives (12 cr.)

Choose four:

- MATH-I 241 Calculus for Data Science I (3 cr.) or MATH-M 220 Calculus for Data Science I (3 cr.) or MATH-I 165 Analytic Geometry and Calculus I (4 cr.)
- MATH-I 242 Calculus for Data Science II (3 cr.) or MATH-M 230 Calculus for Data Science II (3 cr.) or MATH-I 166 Analytical Geometry and Calculus II (4 cr.)
- INFO-I 305 Introduction to Research (3 cr.)
- CSCI-C 310 Data Structures - Python (3 cr.)
- NEWM-N 328 Visualizing Information (3 cr.)
- INFO-I 402 Project Management (3 cr.)
- INFO-I 415 Introduction to Statistical Learning (3 cr.)
- INFO-I 416 Applied Cloud Computing (3 cr.)
- INFO-I 418 Deep Learning Neural Networks (3 cr.)
- INFO-I 421 Applications of Data Mining (3 cr.)
- INFO-I 428 Web Mining (3 cr.)
- INFO-B 429 Machine Learning for Bioinformatics (3 cr.)
- INFO-B 436 Computational Methods for Biomedical Informatics (3 cr.)
- CSCI-C 455 Analysis of Algorithms (3 cr.)
- CSCI-C 463 Artificial Intelligence I (3 cr.)
- INFO-I 467 Internet-of-Things Interface Design for Business Innovation (3 cr.)
- INFO-I 483 Conversational User Interfaces: Experience Design and Applications (3 cr.)

Electives (13 cr.)

Choose that are not equivalent to previously taken courses.

Updated 4/2025

Bachelor of Science in Biomedical Informatics

Bachelor of Science in Biomedical Informatics

The Biomedical Informatics Bachelor of Science degree is aimed at students who have an introductory background in both computing and biology. The 120-credit-hour program integrates knowledge from health, information systems, biomedical science, and other related areas.

Upon enrolling in the program, you'll select a specialty: bioinformatics, health informatics, or premedical bioinformatics. From there, we'll help you to select classes that will elevate your skills in these and other disciplines.

Biomedical Informatics with a Bioinformatics specialization

Data can become an agent for change only when we have the ability to retrieve and organize it. Turn bio-repositories into tools for research and resources for

developing precision medicine. Learn how to utilize genomic, molecular, and patient data to diagnose and treat rare diseases, reduce harmful drug interactions, and repurpose FDA-approved drugs.

Bioinformatics is changing how decisions are made, with focused analysis that redefines clinical practice. Effectively managing the results of experiments using high-throughput technology is crucial to drug research, and genomic and protein sequencing.

Specialization courses include:

- INFO-B 406 Biomedical Informatics (3 cr.)
- INFO-B 419 Introduction to Bioinformatics (3 cr.)
- INFO-B 429 Machine Learning for Bioinformatics (3 cr.)
- INFO-B 436 Computational Methods in Biomedical Informatics (3 cr.)
- INFO-B 446 Foundations of Computational Systems Biology (3 cr.)
- INFO-B 473 Application Programming for Biomedical Data Analysis (3 cr.)
- INFO-B 474 Next Generation Sequencing Data Analysis (3 cr.)

Biomedical Informatics with a Premedical Bioinformatics specialization

This course of study focuses on the same areas of expertise as the bioinformatics specialization. It includes all courses required for medical school at Indiana University and most other universities.

Specialization courses include:

- INFO-I 100 First Year Experience (1 cr.)
- INFO-I 201 Mathematical Foundations of Informatics (4 cr.)
- INFO-B 210 Information Infrastructure I (4 cr.)
- INFO-B 211 Information Infrastructure II (4 cr.)
- INFO-I 223 Data Fluency (3 cr.)
- INFO-I 421 Applications of Data Mining (3 cr.)
- HIM-M 200 Database Design for HIM (3 cr.)
- PBHL-B 302 Biostatistics for Informatics (3 cr.)
- INFO-I 400 Topics in Informatics: Data Structures (3 cr.)
- INFO-B 406 Biomedical Informatics (3 cr.)
- INFO-B 419 Introduction to Bioinformatics (3 cr.)
- INFO-B 429 Machine Learning for Bioinformatics (3 cr.)
- INFO-B 473 Application Programming for Biomedical Data Analysis (3 cr.)
- INFO-B 474 Next Generation Sequencing Data Analysis (3 cr.)

Biomedical Informatics with a Health Informatics specialization

Each of us intersects with the world of health care. It may be as a diagnostician, researcher, lab technician … and, almost surely at some point, as a patient.

Learn to solve real-world problems in computational biology using informatics. Specializing in health informatics means you'll develop skills to enhance research, and to improve both the security of our electronic medical records and the ways we obtain care. Standardizing data and how we retrieve it has far-reaching implications. Health informatics allows us to access and monitor our own health information, and aids researchers in detecting trends to contain outbreaks of disease.

Specialization courses include:

- HIM-M 200 Database Design for HIM (3 cr.)
- HIM-M 275 Effective Communication in Health Care (3 cr.)
- HIM-M 350 Pathophysiology and Pharmacology for HIM I (3 cr.)
- HIM-M 351 Pathophysiology and Pharmacology for HIM II (3 cr.)
- INFO-B 406 Biomedical Informatics (3 cr.)
- INFO-B 430 Introduction to Health Informatics (3 cr.)
- INFO-B 435 Clinical Information Systems (3 cr.)
- INFO-B 441 Business of Health Informatics (3 cr.)
- INFO-B 442 Clinical Decision Support (3 cr.)
- INFO-B 473 Application Programming for Biomedical Data Analysis (3 cr.)
- INFO-B 481 Health Information Standards and Terminologies (3 cr.)
- INFO-B 483 Security and Privacy Policies and Regulations for Healthcare (3 cr.)

Capstone Project
During the senior year, students culminate their course studies through practical application of concepts and practices working in industry. Course requires prior authorization and approval of internship through the Luddy Career Services Office. Required coursework is completed via Canvas.

Basic degree requirements:

Degree Requirements

Core A Requirements (31 cr.)

- INFO-I 100 First Year Experience (1 cr.)
- INFO-B 101 Intro to Biomedical Informatics
- INFO-I 201 Mathematical Foundations of Informatics (4 cr.)
- INFO-B 210 Information Infrastructure I (4 cr.)
- INFO-B 211 Information Infrastructure II (4 cr.)
- INFO-I 223 Data Fluency (3 cr.)
- INFO-I 421 Applications of Data Mining (3 cr.)
- HIM-M 200 Database Design Health Information Management (3 cr.)
- INFO-I 400 Topics in Informatics: Data Structures (3 cr.)
- PBHL-B 302 Biostatistics for Informatics (3 cr.)

Specialization Requirements (21 cr.)

Career Planning (2 cr.)

- NEWM-N 299 Career Readiness (2 cr.)

Capstone (3 cr.)

- INFO-I 491 Capstone Project Internship (3 cr.)

General Education Requirements (40 cr.)

- Core Communication (6 cr.)
- Analytical Reasoning List A (6 cr.)
  - MATH-M 119 Brief Survey of Calculus (3 cr.)

- MATH-M 118 Finite Math (3 cr.)

- Cultural Understanding (3 cr.)
  - Recommended to take ANTH-A 104 Cultural Understanding (3 cr.).
- Life and Physical Sciences (16 cr.)
  - BIOL-K 101 Concepts of Biology (5 cr.)
  - BIOL-K 103 Concepts of Biology II (5 cr.)
  - BIOL-N 322 Introductory Principles of Genetics (3 cr.)
  - CHEM-C 110 The Chemistry of Life (3 cr.)
- Arts and Humanities (3 cr.)
- Social Sciences (6 cr.)
  - Recommended to take HLHS-H 200 Survey of Health Care Systems.
  - Recommended to take PBHL-P 109, PBHL-S 120, or PBHL-H 101.

General Electives (23 cr.)

Last updated: 4/2025

Computer Science
Immerse yourself in the future of computing

By earning a computer science degree, you'll learn how to understand, design, and create next-generation human-centered computing systems–the kind you'd like to use.

Whether solving problems or designing systems, Luddy Indianapolis puts human needs and abilities first while putting you in control of your education:

Degree options

Students can earn a bachelor of arts or a bachelor of science degree in computer science. Both degrees qualify students for the same types of jobs.

Bachelor of Arts

The B.A. has a world languages requirement and an additional writing course. It also has an area of specialization that could be any minor or certificate on campus.

Degree Requirements

Core A (27 cr.)

- INFO-I 100 First-Year Experience (1 cr.)
- CSCI-C 200 Introduction to Computers and Programming (4 cr.)
- CSCI-C 212 Introduction to Software Systems (4 cr.)
- CSCI-C 241 Discrete Structures for Computer Science (3 cr.)
- CSCI-C 310 Data Structures – Python (3 cr.) or CSCI-C 343 Data Structures – Java (3 cr.)
- CSCI-C 335 Computer Structures (3 cr.) or CSCI-B 443 Introduction to Computer Architecture (3 cr.)
- CSCI-B 401 Fundamentals of Computer Theory (3 cr.) or CSCI-C 455 Analysis of Algorithms (3 cr.)
- CSCI-C 435 Operating Systems (3 cr.)
- INFO-I 453 Computer and Information Ethics (3 cr.)

Technical Writing (3 cr.)

- ENG-W 230 Writing in the Sciences
- ENG-W 231 Professional Writing Skills
- ENG-W 270 Argumentative Writing

General Education (41 cr.)

- Core Communication (6 cr.)
- Cultural Understanding (3-8 cr.)
  - World Language (8 cr.)
    One of the following: Demonstrated 200-level world language proficiency, a 200-level world language course, or a first-year world language sequence (131 and 132)
- Life and Physical Sciences (6 cr.)
- Arts and Humanities (3–6 cr.)
- Social Sciences (3–6 cr.)
  - An HCI course is recommended: INFO-I 270 Introduction to Human-Computer Interaction Principles and Practices (3 cr., Fall and Spring) or INFO-I 275 Introduction to Human-Computer Interaction Theory (3 cr., Fall and Spring)
- Analytical Reasoning (12 cr.)
  - MATH-I 153 College Algebra (3 cr., Fall and Spring)
  - MATH-I 154 Trigonometry (3 cr., Fall and Spring)
  - MATH-I 243 Linear Algebra for Data Science (3 cr., Fall)
  - PBHL-B 275 Probability – R (3 cr.,) or PBHL-B 302 Biostatistics for Informatics – Python (3 cr., Fall and Spring) or PBHL-B 304 Biostatistics for Health Data Science – R (3 cr., Fall and Spring)

A total of 9 Arts and Humanities and Social Science credits is required, with at least 3 credits from each category.

Career Readiness (2 cr.)

- NEWM-N 299 Career Readiness (2 cr.)

Core B (9 cr.)

Choose three courses at the 300-level or higher from:

- CSCI-B
- CSCI-C
- CSCI-P

Experiential Learning (3 cr.)

Choose one course:

- CSCI-Y 399 Project in Professional Practice (3 cr.)
- CSCI-C 460 Senior Project I (3 cr.)
- CSCI-P 465 Software Engineering for Information Systems I (3 cr.)
- INFO-I 490 Capstone Internship (3 cr.)

Area of Specialization (18 cr.)

Choosing an area of specialization is required, and you may select any minor, major, or certificate through Indiana

University Indianapolis to best customize your degree to your career interests.

The number of credits required for each minor, certificate, or specialization varies. If you choose an option that is less than 18 credit hours, you will need to add additional electives to your degree plan to reach 120 credit hours.

Bachelor of Science

Degree Requirements

Core A (27 cr.)

- INFO-I 100 First-Year Experience (1 cr.)
- CSCI-C 200 Introduction to Computers and Programming (4 cr.)
- CSCI-C 212 Introduction to Software Systems (4 cr.)
- CSCI-C 241 Discrete Structures for Computer Science (3 cr.)
- CSCI-C 310 Data Structures – Python (3 cr.) or CSCI-C 343 Data Structures – Java (3 cr.)
- CSCI-C 335 Computer Structures (3 cr.) or CSCI-B 443 Introduction to Computer Architecture (3 cr.)
- CSCI-B 401 Fundamentals of Computer Theory (3 cr.) or CSCI-C 455 Analysis of Algorithms (3 cr.)
- CSCI-C 435 Operating Systems (3 cr.)
- INFO-I 453 Computer and Information Ethics (3 cr.)

Core B (9 cr.)

Choose three courses at the 300-level or higher from:

- CSCI-B
- CSCI-C
- CSCI-P

General Education (42 cr.)

- Core Communication (6 cr.)
- Cultural Understanding (3 cr.)
- Life and Physical Sciences (6 cr.)
- Arts and Humanities (3–6 cr.)
- Social Sciences (3–6 cr.)
  - An HCI course is recommended: INFO-I 270 Introduction to Human-Computer Interaction Principles and Practices (3 cr., Fall and Spring) or INFO-I 275 Introduction to Human-Computer Interaction Theory (3 cr., Fall and Spring)
- Analytical Reasoning (18 cr.)
  - MATH-I 153 College Algebra (3 cr., Fall and Spring)
  - MATH-I 154 Trigonometry (3 cr., Fall and Spring)
  - MATH-I 241 Calculus for Data Science I (3 cr., Fall)
  - MATH-I 242 Calculus for Data Science II (3 cr., Spring)
  - MATH-I 243 Linear Algebra for Data Science (3 cr., Fall)
  - PBHL-B 275 Probability – R (3 cr.,) or PBHL-B 302 Biostatistics for Informatics – Python (3 cr., Fall and Spring) or PBHL-B 304 Biostatistics for Health Data Science – R (3 cr., Fall and Spring)

A total of 9 Arts and Humanities and Social Sciences credits is required, with at least 3 credits from each category.

Career Readiness (2 cr.)

- NEWM-N 299 Career Readiness (2 cr., Fall and Spring)

Experiential Learning (3 cr.)

Choose one course:

- CSCI-Y 399 Project in Professional Practice (3 cr.)
- CSCI-C 460 Senior Project I (3 cr.)
- CSCI-P 465 Software Engineering for Information Systems I (3 cr.)
- INFO-I 491 Capstone Internship (3 cr.)

Selectives (18 cr.)

Choose 18 credits of courses in the following minor or certificates or Core B courses or CSCI or INFO courses at the 300 level or higher:

Minor

- Game Design and Development

Certificates

- Applied Data Science
- Applied Information Science
- Artificial Intelligence
- Human-Computer Interaction
- Legal Informatics
- Multi-Device Development
- Software Bots for Cognitive Automation

General Electives (19 cr.)

Includes calculus to prepare for certain advanced courses like deep learning and for the data science M.S. and Ph.D. The B.S. also requires computing-related courses.

What you'll learn

- Programming
- Data structures
- Discrete structures
- Computer architecture
- Algorithms and theory of computation

Customize your degree by exploring what interests you, including:

- Operating systems
- Software engineering
- Programming languages
- Computer networks
- Cybersecurity

Certifications

Individual courses help prepare students for industry certification tests.

5 year B.S. + M.S.

- Applied Data Science
- Computer Science

- Human-Computer Interaction

Bring your passion to your degree

Customize your course of study to focus on what interests you. Luddy Indianapolis makes it easy to specialize your computer science degree, so you can explore:

- Cognitive automation
- Data science
- Full-stack development
- Game development
- Human-computer interaction
- Information science
- Legal informatics

And more.

last updated: 4/2025

Five Year Bachelor's and Master's Program

Five Year Bachelor's and Master's Program
A fast track to future success!

The Luddy School of Informatics, Computing, and Engineering also offers the following innovative, accelerated 5-year B.S./M.S. degree programs in the following areas:

- B.A. Artificial Intelligence + M.S. Applied Data Science
- B.S. Computer Science + M.S. Applied Data Science
- B.S. Computer Science + M.S. Computer Science
- B.S. Data Science + M.S. Applied Data Science
- B.S. Data Science + Master of Library and Information Science
- B.S. Health Information Management + M.S. Health Informatics
- B.S. Informatics + M.S. Applied Data Science
- B.S. Informatics + M.S. Bioinformatics
- B.S. Informatics + M.S. Health Informatics
- B.S. Informatics + M.S. Human-Computer Interaction
- B.S. Informatics + Master of Jurisprudence
- B.S. Mathematics + M.S. Applied Data Science
- B.S. Media Arts & Science + M.S. Human-Computer Interaction
- B.S. Media Arts & Science + Master of Library and Information Science
- B.S. Biology + M.S. Bioinformatics
- B.S. Biomedical Informatics + M.S. Bioinformatics
- B.S. Biomedical Informatics + M.S. Health Informatics
- B.S. Health Sciences + M.S. Health Informatics
- B.S. Nursing + M.S. Health Informatics
- B.S. Sports Management + M.S. Applied Data Science with Sports Analytics specialization

Informatics and computing professionals are in constant demand within an ever-evolving and growing field. As a result, employers are seeking graduates with the highest qualifications and skill sets to emerge as tomorrow's technology leaders. With these needs in mind, the Luddy School of Informatics, Computing, and Engineering at IU Indianapolis offers four, for top-achieving and motivated students.

These forward-thinking programs combine our very best degree offerings in an accelerated format designed to prepare highly-skilled, marketable and successful graduates. Alumni of our BS+MS programs will be well-equipped not only for success in the computing and information technology fields, but also the healthcare, science, business, interactive media and design industries, among others. Key benefits of our five-year BS +MS degree programs include:

- Save time and tuition
- Stand out in the job market with advanced skills and education
- Increased lifetime earning potential

Last updated: 4/2025

Bachelor of Science in Health Information Management

Bachelor of Science in Health Information Management

Degree Requirements

The Health Information Management Bachelor of Science is a 120 credit hour program. Students must earn a C- or higher in all courses and maintain a cumulative grade point average of 2.0 or higher to graduate.

Students are responsible for completing the degree requirements for their particular plan of study. Transfer students should consult a School of Informatics and Computing academic advisor regarding potential course exceptions and/or substitutions.

The plan of study is subject to revision. We encourage all students to meet with an academic advisor prior to registration each semester.

Some classes are only offered annually. Please work with your academic advisor to plan classes if you started in a spring semester.

Year 1

Fall

- INFO-I 100 First Year Seminar (1 cr.)
- HIM-M 108 Introduction to Health Information Management (3 cr.)
- HIM-M 110 Computer Concepts for Health Information (3 cr.)
- Core Communication (3 cr.)
- MATH-M 118 Finite Math (3 cr.)
- BIOL-N 211 Anatomy for Healthcare Management (3 cr.) or BIOL-N 261 Human Anatomy (5 cr.)

Spring

- HIM-M 120 Data Organization & Presentation in Healthcare Environment (3 cr.)
- HIM-M 330 Medical Terminology (3 cr.)

- Core Communication (3 cr.)
- BIOL-N 207 Physiology for Healthcare Management (3 cr.) or BIOL-N 217 Human Physiology (5 cr.)

Year 2

Fall

- HIM-M 200 Database Design for HIM (3 cr.)
- HIM-M 370 Health Information Management (3 cr.)
- Cultural Understanding (3 cr.)
- PBHL-B 301 Biostatistics for Health Information Management (3 cr.)
- Social Science (INFO-I 270 or INFO-I 275) (3 cr.)

Spring

- HIM-M 220 Healthcare Informatics for Decision Support (3 cr.)
- HIM-M 275 Cultural Competence in Healthcare Communication (3 cr.)
- Arts and Humanities (3 cr.)
- HIM-M 345 Healthcare Law, Ethics, and Information Release (3 cr.)
- NEWM-N 299 Career Readiness (2 cr.)
- Elective (1 cr.)

Year 3

Fall

- HIM-M 325 Healthcare Information Requirements and Standards I (3 cr.)
- HIM-M 350 Pathophysiology and Pharmacology for HIM I (3 cr.)
- HIM-M 355 ICD-10-CM/PCS Coding (3 cr.)
- HIM-M 475 Health Information Technology (3 cr.)
- LIS-S 301 Data Policy and Governance (3 cr.)

Spring

- HIM-M 327 Healthcare Information Requirements and Standards II (3 cr.)
- HIM-M 351 Pathophysiology and Pharmacology for HIM II (3 cr.)
- HIM-M 358 CPT Coding (3 cr.)
- HIM-M 400 Health Information Research and Analysis Methods (3 cr.)
- HIM-M 470 Healthcare Reimbursement Systems (3 cr.)

Year 4

Fall

- HIM-M 425 Quantitative Analysis of Health Information (3 cr.)
- HIM-M 443 Professional Practicum in Health Information Management I (2 cr.)
- HIM-M 462 Healthcare Quality Improvement (3 cr.)
- INFO-B 430 Introduction to Health Informatics (3 cr.)
- INFO-B 481 Health Information Standards and Terminologies (3 cr.)

Spring

- HIM-M 420 Health Information Project Management (3 cr.)
- HIM-M 444 Professional Practicum in Health Information Management II (2 cr.)
- HIM-M 490 RHIA Exam Preparation (3 cr.)
- INFO-B 435 Clinical Information Systems (3 cr.)
- Elective (4 cr.)

The final practicum requires students to present their supervising site project at a Capstone event held at the end of the fall and spring semester. Online students may choose to present in person or remotely by videoconferencing. During the event all students will interact “live” with faculty and answer questions.

The Professional Program
Students may begin the HIM Professional Program in either the fall or spring semester. Students must have all of their pre-requisite courses completed prior to starting the professional program. Upon successful completion of the professional program students are eligible to sit for the internationally recognized Registered Health Information Administrator (RHIA) credential.

The Professional Practicum Experience
Our program offers one-of-a-kind experiential learning that gives you a distinct advantage as you begin your career. Students will experience a mentored professional practicum within a variety of healthcare related settings. Practicums are project-based allowing students to integrate classroom based knowledge in a real world setting solving real world problems.

Last updated: 4/2025

Undergraduate Programs

Undergraduate Degree Programs
Prior to each semester’s enrollment, a faculty member or an academic advisor provides academic counseling for each student in the Luddy School of Informatics, Computing and Engineering. Although academic counseling is intended to provide effective guidance, students are responsible for planning their own programs and for meeting the following degree requirements for graduation.

Students are advised to read bulletin descriptions of all courses selected, paying careful attention to conditions concerning awarding of credit.

The Luddy School of Informatics, Computing, and Engineering offers the following undergraduate degrees:

- Artificial Intelligence (B.A. and B.S.)
- Biomedical Informatics
- Computer Science
- Data Science
- Health Information Management
- Informatics
- Media Arts and Science

Last updated: 3/2024

Bachelor of Science in Informatics

Bachelor of Science in Informatics

To graduate with the B.S. in Informatics, you must complete a total of 120 semester credit hours, broken down as follows.

Requirements are broken down as follows:

- Informatics core courses (39 credit hours)
- Cognate courses (15-18 credit hours)
- General education courses (30-42 credit hours)
- Informatics electives (9 credit hours)
- General electives (12-27 credit hours)

Area of Specialization
An area of specialization is an integrated program of courses concentrating on the applications – and impact – of informatics within the context of another discipline. Choosing an area of specialization is required, and you may select from virtually any IU Indianapolis program to best customize your degree to your career interests. The most popular specializations include:

The most popular specializations include:

- 3D Graphics and Animation minor
- Applied Computer Science certificate
- Applied Computer Science minor
- Applied Data Science certificate
- Biology minor
- Business certificate or Business minor
- Computer and Information Science minor
- Data Studies certificate
- Digital Humanities minor
- Full-Stack Development certificate
- Game Design and Development minor
- Human-Computer Interaction certificate
- Legal Informatics certificate
- Software Bots
- Video Production minor
- Virtual Production certificate

Capstone Project
From there, you'll complete specialized, hands-on courses that give you the tools and techniques needed as a future computing and technology professional. This includes completion of a capstone project during your senior year.

The capstone represents the culmination of your skills and knowledge within informatics and your chosen area of specialization. It may take the form of a thesis, a research project, a for-credit internship or an applied learning project to develop an information system.

Career Development
And before you graduate, you'll work with our Career Services Office to learn how to job search, assemble a portfolio of your work, pursue internship opportunities and connect with employers.

- Plan of Study
- Areas of Specialization
- Learning Outcomes

Last updated: 4/2025

Data Science

Bachelor of Science in Data Science

The data science and information science specializations prepare you to work with data at every stage. You'll learn how to create, obtain, curate, manage, preserve, visualize, and analyze data needed for valuable knowledge. Build skills needed in nearly every field and increase your ability to make smart, data-driven decisions in our interconnected world

The Bachelor of Science in Data Science is a 120 credit hour program. Students must earn a C- or higher in all courses and maintain a cumulative grade point average of 2.0 or higher to graduate.

First Year Seminar

- INFO-I 100 First Year Experience (1 cr.)

Data Science Core (54 cr.)

- AII-I 200 Introduction to Data Science (4 cr.)
- INFO-I 201 Mathematical Foundations of Informatics (4 cr.)
- LIS-S 201 Foundations of Data Studies (3 cr.)
- INFO-I 202 Social Informatics (3 cr.)
- LIS-S 202 Data Organization and Representation (3 cr.)
- INFO-B 210 Information Infrastructure I (4 cr.)
- INFO-B 211 Information Infrastructure II (4 cr.)
- INFO-I 223 Data Fluency (3 cr.)
- LIS-S 301 Data Policy and Governance (3 cr.)
- INFO-I 305 Introduction to Research in Informatics (3 cr.)
- LIS-S 305 Data Curation and Management (3 cr.)
- INFO-I 308 Information Representation (3 cr.)
- NEWM-N 328 Visualizing Information (3 cr.)
- INFO-I 415 Introduction to Statistical Learning (3 cr.)
- INFO-I 421 Applications of Data Mining (3 cr.)
- INFO-I 428 Web Mining (3 cr)
- INFO-B 443 Natural Language Processing (3 cr)

Career Readiness (2 cr.)

- NEWM-N 299 Career Readiness (2 cr.)

Informatics Capstone (3 cr.)

- INFO-I 400 Finland Study Abroad (3 cr.)
- INFO-I 491 Capstone Project Internship (3 cr.)
- INFO-I 492 Capstone Thesis (3 cr.)
- INFO-I 494 Capstone Project (3 cr.)

General Education (33 cr.)

- Core Communication (6 cr.)
- Analytical Reasoning A (9 cr.)
  - MATH-I 153 College Algebra (3 cr.)
  - MATH-I 154 Trigonometry (3 cr.)
  - MATH-I 243 Linear Algebra (3 cr.)
- Analytical Reasoning B (3 cr.)
  - PBHL-B 302 Biostatistics for Informatics (3 cr.)
- Cultural Understanding (3 cr.)
- Life and Physical Sciences (6 cr.)

- Arts and Humanities (3 cr.)
- Social Science (3 cr.)

Explore the specializations

Data Science

Develop math and tech skills to analyze complex data sets and solve real-world problems. Study analytics, cloud computing, and information infrastructure. Learn to design algorithms and make decisions effectively, using big data insights.

Specialization (21 cr.)

- MATH-I 241 Calculus for Data Science I (3 cr.)
- MATH-I 242 Calculus for Data Science II (3 cr.)
- CSCI-C 310 Data Structures-Python (3 cr.)
- LIS-S 302 Data and Society OR LIS-S 404 Surveillance Studies (3 cr.)
- INFO-I 416 Cloud Computing for Data Science (3 cr.)
- INFO-I 418 Deep Learning Neural Networks (3 cr.)
- LIS-S 304 Social Media Data or LIS-S 407 Social Science Data or Graduate Statistics (INFO-H 510 or PBHL-B 561) (3 cr.)

Electives (6 cr.)

6 credit hours of electives.

Information Science

Develop skills to organize, access, and manage datasets. Study data curation and management, data archives, and data organization. Explore the societal impact of data work to responsibly manage the data we create every day.

Specialization (15 cr.)

- LIS-S 302 Data and Society (3 cr.)
- INFO-I 304 Social Media Data (3 cr.)
- LIS-S 404 Surveillance Studies (3 cr.)
- LIS-S 405 Data Archives (3 cr.)

Electives (12 cr.)

12 credit hours of electives.

Last updated: 4/2025

Bachelor of Science in Media Arts and Science

Bachelor of Science in Media Arts and Science

Students in the Media Arts and Science program must successfully complete a minimum of 120 credit hours. Students must earn a C- or higher in all courses and maintain a cumulative grade point average of 2.0 or higher to graduate.

Transfer students should consult an academic advisor from our school regarding potential course exceptions and/or substitutions.

Degree Maps

- B.S. Degree
- Full Stack Developer
- B.S. + HCI M.S.
- B.S. + MLIS

Core (27 cr.)

- INFO-I 100 First Year Seminar (1 cr.)
- NEWM-N 100 Foundations of New Media (3 cr.)
- NEWM-N 102 Digital Media Imagery (3 cr.)
- NEWM-N 115 Introduction to Front-end Development (3 cr.)
- NEWM-N 201 Design Issues in Digital Media (3 cr.)
- NEWM-N 202 Digital Storytelling (3 cr.)
- INFO-I 210 Information Infrastructure (4 cr.)
- NEWM-N 299 Career Readiness (2 cr.)
- NEWM-N 399 Portfolio Development (2 cr.)
- NEWM-N 420 Multimedia Project Development (3 cr.)

Capstone (3 cr.)

Select one of the following options:

- INFO-I 491 Capstone Project Internship (3 cr.)
- NEWM-N 499 Capstone Project (3 cr.)

General Education (21 cr.)

- Core Communication (6 cr.)
- Analytical Reasoning List A (3 cr.)
  (List B is fulfilled by completing the MAS Core.)
- Cultural Understanding (3 cr.)
- Life and Physical Sciences (6 cr.)
- Arts and Humanities is fulfilled by completing the MAS Core.
- Social Sciences (3 cr.)

General Electives (up to 15 cr.)

Choose from other IU Indianapolis courses.

Course of Study

At least 42 credit hours must be NEWM courses, with at least 12 hours at the 300-level, 9 hours at the 400-level and 21 hours at any level. This would include courses in your specialization.

Specialty Areas

From there, you'll take additional core courses and electives in your chosen specialty area(s), becoming fluent in the use of contemporary media tools and project management principles. A specialty area is your opportunity to customize your education in those aspects of media and production best-suited for your career goals. Specialty areas include:

- 3-D Graphics and Animation
- Digital Storytelling
- Game Design and Development
- Video Production and Sound Design
- Web Design and Development

Capstone Project

With your skills sets firmly in place, you'll design and complete a faculty-mentored capstone project during your final semester. Your capstone project signals your readiness to graduate and represents the culmination of your knowledge and skill within your chosen specialty area(s).

And as a graduating senior, you'll showcase that education and passion to your fellow classmates, family, faculty, alumni and visiting employers during the School

of Informatics and Computing Capstone Event held at the close of each semester.

Last updated: 4/2025

Informatics Minor

Informatics Minor

With this minor you'll be positioned to:

- Design better information systems
- Use digital technology more effectively at work
- Integrate new and updated computing applications into your specialty

Your courses will introduce you to the basic concepts of software architecture and provide you with practical experience in application development.

Plan of Study
Students must earn a C- or higher in each individual course as well as a cumulative grade point average of a 2.0 or higher in order to graduate with the Informatics minor.

Required Courses (12 cr.)
- **INFO I101 Introduction to Informatics** (4 cr.)
- INFO I210 Information Infrastructure I (4 cr.)
- INFO I211 Information Infrastructure II (4 cr.)

Additional Requirements (9 cr.)
Choose three courses.

Any INFO-I course

Or select from the following New Media classes which are taken as part of the Informatics BS.

NEWM-N220 Introduction to Media Application Development

NEWM-N320 Intermediate Media Application Development

NEWM-N328 Visualizing Information

NEWM-N450 Usability Principles for New Media Interfaces

Last updated: 3/2024

3D Graphics and Animation Minor

3D Graphics and Animation Minor

The undergraduate minor in 3D Graphics and Animation enables students to design, model, texture, animate, light, and render 3D computer animated creatures, characters, props, scenery, and artifacts. Students learn the process from preproduction, to production, to postproduction for films, videogames, environments, motion graphics, commercial graphics, visual stories, scientific simulation, 3D printing, and virtual and augmented reality. Students develop production quality projects with advanced aesthetics using the entire 3D production pipeline.

Plan of Study

Prerequisite

The minor requires knowledge of Adobe Photoshop, which may be demonstrated by test, portfolio, credential, or by taking a course that covers Photoshop, such as NEWM N102 Digital Media Imagery.

Required Courses (15 cr.)

- NEWM N243 Introduction to 3D (3 cr.)
- NEWM N341 Lighting and Materials (3 cr.)
- NEWM N343 Hard Surface 3D Modeling (3 cr.)
- NEWM N345 Organic Modeling and Texturing (3 cr.)
    - and choose one:
- NEWM N342 3D Animation (3 cr.) or
- NEWM-N340 Motion Graphics (3 cr.)

Students must earn a C- or higher in each course to graduate with the 3D Graphics and Animation minor.

Admissions and Advising

The minor is open to IU Indianapolis students in any major except Media Arts and Science. Media Arts and Science students may pursue the 3D Graphics and Animation specialization instead.

Last updated: 3/2024

Digital Humanities Minor

Digital Humanities Minor (16 cr.)

Offered jointly by the School of Liberal Arts, Herron School of Art and Design, and the Luddy School of Informatics, Computing, and Engineering in Indianapolis, this minor guides students in employing visual communication and informatics in the arts, social sciences, and humanities.

You'll learn to understand technology not as a thing apart, but as a part of our creative culture. Through this minor, students have the opportunity to view the technologies they use as objects of humanistic and artistic design, laden with historical and cultural perspectives that interact with political and economic systems.

This experience with digital technologies and humanistic thinking expands your opportunities in today's highly interconnected global environment, as you learn to work with large data sets and perform data analysis on texts.

Minor Requirements

Required Courses (10 cr.)

- HIST-H 195 Introduction to Digital Humanities (3 cr.)
- HER-F 130 Studio Art and Technology (3 cr.)
- INFO-I 101 Introduction to Informatics (4 cr.)

HIST-H 195 is approved for the Arts and Humanities component of the General Education core. INFO-I 101 is approved for the Analytical Reasoning, List B, component of the General Education core.

Elective Courses (6 cr.)

Select two courses from outside your major:

Humanities

- AMST-A 303 American Cyber Identity (3 cr.)

- COMM-M 150 Mass Media and Society (3 cr.)
- COMM-M 215 Media Literacy (3 cr.)
- ENG-W 315 Writing for the Web (3 cr.)
- ENG-W 318 Finding Your E-Voice (3 cr.)
- ENG-W 412 Literacy and Technology (3 cr.)
- GEOG-G 337 Cartography and Graphics (3 cr.)
- GEOG-G 439 Seminar in Geographic Information Science (3 cr.)

Informatics and Information Science

- INFO-I 210 Information Infrastructure (4 cr.)
- INFO-I 223 Data Fluency (3 cr.)
- INFO-I 270 Introduction to Human-Computer Interaction: Principles and Practices (3 cr.)
- INFO-I 421 Applications of Data Mining (3 cr.)
- LIS-S 223 Genealogy and Local History Resources (3 cr.)
- LIS-S 282 Digital Preservation (3 cr.)
- LIS-S 303 Organization and Representation of Knowledge and Information (3 cr.)
- LIS-S 321 Humanities Information (3 cr.)
- LIS-S 352 Digital Libraries (3 cr.)

Media Arts

- NEWM-N 115 Introduction to Multi-Device Web Development (3 cr.)
- NEWM-N 202 Digital Storytelling (3 cr.)
- NEWM-N 253 Introduction to Digital Video (3 cr.)
- NEWM-N 243 Introduction to 3D (3 cr.)
- NEWM-N 343 Hard Surface 3D Modeling (3 cr.)
- NEWM-N 449 3D Prototyping for Visualization and Abstraction (3 cr.)

Students must earn a C- or higher in each course and maintain a 2.0 GPA to graduate with the Digital Humanities minor.

last updated: 3/2024

Game Design and Development Minor

Game Design and Development Minor

Learn the process of creating mobile, console, virtual reality, board, and video games.

Our goal-driven game development program is focused on completing play-ready products. Be prepared for a hands-on experience that will draw on all your skills — creative, managerial, technical — to conceptualize and prototype games. Deepen your understanding of cognitive theory and the psychology behind games as you combine formal and engaging elements of video game design to build interactive levels, environments, and experiences.

Minor Requirements

Introductory Course (3 cr.)

- NEWM-N 132 Game Design Psychology: Theory and Prototyping (3 cr.)

3D Graphics or Programming Course (3–4 cr.)

Select one of the following courses:

- NEWM-N 243 Introduction to 3D (3 cr.)
- CGT 11600 Geometric Modeling for Visualization and Communication (3 cr.)
- CSCI 23000 Computing I (4 cr.)
- CIT 21500 Web Programming (3 cr.)
- INFO-I 210 Information Infrastructure I (4 cr.)
- INFO-B 210 Information Infrastructure I (4 cr.)
- NEWM-N 220 Introduction to Media Application Development (3 cr.)
- NEWM-N 232 Intro to Gameplay Scripting (3 cr.)

Students may test out of the 3D graphics or programming requirement by prior learning assessment, in which case they take an additional advanced course.

Two Course Gaming Core

- NEWM-N 230 Introduction to Game Design and Development (3 cr.)
- NEWM-N 330 Intermediate Game Design and Development (3 cr.)

Advanced Course or Elective

Select one of the following courses:

- NEWM-N 331 Game Testing and Evaluation (3 cr.) (recommended)
- NEWM-N 430 Advanced Game Design and Development (3 cr.) (recommended)
- CGT 11600 Geometric Modeling for Visualization and Communication (3 cr.) or
- NEWM-N 243 Introduction to 3D (3 cr.)
- CSCI 43700 Introduction to Computer Graphics (3 cr.)
- CSCI 43800 Advanced Game Development (3 cr.)
- CSCI-N 355 Introduction to Virtual Reality (3 cr.)
- CSCI-N 451 Web Game Development (3 cr.)
- NEWM-N 332 Intermediate Gameplay Scripting (3 cr.)
- NEWM-N 333 Creature and Character Design for Videogames, Comics, Film, and Animation (3 cr.)
- NEWM-N 261 Storyboarding for Multimedia (3 cr.)
- NEWM-N 335 Character Design and Animation (3 cr.)
- NEWM-N 337 Virtual World Design and Development (3 cr.)
- NEWM-N 339 Augmented Reality Application Design and Development (3 cr.)
- NEWM-N 434 Serious Games and Simulations (3 cr.)
- NEWM-N 436 Game Production (3 cr.)

Students must earn a C- or higher in each course and maintain a 2.0 GPA.

last updated: 3/2024

Studio Art and Technology Minor

Studio Art and Technology Minor

Visual platforms transcend language, resonating across the widest audiences. Get your message to the masses by becoming an effective visual communicator, combining

traditional foundations of art with the digital techniques of the here and now.

From basic drawing techniques to web page design and layout, learn to combine media, development, and artistic skills to broaden your communications knowledge and impact. The Studio Art and Technology minor, offered jointly through the Herron School of Art and Design and Luddy Indianapolis, offers a unique combination of courses from Media Arts and Science, Fine Arts and Visual Communication Design.

Minor Requirements

18 credit hours are required for this minor, which is only open to students majoring in Media Arts and Science.

- HER-E 101 Beginning Drawing (or D101 Drawing 1)
- HER-E 102 Beginning Drawing 2 (or D102 Drawing 2)
- HER-S 201 Sculpture I

Choose one of the following:

- NEWM-N 201 Design Issues in Digital Media (may be counted as a general education course in the Arts and Humanities)
- NEWM-N 215 Intermediate Multi-Device Web Development (Prerequisite: N115)
- NEWM-N 243 Introduction to 3D
- NEWM-N 253 Introduction to Digital Video
- NEWM-N 255 Introduction to Digital Sound

Choose two of the following:

- HER-D 251 Anatomy for Artists (3 credits)
- HER-Q 261 Introduction to CNC (3 credits)
- HER-S 202 Sculpture II (Sculpture I is prerequisite, 3 credits)
- HER-V 210 Foundations of Graphic Design (3 credits)
- HER-D 230 Figure Drawing (3 credits)
- HER-V 211 Typography I (3 credits)
- HER-V 251 Typography II (3 credits)

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Video Production Minor

Video Production Minor (15 cr.)

You'll master filmmaking techniques through experiential learning when you earn our undergraduate minor in Video Production.

Students use industry-standard equipment, advanced editing software, professional lighting techniques, and digital effects. Utilize field production techniques as you shoot interviews and narrative scenes to create documentaries and short narrative films.

Learn how to plan, shoot, edit, and deliver complex video productions. You'll apply advanced lighting and photography techniques for a variety of conditions while putting into practice the principles of composition, continuity, cinematic space, and A/B roll editing. Prepare to develop story ideas, translate them into a visual medium, and structure them effectively using creative methods of information presentation and narrative storytelling.

Core (9 cr.)

- NEWM-N 253 Introduction to Digital Video (3 cr.)
- NEWM-N 353 Intermediate Digital Video (3 cr.)
- NEWM-N 356 Lighting and Field Production (3 cr.)

Selectives (6 cr.)

Select two:

- NEWM-N 255 Introduction to Digital Sound (3 cr.)
- NEWM-N 354 Directorial Analysis, Production, and RAW Workflow (3 cr.)
- NEWM-N 355 Intermediate Digital Sound Design (3 cr.)
- NEWM-N 357 Digital Effects (3 cr.)
- NEWM-N 415 Documenting Cultural Heritage: Artifacts and Traditions (3 cr.)
- NEWM-N 453 Advanced Digital Video (3 cr.)
- NEWM-N 456 Digital Cinema (3 cr.)
- NEWM-N 468 Video for Social Change (3 cr.)

Additional Herron and Liberal Arts courses, including topics courses, seminars, and independent studies, may be counted as selectives with the faculty advisor's approval.

Substitute Courses

CGT 34600 Digital Video and Audio (3 cr.), HER-K 300 Photography and Intermedia: Time-based Art (3 cr.), or MUS-A 242 Music Technology Lab IV may be taken instead of NEWM-N 253 Introduction to Digital Video (3 cr.) to satisfy the core requirement.

MUS-Z 320 Advanced Special Topics in Music/Non-Majors: Digital Sound Design (3 cr.) may be substituted for NEWM-N 255.

Students must earn a C or higher in each course to graduate with the Video Production minor.

last updated: 3/2024

Computer Science Minor

Computer Science Minor (20 cr.)

Increase your employability by enhancing your computational thinking and problem-solving abilities, in fields ranging from science and engineering to business and the humanities.

The 20-credit Undergraduate Minor in Computer Science equips students with essential skills in data structures, software development, and programming.

Gain proficiency in designing, implementing, and evaluating software solutions, preparing them for diverse computing challenges and enhancing their critical thinking, problem-solving, and innovative capabilities.

Required courses

- CSCI-C 241 Discrete Structures for Computer Science (3 cr., on-campus) or CSCI-C 251 Foundations of Digital Computing (3 cr., online)
- CSCI-C 343 Data Structures – Java (3 cr., on-campus and online) or CSCI-C 310 Data Structures – Python (3 cr., online)

Programming Sequence (choose 1)

- Online:
  - CSCI-C 155 Problem Solving and Programming I (4 cr.) and CSCI-C 255 Problem Solving and Programming II (4 cr.)
- On-campus:
  - CSCI-C 200 Introduction to Computers and Programming (4 cr.) and CSCI-C 212 Introduction to Software Systems (4 cr.)

Elective or substitute courses

Choose an additional two approved selectives (6 cr. min.) from this list:

- CSCI-A, CSCI-B, CSCI-C, or CSCI-P courses at the 300 level or above;
- Calculus I (MATH-I 165, MATH-I 241, or MATH-M 220)
- Calculus II (MATH-I 166, MATH-I 242, or MATH-M 230)
- Linear Algebra (MATH-I 243 or MATH-M 303)

The minimum passing grade for both required courses and selectives is C–.

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Human Computer Interaction (HCI) Undergraduate Certificate

Human Computer Interaction (HCI) Undergraduate Certificate
Upon completion of the undergraduate Human-Computer Interaction Certificate, students will be able to demonstrate knowledge in the following core competencies:

1. **Basic Human-Computer Interaction Theory and Usability Terms, Principles and Practices**
   - Understanding of human-computer interaction and usability terms, concepts, principles and practices
   - Problem space definition and conceptual models of interactive products
   - User-centered approaches to interaction design as applied to software and the web
   - User profiling, needs and requirements
   - Interface design principles and processes; including related areas of visual design
   - Cognitive and information processing
   - Processes and life-cycles of interactive product design
   - Interactive product evaluation and testing methods, both qualitative and quantitative
2. **Ability to Understand and Demonstrate Basic Design and Evaluation of Interactive Products Up to the High Fidelity Prototype Stage**
   - Interactive product interface design and prototyping based on user/needs assessments
   - Human-computer interaction principles and a user-centered approach to interaction design as applied to software and the Web
   - Apply evaluation and usability testing methods to interactive products to validate design decisions

Last update: 02/04/2014

Undergraduate Informatics Certificate

Undergraduate Informatics Certificate
Upon completion of the undergraduate Informatics Certificate, students will be able to demonstrate knowledge in the following core competencies:

1. **Technical Knowledge:**
   - Define terms and explain basic principles important to the operation of computing systems, as well as fundamental programming concepts
   - Demonstrate knowledge and skills in data representation, models, structures and management
2. **Social Dynamics of Informatics and Information Technology:**
   - Understand and apply major societal trends affecting the development and deployment of modern day IT, such as access, privacy, intellectual property, security and others
   - Critically analyze the impact of IT on individuals, groups and organizations at local and global levels
   - Analyze the social, cultural and organizational settings in which technology solutions will be deployed to achieve successful implementation
3. **Domain-specific* Critical Thinking and Problem Solving Skills:**
   - Define terms and explain basic principles, concepts and theories from another domain or discipline in which IT skills will be applied
   - Access evolving trends in information technology and IT research
   - Synthesize and analyze information and ideas from multiple sources and perspectives
   - Evaluate data, arrive at reasoned conclusions and solve challenging problems
4. **Collaborative Teamwork:**
   - Select and effectively utilize oral, written, visual and quantitative communication skills within the context of an interdisciplinary team
   - Identify and demonstrate the skills, behaviors and attitudes necessary to function as an effective team member, including working cooperatively with diverse group members

- Articulate legal and ethical issues when using the creative work of others; respect the intellectual property of others

5. **Professional Ethics and Development:**
   - Participate in the development of a personal code of ethics that considers information ethics
   - Articulate principles for resolving ethical conflicts

Last update: 02/04/2014

Undergraduate Legal Informatics Certificate

Undergraduate Legal Informatics Certificate
Upon completion of the undergraduate Legal Informatics Certificate, students will be able to demonstrate knowledge in the following core competencies:

- Students will be prepared to find employment in law firms and legally-related agencies and organizations, such as courts, law schools, non-profit organizations, regulatory agencies, and vendors that develop and sell products for the legal industry. For example, most federal courts in the U.S. use electronic filing, docket control and document retrieval, provide legal documents and information to the public through websites, offer webinars of oral arguments and other proceedings and have sophisticated systems for courtroom presentations. State courts are moving to become what is known as “the electronic courtroom.” The International Legal Technology Association (ITLA) has a long list of job openings that would provide interesting positions for those who complete the Certificate in Legal Informatics. Moreover, *Fifty Legal Careers for Non-Lawyers* describes a number of career opportunities that are encompassed in the legal informatics curriculum.
- Students who are already working as law technology professionals or paralegals will have an opportunity to update their skills and to have a recognizable certificate from a high-quality institution of higher education, namely, the IU School of Informatics, IU Indianapolis.
- Students will be prepared to bring cutting edge technology to law practices and other legally-related organizations and will not require training on these systems beyond a customary orientation program.
- Students will implement systems and technology that will impact the quality and cost of client services, ease the workload and enhance the productivity of busy attorneys and add greater efficiency to a variety of legally-related agencies and organizations.
- Students who want to focus on electronic discovery in their future careers will be able to sit for the electronic discovery certification examinations being developed by the Organization of Legal Professionals (OLP).

Last update: 02/06/2014

Undergraduate Medical Coding Certificate

Undergraduate Medical Coding Certificate
Students completing the Medical Coding Certificate will aquire competencies in several domains.

Domain I - Life Sciences

1. **Anatomy and Physiology**
   - Identify the structures and functions of the human body
   - Locate anatomical online lookups (Adam, etc.)

2. **Medical Terminology**
   - Demonstrate their ability to spell, define, and pronounce medical terms of major disease processes, diagnostic procedures, laboratory tests, abbreviations, drugs, and treatment modalities
   - Demonstrate knowledge of root/suffix/prefix word build concepts and common medical terms

3. **Pathophysiology**
   - Identify specific disease processes by human body system
   - Identify cause, diagnosis, and treatment for each disease process

4. **Pharmacotherapy & Laboratory Findings**
   - Recognize the action of drugs such as: absorption, distribution, metabolism and excretion by the body.
   - Differentiate between drug classifications
   - Identify the most commonly prescribed drugs
   - Describe a formulary
   - Match drugs to common conditions
   - Match drugs to lab findings

Domain II - Information Technology

1. **Introduction to Desktop Applications**
   - Demonstrate keyboard and web access skills
   - Identify concepts related to hardware and software
   - Demonstrate knowledge of Microsoft Office Suite applications

2. **Computer Software Applications in Healthcare**
   - Recognize commonly used software in healthcare
   - Compile public reporting for disease and disease trends
   - Describe how acute care organizations store and retrieve electronic health records
   - Analyze different types of encoder software
   - Analyze online coding tools (coding reference tools)
   - Evaluate Computer Assisted Coding (CAC) software
   - Identify the issues involving the migration from a paper-based Health Information Management department to an electronic Health Information Management department
   - Summarize acute care environment vendors and their system strengths.
   - Evaluate an Electronic Health Record (EHR)
   - Evaluate a Personal Health Record (PHR)

- Evaluate Heath Information Exchanges (HIE)

Domain III - Health Information Management

1. **Introduction to Health Information Management**
   - Recognize the content & structure of healthcare data
   - List the content of medical records
   - State the documentation requirements for medical records
   - Identify legal/ethics issues in Health Information Management such as privacy, security, and the Health Insurance Portability & Accountability Act
   - Recognize release of Information issues
   - Identify the Code of Ethics for Health Information Management
2. **Healthcare Delivery Systems**
   - Identify types of healthcare organizations
   - Identify types of healthcare workers
   - Identify healthcare settings that employ coders
   - Understand the types and levels of Healthcare Delivery Systems in the U.S., and of the governing bodies that regulate the Health Information Management processes, and an understanding how eHIM will change this environment
   - Recognize the organization of healthcare delivery
   - Interpret accreditation standards
   - Discuss licensure/regulatory agencies

Domain IV - Clinical Classification Systems

1. **Basic Diagnosis Coding Systems**
   - Demonstrate knowledge of the International Classification of Diseases ICD-9-CM
   - Recognize diagnostic based prospective payment groups such as DRG, APR-DRG, & RUGS.
   - Recognize the International Classification of Diseases ICD-10-CM
   - Recognize the Systematized Nomenclature of Medicine (SNOMED)
   - Demonstrate knowledge of Current Procedural Terminology (CPT)
   - Recognize procedure based payment systems such as Resource Based Relative Value (RBRV), Evaluation &Management and Ambulatory Payment Classification (APC)
   - Identify the impact that coding and sequencing has on reimbursement
2. **Reimbursement Methodologies**
   - Identify Ambulatory Surgery Center reimbursement
   - Identify third party payers
   - Describe billing and insurance procedures
   - Discuss an explanation of benefits
   - Recognize Quality Improvement Organizations (QIO) and their role in the payment process
   - Identify charge master description and maintenance
   - Describe managed care/capitation
   - Recognize compliance issues
   - Audit and monitor the coding process for regulatory compliance

Last updated: 02/04/2014

Bachelor of Science in Health Information Administration

Bachelor of Science in Health Information Administration
Upon graduation, students are eligible for a national registry examination offered through the American Health Information Management Association (AHIMA) and earn the credential of Registered Health Information Administrator (RHIA). This credential exhibits the graduate's expertise in the professional fields of Health Information Management.

Indiana University takes great pride in the fact that graduates of the Health Information Management program have exceeded the AHIMA national average scores on all core competencies on the Registered Health Information Administrator (RHIA) national exam.

Graduates of the Health Information Administration undergraduate program will demonstrate expertise in the following core competencies essential to success as an informatics, computing and information technology professional specializing in health information:

1. **Health Data Management**
   1. Health Data Structure, Content and Standards
   2. Healthcare Information Requirements and Standards
   3. Clinical Classification Systems
   4. Reimbursement Methodologies
2. **Health Statistics, Biomedical Research and Quality Management**
   1. Healthcare Statistics and Research
   2. Quality Management and Performance Improvement
3. **Health Services Organization and Delivery**
   1. Healthcare Delivery Systems
   2. Healthcare Privacy, Confidentiality, Legal and Ethical Issues
4. **Information Technology & Systems**
   1. Information and Communication Technologies
   2. Data, Information, and File Structures
   3. Data Storage and Retrieval
   4. Data Security
   5. Healthcare Information Systems
5. **Organization and Management**
   1. Human Resources Management
   2. Financial and Resource Management
   3. Strategic Planning and Organizational Development
   4. Project and Operations Management

Last updated: 02/04/2014

Student Learning Outcomes

Student Learning Outcomes

Informatics is an applied, professional computing discipline. It responds to society's need to solve increasingly complex problems in all fields of human endeavor by acquiring, managing and interpreting data. Informatics studies the ways in which people, information and digital technologies interact.

Nearly all fields benefit from the rapidly evolving fields of computing and information science. Informatics graduates solve problems through the application of computing or computation in the sciences, business, the humanities and the arts.

Computing and information technology are evolving rapidly. The student learning outcomes articulated here are central to educating Informatics graduates who possess both the technological and human-centered design skills necessary to develop and deploy useful digital tools that acquire and manage data for informed decision-making. They incorporate intellectual and ethical standards that every Luddy School of Informatics, Computing, and Engineering graduate should attain.

Bachelor of Science Degrees

- **Applied Data and Information Science**: graduates focusing on Applied Data will Develop math and tech skills to analyze complex data sets and solve real-world problems. Study analytics, cloud computing, and information infrastructure. Learn to design algorithms and make decisions effectively, using big data insights. Graduates focusing on Applied Information Science will Develops skills to organize, access, and manage datasets. Study data curation and management, data archives, and data organization. Explore the societal impact of data work to responsibly manage the data we create every day.
- **Artificial Intelligence (BA)**: graduates will learn about Design user interfaces to improve human-AI interaction and real-time decision-making, Evaluate the advantages, disadvantages, challenges, and ramifications of human-AI augmentation, Design and develop symbiotic human-AI systems that balance the information processing power of computational systems with human intelligence and decision making, Explain the benefits, limitations, and tradeoffs of designing engaging and ethical conversational user interactions, including those supported by chatbots, smart speakers, and other AI-driven, voice-based technologies and Design and evaluate conversational interfaces for different users and contexts of use.
- **Biomedical Informatics**: graduates enrolled in our Biomedical Informatics degree program learn how to effectively use biomedical data, information, and knowledge for scientific inquiry, problem-solving, and decision making, motivated by efforts to improve human health.
- **Computer Science:** graduates will learn programming, data structures, discrete structures, computer architecture, algorithms and theory of computation as well as exploring operating systems, software engineering, programming languages, computer networks and cybersecutiry. Individual courses will allow students to pursue certifications for industry tests.
- **Health Information Management**: graduates will learn about data governance, content and structure, information protection access, use, disclosure, privacy and security, informatics, analytics and data use, revenue cycle management, health law and compliance, and organizational management and leadership in the health industry.
- **Informatics**: graduates will demonstrate expertise in the following core competencies essential to success as an informatics, computing, and information technology professional. Those competencies are: Foundations of Informatics and Computing, problem solving and critical thinking, data studies and analytics, design and analysis of information systems, social dynamics of informatics and information technology, and professional and domain specific knowledge and skills.
- **Media Arts and Science**: the following core competencies essential to success as an informatics, computing and information technology professional specializing in new and interactive media:
    1. Communicate ideas effectively in written, oral, and visual form to a range of audiences.
    2. Work effectively as a member of a team to achieve a common goal.
    3. Analyze a problem, identify and evaluate alternatives and plan an appropriate solution.
    4. Evaluate media from multiple perspectives using the theories, concepts, and language of digital media with an appreciation for the history, theory, and traditions of digital media.
    5. Demonstrate mastery of the concepts, techniques and tools in one or more digital media specialties.
    6. Develop professional quality digital media productions by promptly applying knowledge and skills including best practices and standards.
    7. Explain the impact of digital media on individuals, organizations and society.
    8. Acknowledge diverse opinions regarding professional, ethical, legal and social issues with a global perspective.
    9. Appreciate the need for lifelong learning and have a plan for continuing professional development.
    10. Understand digital media and its effective use as a form of communication.
- **Full Stack Development (Informatics BS+ Media Arts and Science BS)**: will combine the learning outcomes of both the Informatics and Media Arts and Science degrees with a special focus on web design and development.

Undergraduate Certificates

- **Applied Data Science**: students will learn to develop data-driven solutions, allowing us to better understand ourselves, our communities, and the global market. Unlocking the power of data enables us to run businesses more efficiently, make groundbreaking scientific discoveries, and promote

the common good. And, develop mathematical and technological skills to analyze data sets, leading to valuable knowledge and the societal implications of data work, including privacy and surveillance.

- **Applied Data Information Science**: students will demonstrate the value of data in society and articulate the roles of data creators and consumers, apply principles of representation and organization to provide access to resources in various information environments, interpret stakeholder needs for databases and information layers using iterative and reflexive design processes, identify the stages of the data curation process and the issues associated with the storage, preservation, and security of data, analyze the implications of data policy creation, the concerns involved, and its communication to information organizations.
- **Artificial Intelligence:** graduates will acquire AI knowledge and skills using algorithms or results produced by artificial intelligence in a variety of ways to apply towards work as an artificial intelligence specialist, business intelligence analyst, cloud engineer, data scientist and machine learning engineer.
- **Human-Computer Interaction**: graduates will be able to demonstrate knowledge in the following core competencies: interactive product interface design and prototyping based on user/needs assessments, human-computer interaction principles and a user-centered approach to interaction design as applied to software and the web and apply evaluation and usability testing methods to interactive products to validate design decisions.
- **Legal Informatics**: graduates will be able to implement specialized technology in law firms and law-related organizations, assist with presenting a legal case in court, handle electronic evidence with confidence, incorporate effective information governance into any organization, establish proper security and privacy programs and protect an organization's intellectual property.
- **Medical Coding**: To make valid decisions, accurate information is key, The medical coder carefully reviews health records for accurate coding and billing. By earning this certificate, you'll learn to understand medical terminology, private payer policies, and government regulations,
- **Multi-Device Development**: boot camp-style program equips you with the skills for an entry-level job creating client-side websites and web and mobile applications, earning $40,000 a year or more. It's ideal for recent high school graduates and adult learners.
- **Post Baccalaureate in Health Information Management:** graduates will enhance their biological or health science bachelor's degree with courses that will prepare for a career in the health information industry along with potential accreditation with the RHIA.
- **Software Bots for Cognitive Automation**: certificate prepares for jobs in intelligent process automation cover a wide area, including design, development, and analysis, This job-driven certificate in consultation with companies that expect a growing need for designers, developers, and analysts in cognitive automation.
- **Virtual Production**: certificate empowers filmmakers, actors, and animators across multiple locations to collaborate in real time, They create together by using software tools to combine live-action footage with computer-generated graphics. Virtual production has become integral to filmmaking. Studios need talent with a solid understanding of this new field in digital cinema. Gain in-demand skills by earning an undergraduate certificate in virtual production. You'll learn the software and equipment used to create virtual sets and reactive backgrounds in real time,

Last updated: 3/2024

Bachelor of Science in Informatics

Bachelor of Science in Informatics
Graduates of the Informatics undergraduate program will demonstrate expertise in the following core competencies essential to success as an informatics, computing and information technology professional:

1. **Technical Knowledge:**
   - Demonstrate knowledge and skills in the mathematical and logical foundations of informatics, data representation, models, structures and informatics-centric management
   - Define terms and explain basic principles essential to the design and development of IT and computing systems
   - Acquire fundamental concepts and skills in software architectures and the development of information systems
2. **Social Dynamics of Informatics and Information Technology:**
   - Understand and apply major societal trends affecting the development and deployment of modern day IT, such as access, privacy, intellectual property, security and others
   - Critically analyze the impact of IT on individuals, groups and organizations at local and global levels
   - Apply a user-centered approach to interaction design and product usability, including techniques for quantitative and qualitative testing of interface and interaction design
   - Utilize digital tools to communicate with a range of audiences
   - Analyze the social, cultural and organizational settings in which IT solutions will be deployed to achieve successful implementation
3. **Domain-specific* Critical Thinking and Problem Solving Skills:**
   **Domains are areas of specialization that may include business, science, the arts or humanities.*
   - Define terms and explain basic principles, concepts and theories from another domain or discipline in which IT skills will be applied

- Deploy IT resources in the context of another domain and/or discipline
- Synthesize, analyze and conceptualize information and ideas from multiple sources and perspectives
- Evaluate data, arrive at reasoned conclusions and solve challenging problems

4. **Collaborative Teamwork:**
   - Select and effectively utilize oral, written, visual and quantitative communication skills within the context of an interdisciplinary team
   - Identify and demonstrate the skills, behaviors and attitudes necessary to function as an effective team member, including working cooperatively with diverse group members
   - Acquire the skills to initiate, manage and execute an IT project
   - Articulate legal and ethical issues when using the creative work of others; respect the intellectual property of others
5. **Professional Ethics and Development:**
   - Create a personal code of ethics; articulate principles for resolving ethical conflicts
   - Commit to a regular program of continuing education and lifelong learning that is independent of employer sponsorship
   - Participate in professional organizations that promote responsible computing and service to society

   Last updated: 02/04/2014

Bachelor of Science in Media Arts and Science

Bachelor of Science in Media Arts and Science
Graduates of the Media Arts and Science undergraduate program will demonstrate expertise in the following core competencies essential to success as an informatics, computing and information technology professional specializing in new and interactive media:

1. Understand digital media and its effective use as a form of communication.
2. Communicate ideas effectively in written and oral form to a range of audiences.
3. Work effectively as a member of a team to achieve a common goal.
4. Analyze a problem, identify and evaluate alternatives, plan an appropriate solution.
5. Appreciate the history, theory, and traditions of digital media. Evaluate media from multiple perspectives using the theories, concepts, and language of digital media.
6. Demonstrate mastery of the concepts, techniques, and tools in one or more digital media specialties.
7. Apply knowledge and skills to develop professional quality digital media productions in a timely manner and utilizing best practices and standards.
8. Explain the impact of digital media on individuals, organizations, and society.
9. Acknowledge diverse opinions regarding professional, ethical, legal, and social issues with a global perspective.
10. Appreciate the need for lifelong learning and have a plan for continuing professional development.

Last updated: 02/04/2014

Undergraduate Programs

Undergraduate Programs

The Luddy School of Informatics, Computing, and Engineering offers Bachelor of Science degrees in Applied Data and Information Science, Artificial Intelligence, Biomedical Informatics, Computer Science, Health Information Management, Informatics, Media Arts and Science and Full Stack Development which combines Informatics and Media Arts and Science as a dual degree.

The very nature of these degrees, with the changing technologies and applications, requires that the content of each degree be continuously assessed and revised. Therefore, the faculty of the Luddy School of Informatics, Computing, and Engineering will periodically review and revise the curricula to ensure that students are prepared to meet contemporary workplace and intellectual demands.

Accelerated Bachelor's and Master's

Earn a bachelor's and master's degree by completing both undergraduate and graduate programs in only 5 years, and get an accelerated start to your future career.

Please contact the Luddy School of Informatics, Computing, and Engineering office, or refer to our website at luddyIN.edu to confirm current program requirements.

Last Updated: 3/2024

Clinical Informatics

Clinical Informatics

Passionate about information technology, workflow redesign and engagement strategies for health care clinicians? This one-year certificate program is designed for licensed physicians, nurses and other clinical health care professionals seeking leadership roles leveraging information systems to

- Improve health care safety and quality
- Maximize workflow efficiencies
- Preserve user and patient satisfaction

New government requirements for electronic health record adoption and utilization will create a shortage of qualified clinical leaders who truly understand information systems and how to implement them to decrease medical errors and adverse events, while improving overall quality and patient outcomes. Completion of this training program prepares the participant for the implementation of certified electronic health record systems.

Certificate includes two core courses and three specialized courses for a total of 15 credit hours. All courses can be completed online.

Core Curriculum

- INFO B530 Foundation of Health Informatics
- INFO B581 Health Informatics Standards and Terminology

Specialized Courses (Choose 3)

- INFO B505 Informatics Project Management
- INFO B535 Clinical Information Systems
- INFO B605 Social Foundations of Informatics
- INFO B642 Clinical Decision Support Systems
- INFO B643 Natural Language Processing
- INFO B644 Consumer Health Informatics

last updated 4/2025

Human-Computer Interaction

Certificate Requirements

All certificate requirements must be completed within three years and with a minimum cumulative GPA of 3.0 (B). Courses with a grade below a B- will not count towards the certificate program.

Applicants who have already earned credit for one or more equivalent courses from other institutions and programs may request to apply/transfer up to three credits toward this certificate, subject to approval. No undergraduate courses can be applied to certificate requirements.

Required Core (9 cr.)

- INFO-H 541 Interaction Design Practice
- INFO-H 543 Interaction Design Methods
- INFO-H 563 Psychology of HCI

Specialization Requirements (6 cr.)

Select two courses:

- INFO-H 517 Visualization Design, Analysis, and Evaluation
- INFO-H 561 Meaning and Form in HCI
- INFO-H 564 Prototyping Interactive Systems
- INFO-H 566 Experience Design for Ubiquitous Computing
- INFO-H 565 Collaborative and Social Computing
- INFO-H 567 IoT Interface Design for Business Innovation (Course permission required)
- INFO-H 570 Experience Design for Tangible and Embodied Systems
- INFO-H 583 Conversational User Interfaces: Experience Design and Applications

last updated 4/2025

Health Information Security

Health Information Security

This certificate program provides comprehensive knowledge and skill in health information security program development and administration, including policy, procedures, architectures, risk assessment, disaster recovery and business continuity for both health care and public health organizations. Program graduates will be prepared to take on the roles like:

- Information Security Officer
- Health Information Privacy and Security Specialist
- Chief Healthcare and Information Privacy and Security Officers (CISO),

Successful applicants will possess a bachelors or masters degree who are seeking professional education in health IT.

Certificate Requirements

This 15-credit-hour program includes five courses. Students must maintain a cumulative GPA of a 3.00, with a grade of a B- or better in all individual coursework.

Core Curriculum

- INFO B581 Health Informatics Standards and Terminology
- INFO B583 Security and Privacy Policies and Regulations for Health Care

Specialized Courses (Choose 3)

- INFO B535 Clinical Information Systems
- INFO-B 513 The Design, Implementation, and Evaluation of Electronic Health Record Systems
- INFO-B 626 Human Factors Engineering for Health Informatics
- CIT 52800 Information Security Risk Assessment
- CIT 56200 Mobile and Network Forensics*
- CIT 53200 Wireless Security and Technology*
- CIT 55510 Network Security*
- CIT 51600 Database Security*
- CIT XXXXX Network and Mobile Forensics*
- These courses may be offered under TECH 58100 Workshop in Technology until the course numbers are approved.

last updated 4/2025

Graduate Certificate Programs

Graduate Certificate Programs

In addition to Master's and PhD degree programs, the Luddy School of Informatics, Computing, and Engineering offers a number of graduate certificate programs:

- Archives Management
- Clinical Informatics
- Health Information Security
- Human-Computer Interaction
- School Library

last updated: 3/2025

School Librarianship Certificate

School Library Certificate

The School Library Certificate is for certified teachers interested in adding to their license. The core learning concepts for the certificate include: collaborative instruction, design, delivery, and assessment, integrated technology, student inquiry, 21st Century skills and processes, collection development, library program administration, basic resources and ILS management, PK-12 youth literature, and advocacy and leadership.

For more information please contact Kym Kramer, MLS, Director of School Library Education, kakramer@indiana.edu, 317-278-2093.

last updated 4/2025

Archives Management Certificate

The Archives Management Certificate provides an exciting educational opportunity for prospective students throughout Indiana and the U.S. including working professionals, who would like to keep up with changes and earn an additional credential; professional changing careers within the same field and students from relevant fields (e.g. history and museum studies).

Our program gives students core knowledge and skills they need to develop to be a professional archivist, by addressing the core values for archivists stated by the Society of American Archivists (SAA).

Requirements

This certificate requires a total of 18 credit hours.

Core Course requirement (12 credit hours)

LIS-S581 Archives and Records Management

LIS-S582 Digital Preservation

LIS-S584 Archival Arrangement and Description

LIS-S585 Archival Appraisal and Management

Electives (6 credit hours)

Two electives from the suggested list.

LIS-S583 Data Curation and Management

LIS-S586 Archival Intelligence

LIS-S591 Grant Writing

LIS-S604 Topics in Library and Information Science

LIS-S605 Internship in Library and Information Science

LIS-S623 Genealogy and Local Hisotry

LIS-S685 Electronic Records Management

LIS-S686 Web Archiving and Preservation

Non-LIS graduate students are required to take LIS-S500 Methods and Tools for the Information Profession.

last updated: 4/2025

Applied Data Science

Applied Data Science

You'll learn methods of data mining, to transform large datasets into usable knowledge, and how to represent information visually. The master's in data science provides students with core competencies in the latest methods of analysis, data management, and infrastructure and high-throughput data processing and storage.

Our curriculum includes instruction in client–server application development and the professional and ethical management of data science projects.

The plan of study is 30 credit hours. It includes six core courses and four elective courses. Transfer students may be able to transfer in approved graduate courses from an accredited institution.

F-1 students can only take one online course per semester. They must take a minimum of 8 credit hours per semester; the exception being in their final semester. These limitations apply to fall and spring semesters but not summer sessions.

Core Courses (18 cr.)

- INFO-I 501 Introduction to Informatics
- INFO-H 510 Statistics for Data Science
- LIS-S 511 Database Design
- INFO-H 515 Statistical Learning (prerequisite: graduate statistics course)
- INFO-H 516 Cloud Computing for Data Science (prerequisites: graduate database course)
- INFO-H 611 Mathematical and Logical Foundations of Informatics

Students may test out of INFO-H 611 and LIS-S 511. Students do not receive credit toward their required 30 credit hours by testing out of a course. However, they may instead replace the course with a specialization course or approved elective.

Elective Courses (12 cr.)

- INFO-B 505 Informatics Project Management
- INFO-H 517 Visualization Design, Analysis, and Evaluation (prerequisite: programming experience)
- INFO-H 518 Deep Learning Neural Networks
- INFO-H 519 Natural Language Processing with Deep Learning
- INFO-H 695 Thesis/Project in Applied Data Science
- INFO-I 575 Informatics Research Design
- INFO-I 595 Professional Internship
- INFO-I 698 Research in Informatics (Independent Study)
- INFO-P 502 Modeling Crisis
- NEWM-N 510 Web Database Development

Students may replace elective courses with non-Luddy courses with the permission of the program director.

Thesis or Project

The Thesis/Project is available to highly motivated students ready to carry out publishable research. Students must prepare a prospectus and gain a commitment from a primary faculty advisor with research interests in data science by the end of the first semester. By the end of the second semester, students must complete a course on research design and methods (e.g., INFO-I 575 or LIS-S 506).

The thesis or project must be completed in two semesters or in a semester and summer. Thesis students register for a total of 6 credits and project students register for a total of 3–6 credits of INFO-H 695 Thesis/Project in Applied Data Science. Students are required to prepare and

defend a research proposal with a timeline of deliverables in addition to the thesis or project.

Last updated: 3/2024

Applied Data Science with Sports Analytics Specialization

Master of Science in Applied Data Science with a specialization in Sports Analytics

Combine sports marketing skills with the analysis and management of data when you earn a master's in Applied Data Science with a specialization in Sports Analytics at IU Indianapolis. Analytics is a crucial part of decision-making in amateur and professional athletics. Teams rely on those with the knowledge to interpret data and relate it to the world of athletics.

Students who earn a Master of Science in Applied Data Science with a specialization in Sports Analytics learn core competencies in data analysis, data management and infrastructure, and client–server application development, and ethical and professional management of informatics projects. Earn additional competencies in sports sales, the management of massive, high-throughput data stores, cloud computing, and the data life cycle.

Plan of Study (30 credits)

The plan of study is 30 credit hours. It includes six core courses and four specialization/ elective courses. Transfer students may be able to transfer in approved graduate courses from an accredited institution.

F-1 students can only take one online course per semester. They must take a minimum of 8 credit hours per semester; the exception being in their final semester. These limitations apply to fall and spring semesters but not summer sessions.

Core Courses (18 credits)

- INFO-I 501 Introduction to Informatics
- LIS-S 511 Database Design
- INFO-H 510 Statistics for Data Science
- INFO-H 515 Statistical Learning (Prerequisite: Graduate Statistics course)
- INFO-H 516 Cloud Computing for Data Science (Prerequisites: Graduate Database course)
- INFO-H 517 Visualization Design, Analysis, and Evaluation (Prerequisite: Programming experience)

Students may test out of LIS-S 511. Students do not receive credit toward their required 30 credit hours by testing out of a course. However, they may instead replace the course with a specialization course or approved elective.

Specialization + Elective Courses (12 credits)

Specialization Courses

- TESM-T 562 Economics of Event Tourism (Fall)
- TESM-T 582 Applied Sport Event Research (Spring)
- TESM-T 598 Master's Consulting Project (Summer)

Elective Courses

- INFO-B 505 Informatics Project Management
- INFO-H 518 Deep Learning Neural Networks
- INFO-H 519 Natural Language Processing with Deep Learning
- INFO-H 695 Thesis/Project in Applied Data Science (MS Thesis students only)
- INFO-I 575 Informatics Research Design
- INFO-I 595 Professional Internship
- INFO-I 698 Research in Informatics (Independent Study)
- INFO-P 502 Modeling Crisis
- NEWM-N 510 Web Database Development

Thesis or Project

The Thesis/Project is available to highly motivated students ready to carry out publishable research. Students must prepare a prospectus and gain a commitment from a primary faculty advisor with research interests in data science by the end of the first semester. By the end of the second semester, students must complete a course on research design and methods (e.g., INFO-I 575 or LIS-S 506).

The thesis or project must be completed in two semesters or in a semester and summer. Thesis students register for a total of 6 credits and project students register for a total of 3–6 credits of INFO-H 695 Thesis/Project in Applied Data Science. Students are required to prepare and defend a research proposal with a timeline of deliverables in addition to the thesis or project.

Last updated: 3/2024

Bioinformatics

Bioinformatics

The M.S. in Bioinformatics is a 36-credit-hour program that integrates knowledge from informatics, computation, information systems, mathematics, biology and other related areas. Successful applicants are expected to have an introductory background in both informatics (or computer science) and biology.

The program may be completed in two years by a full-time student. Part-time study options are available for domestic students. However, international students and any students funded directly by the Luddy School of Informatics, Computing, and Engineering (in the form of an assistantship or fellowship) must complete the program in two years.

Degree Requirements

Required core courses (15 cr.)

- INFO-B 519 Introduction to Bioinformatics (3 cr.)
- INFO-B 528 Computational Methods for Analyzing High-Throughput Biological Data (3 cr.)
- INFO-B 556 Biological Database Management (3 cr.)
- INFO-B 573 Programming for Science Informatics (3 cr.)
- INFO-B 627 Seminar in Bioinformatics (3 cr.)

Advanced core courses (15 cr.)

- INFO-B 506 Biomedical Informatics
- INFO-B 518 Applied Statistical Methods for Biomedical Informatics
- INFO-B 529 Machine Learning in Bioinformatics
- INFO-B 536 Computational Methods for Biomedical Informatics

- INFO-B 585 Biomedical Analytics
- INFO-B 574 Next-Generation Sequencing Data Analysis
- INFO-B 619 Structural Bioinformatics
- INFO-B 636 Genomic Data Analytics and Precision Medicine
- INFO-B 646 Computational System Biology
- INFO-B 656 Translational Bioinformatics Applications

At most, one of the following courses can be counted as an advanced core course.

- INFO-B 535 Clinical Information Systems
- INFO-B 642 Clinical Decision Support Systems
- Other Health Informatics courses (advisor approval required)

Thesis, project, or electives (6 cr.)

Thesis track

- INFO-B 692 Bioinformatics Thesis (6 cr.)

Project track

- INFO-B 692 Bioinformatics Project (3 cr.)
- Elective (3 cr.)
  Students can take other graduate courses either within or outside Luddy.

Non-thesis or project track

- Elective (6 cr.)
  Students can take other graduate courses either within or outside Luddy
- Last updated: 3/2024

Computer Science

Computer Science

Develop the technical proficiency employers are seeking and enhance your ability to craft innovative solutions to complex, real-world computing challenges.

Effectively collaborate with other experts to turn your ideas into reality when you earn our master's degree in computer science. Increase your research options and job prospects, focusing on:

- Project management
- Communication
- Analytical skills highly valued in the industry

The coursework is divided into four categories: foundations, systems, computer science core, and the creativity requirement. For the creativity requirement, students can choose from several options, including courses in computer science, data science, human–computer interaction (HCI), an internship, and thesis or project.

Foundations (3 cr.)

Choose one:

- CSCI-B 501 Theory of Computing
- CSCI-B 503 Algorithms Design and Analysis (Fall and Spring)
- CSCI-B 505 Applied Algorithms

Systems (3 cr.)

Choose one:

- CSCI-P 536 Advanced Operating Systems (Spring)
- CSCI-P 538 Computer Networks (Fall)

Computer Science Courses (15 cr.)

Select four CSCI-B or CSCI-P courses at the 500 level or higher:

Data Science and AI

- CSCI-B 551 Elements of Artificial Intelligence
- CSCI-B 555 Machine Learning (INFO-H 515) (Fall)
- CSCI-P 558 Deep Learning (Spring)
- CSCI-B 561 Advanced Database Concepts (Fall)
- CSCI-B 565 Data Mining (Fall)
- CSCI-B#651 Natural Language Processing (Spring)#P:#CSCI-B 551 or CSCI-B 555 or INFO-H 515

Visual Computing

- CSCI-B 581 Advanced Computer Graphics
- CSCI-B 657 Computer Vision
- CSCI-P 583 Data Visualization (Spring)

Networks and Security

- CSCI-B 504 Introduction to Cryptography (Spring)
- CSCI-B 516 Engineering Cloud Computing (Fall and Spring)
- CSCI-P 538 Computer Networks (Fall)
- CSCI-P 539 Sensor Networks and the Internet of Things (Spring)
- CSCI-B 544 Security for Networked Systems
- CSCI-B 547 Systems and Protocol Security and Information Assurance
- CSCI-B 570 Wireless and Mobile Security (Spring)
- CSCI-B 577 Security Engineering (Fall)

Software Engineering

- CSCI-P 532 Object-Oriented Software Development (Spring)
- CSCI-P 565 Software Engineering I
- CSCI-P#566 Software Engineering II (P: CSCI-P 565) (Fall)
- CSCI-P 567 Software Quality Assurance (Fall)
- CSCI-P#632 Object-Oriented Software Management

Systems

- CSCI-B 534 Distributed Systems
- CSCI-B 543 Computer Architecture (Spring)
- CSCI-P 523 Programming Language Implementation P: CSCI-B 521
- CSCI-P 536 Advanced Operating Systems (Spring)
- CSCI-B 575 Quantum Computing and Applications (Fall)

Additional Computer Science Courses

- CSCI-B 501 Theory of Computing
- CSCI-B 505 Applied Algorithms
- CSCI-B 521 Programming Language Principles

- CSCI-B 522 Programming Language Foundations
- CSCI-B 541 Hardware System Design I
- CSCI-B 546 Malware Epidemic: Threat and Defense
- CSCI-B 555 Machine Learning
- CSCI-B 557 Music Information Processing: Audio
- CSCI-B 590 Topics in Computer Science
- CSCI-C 591 Research Seminar
- CSCI-B 599 Teaching in Computer Science
- CSCI-B 609 Topics in Algorithms and Computing Theory
- CSCI-B 649 Topics in Systems
- CSCI-B 659 Topics in Artificial Intelligence
- CSCI-G 901 Advanced Research
- CSCI-P 515 Specification and Verification
- CSCI-P 523 Programming Language Implementation
- CSCI-P 542 Hardware System Design II
- CSCI-P 556 Applied Machine Learning

May include an independent study:

- CSCI-Y 790 Graduate Independent Study
- CSCI-Y 791 Graduate Independent System Development

Creativity Requirement (9 cr.)

Choose from:

-
  - Computer Science (CSCI-B, CSCI-P)
  - Data Science *(see list below)*
  - Human–Computer Interaction *(see list below)*
  - CSCI-Y 798 Professional Practicum Internship

Up to 6 credit hours of:

- CSCI-Y 790 Graduate Independent Study
- CSCI-Y 791 Graduate Independent System Development
- CSCI-Y 792 Master's Thesis
- CSCI-Y 793 Master's Software Thesis
- INFO-H 695 Thesis/Project in Applied Data Science
- INFO-H 694 Thesis/Project in Human Computer Interaction

Data Science

- INFO-H 501 Introduction to Data Science
- INFO-H 611 Mathematical and Logical Foundations of Informatics (test-out available)
- LIS-S 511 Database Design (test-out available)
- PBHL-B 670 Introduction to Biostatistics in R (or#PSY 60000 Statistical Inference#or#INFO-B 518 Applied Statistical Methods for Biomedical Informatics
- INFO-H 515 Statistical Learning#(prerequisite: PBHL-B 670 or PSY 60000)
- INFO-H 516 Cloud Computing for Data Science#(prerequisites: graduate database course and programming experience)
- INFO-H 517 Visualization Design, Analysis, and Evaluation#(prerequisite: programming experience)
- INFO-H 518 Deep Learning Neural Networks
- INFO-P 502 Modeling Crisis
- LIS-S 506 Introduction to Research#or#INFO-I 575 Informatics Research Design
- NEWM-N 510 Web Database Development

Human-Computer Interaction

- INFO-H 541 Interaction Design Practice
- INFO-H 543 Interaction Design Methods
- INFO-H 561 Meaning and Form in HCI
- INFO-H 563 Psychology of HCI
- INFO-H 564 Prototyping for Interactive Systems
- INFO-H 565 Collaborative and Social Computing
- INFO-H 566 Experience Design for Ubiquitous Computing
- INFO-H 570 Tangible and Embodied Interaction
- INFO-I 575 Informatics Research Design
- INFO-H 581 Experience Design and Evaluation of Access Technologies
- INFO-H 582 UX Design Ethics
- INFO-H 583 Conversational User Interfaces

Thesis or Project

The Thesis/Project is available to highly motivated students ready to carry out publishable research. Students must prepare a prospectus and gain a commitment from a#primary faculty advisor #with research interests in computer science by the end of the first semester. By the end of the second semester, students must complete a course on research design and methods (e.g.# LIS-S 506, or#INFO-I 575), if indicated by the advisor. The thesis or project must be completed in two semesters or in a semester and summer. Thesis students register for a total of 6 credits, and project students register for a total of 3–6 credits. Students must prepare and defend a research proposal with a timeline of deliverables in addition to the thesis or project.

Nonmajor Courses (not for credit)

- CSCI-A 521 Computing Tools for Scientific Research
- CSCI-A 538 Network Technologies and Systems Administration
- CSCI-A 548 Mastering the World-Wide Web
- CSCI-A 590 Topics in Programming
- CSCI-A 591 Introduction to Computer Science
- CSCI-A 592 Introduction to Software Systems
- CSCI-A 593 Computer Structures
- CSCI-A 594 Data Structures
- CSCI-A 595 Fundamentals of Computing Theory
- CSCI-A 596 Programming Languages
- CSCI-A 597 Introduction to Programming I

Other Computer Science Courses

- CSCI-T 599 Topics in Computer Science Education
- CSCI-Y 799 Computer Science Colloquium
- CSCI-Y 890 Thesis Readings and Research

Last updated: 3/2024

Human-Computer Interaction

Human-Computer Interaction (degree can be completed on campus or online)
Prepare to be immersed in a project-based, hands-on user experience environment. By earning a master's in HCI, you'll explore emerging field research, learning how to create effective interactive systems for companies in Indiana and worldwide.

Students in our professional, research-focused program collaborate with industry leaders on real-world projects.

They gain valuable insight from faculty in human-centered design, social computing research, and the Internet of Things.

Through your classes and Capstone project, you'll develop the UX design and research skills essential for a professional career in the field.

Degree requirements for the in-person/hybrid program

Print-friendly Plans of Study

- Fall 2023 Admits
- Spring 2023 Admits
- Fall 2022 Admits
- Spring 2022 Admits
- Fall 2021 Admits

Required Core

- INFO-H 541 Interaction Design Practice
- INFO-H 543 Interaction Design Methods
- INFO-H 561 Meaning and Form in HCI
- INFO-H 563 Psychology of HCI
- INFO-H 564 Prototyping Interactive Systems

Required Selectives

Choose 3 from this list.

- INFO-H 517 Visualization Design, Analysis, and Evaluation
- INFO-H 565 Collaborative and Social Computing
- INFO-H 566 Experience Design for Ubiquitous Computing
- INFO-H 567 IoT Interface Design for Business Innovation
- INFO-H 570 Tangible/Embedded
- INFO-H 581 Experience Design and Evaluation of Access Technologies
- INFO-H 582 UX Design Ethics
- INFO-H 583 Conversational UI

Area of Emphasis in Digital MakingMS HCI students can pursue an area of emphasis in digital making by completing 9-12 credit hours of Media Arts and Science graduate-level sections that count towards 6 elective credits and 3-6 credits of selective courses in the HCI MS programs. The area of emphasis in digital making allows students to complement their HCI preparation with application development skills to produce interactive media experiences and environments, and explore their connections with local businesses as well as the national industry. This area of emphasis is particularly well-suited to HCI MS students with a solid programming background. The Media Arts and Science graduate-level sections available for this area of emphasis include:

- NEWM-N 501 Foundations of Digital Production
- NEWM-N 505 Advanced Issues in Emerging Media Environments
- NEWM-N 585 Experiential Innovation I – Advanced Visualization
- NEWM-N 585 Real-world Emerging Wearable Technology Applications for Enterprise Business
- NEWM-N 585 Motion Graphics

Open Electives

Recommended electives include:

- INFO-I 595 Professional Internship
- Any 500-level course on campus that complements your HCI background
- Any additional course from the selective list after the first three.

Students must check for prerequisites and course availability from the respective schools and departments.

Final Project

Capstone OptionAll HCI students must complete a final MS capstone project by registering for two courses: H680 HCI Professional Practice 1 and H681 HCI Professional Practice 2, taken in two consecutive semesters. Each course includes a formally scheduled in-class time that students must attend. Students will work on one comprehensive, final MS HCI project that extends throughout the two courses, i.e., in both fall and spring semesters. Students will receive an official grade at the conclusion of each course/semester. Incompletes are not permitted.Thesis OptionThe MS Thesis option is reserved for students who possess a demonstrated ability to carry out publishable empirical research. Qualified students must find a research-active faculty member willing to advise them on a thesis by the end of the second semester.Students taking the Thesis option must take and successfully pass I575 Informatics Research Design or an equivalent research methods course decided in concert with the thesis advisor by the completion of their first year. It is the student's responsibility to propose a thesis that can be completed within a two-semester timeline. To do this, students MUST provide their primary thesis advisor with a full thesis proposal and outline that includes a timeline for the writing of the thesis.

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Luddy School of Informatics, Computing, and Engineering resources and social media channels

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The M.S. in Human-Computer Interaction is a 36-credit-hour program that integrates computing, usability, interface design, the social sciences and other disciplines in the design and development of user-friendly technologies, software and information systems.
As a graduate, you'll be well prepared for a career in private industry or academia, or for admission to the Ph.D. in Informatics program with a human-computer interaction specialization.

The program may be completed in two years by a full-time student. Part-time study options are available for domestic students. However, international students and any students funded directly by the Luddy School of Informatics, Computing, and Engineering (in the form of an assistantship or fellowship) must complete the program in two years.
A thesis or applied research project is required to complete your degree.

Plan of Study

Core (24 cr.)
- INFO H501 Introduction to Informatics (3 cr.)
- INFO H541 Interaction Design Practice (3 cr.)
- INFO H543 Interaction Design Methods (3 cr.)
- INFO H561 Meaning and Form in HCI (3 cr.)
- INFO H563 Psychology of HCI (3 cr.)
- INFO H564 Prototyping for Interactive Systems (3 cr.)
- INFO H590 Ubiquitous Computing (3 cr.)
- INFO H590 Social Computing (3 cr.)

Final Project or Thesis (6 cr.)

Final Project Option
All HCI students must complete a final project by registering for two courses: H680 HCI Professional Practice 1 (offered ONLY in the Fall) and H681HCI Professional Practice 2 (offered ONLY in the Spring). Each course includes a formally scheduled in-class time that students must attend. Students will work on one final project that extends throughout the two courses, i.e., in both fall and spring semesters. Students will receive an official grade at the conclusion of each course/semester. Students are encouraged to propose a project that can be realistically completed by the conclusion of H681, the Spring semester. Incompletes are NOT permitted.

Required Courses
- INFO H680 HCI Professional Practice 1 (3 cr.) – Required for Final Project
  Note: Pre-requisites: INFO H541, H561, H543, H563, and H564
- INFO H681 HCI Professional Practice 2 (3 cr.) – Required for Final Project
  Note: Pre-requisites: INFO H680

Thesis Option
The Thesis option is reserved for students who possess a demonstrated ability to carry out publishable empirical research. Qualified students must find a research-active faculty member willing to advise them on a thesis by the end of the second semester.
Students taking the Thesis option must take and successfully pass I575 Informatics Research Design by the completion of their first year. They should also take an additional statistics course prior to their final regular semester. As with the final project, an incomplete will NOT be permitted. It is the student's responsibility to propose a thesis that can be completed within a two-semester timeline. To do this, students MUST provide their primary thesis advisor with a full thesis proposal and outline that includes a timeline for the writing of the thesis.
Required Course
- INFO H694 HCI Thesis (6 cr.)

Electives (6 cr.)
his plan of study applies only to students enrolled in the 100% fully online HCI MS program.Semester offering may vary – check the campus registrar for most updated schedule of courses.Online courses are typically offered in 100% asynchronous mode (noted as WWW on the Registration page), with weekly paced activities, but no synchronous online meetings. At times, online courses may be scheduled in "Hybrid-Distance" mode, which means fully online but with required weekly online meetings at a schedule time. Check mode details when registering for courses.**Recommended course load for online students:** If you are a full-time graduate student, we recommend you to take no more than three graduate courses per semester. If you're already working full-time, we recommend you to take one or two courses per semester. On average, a graduate course of 3 credits requires approximately 9-12 hours of workload per week, including class attendance.

General Core (15 credits)
- INFO-H 541 Interaction Design Practice
- INFO-H 543 Interaction Design Methods
- INFO-H 561 Meaning and Form in HCI
- INFO-H 563 Psychology of HCI
- INFO-H 564 Prototyping for Interactive Systems

Specialized Selectives (15-21 credits)
- INFO-I 501 Introduction to Informatics
- NEWM-N 510 Web Database Concepts
- INFO-H 517 Visualization Design and Analysis
- INFO-H 565 Collaborative and Social Computing
- INFO-H 566 Experience Design for Ubiquitous Computing
- INFO-H 570 Tangible and Embodied Interaction
- INFO-I 575 Informatics Research Design
- INFO-H 581 Experience Design and Evaluation of Access Technologies
- INFO-H 582 UX Design Ethics
- INFO-H 583 Conversational User Interfaces
- INFO-I 590 Programming for Interaction Designers
- INFO-I 595 Professional Internship

Additional selectives may become available.

Open Electives (0-6 credits)
Any relevant online course (500 or higher).
- HERR Visual Design for User Interfaces
- INFO-B 505 Informatics Project Management
- INFO-H 554 Independent Study in HCI

Additional electives may become available.
Last Updated: 3/2024

Health Informatics
Health Informatics

The Master of Science in Health Informatics degree integrates health care, health information technology, informatics, and many other fields. Our students learn to analyze and protect patient data, and to improve the quality of medical care and make it more efficient.

Our 36-credit-hour program equips students to examine how patients use their health care information, and to the build the tools that make it easier to manage unstructured

data and extract useful information. By learning how to appropriately utilize natural language processing and other tools, our graduates can improve clinical decision support, electronic health records management, and patient privacy.

You'll complete your health informatics master's degree with either a thesis or a project, which provides a practical solution to a health information problem.

Degree Requirements

The master's degree is 36 credit hours. It includes a health informatics core of seven courses, a professional or thesis track of three courses, and two electives.

Select electives that reflect your particular focus, whether it's data science, programming languages, or health information security. The right classes can help you acquire skills to develop home health software, or to specialize in clinical research informatics or become proficient in implementing health care information systems.

Health Informatics Core

- INFO-I 501 Introduction to Informatics
- INFO-B 505 Informatics Project Management
- INFO-B 518 Applied Statistical Methods for Biomedical Informatics
- INFO-B 530 Foundations of Health Informatics or DENT-R 978 Introduction to Health Information Technology in Dentistry
- INFO-B 535 Clinical Information Systems (prerequisite: INFO-B 530)
- INFO-B 581 Health Informatics Standards and Terminologies (prerequisite: INFO-B 530)
- INFO-B 642 Clinical Decision Support Systems (prerequisites: INFO-I 501 and INFO-B 535)

Professional Track

- INFO-B 583 Security and Privacy Policies and Regulations for Health Care (prerequisites: INFO-I 501 and INFO-B 530)
- INFO-B 626 Human Factors Engineering for Health Informatics (prerequisites: INFO-I 501 and INFO-B 535)
- INFO-B 584 Practicum in Health Information Technology or INFO-B 691 Thesis/Project in Health Informatics

Thesis Track

- INFO-B 585 Biomedical Analytics
- LIS-S 506 Introduction to Research or INFO-I 575 Informatics Research Design
- INFO-B 691 Thesis/Project in Health Informatics

Approved Electives

- DENT-R 957 Introduction to Research in Oral Biology
- INFO-B 512 Scientific and Clinical Data Management (Health Informatics)
- INFO-B 513 The Design, Implementation, and Evaluation of Electronic Health Record Systems (Corequisite: INFO-B 642) (spring)
- INFO-B 529 Machine Learning in Bioinformatics
- INFO-B 536 Computational Methods for Biomedical Informatics
- INFO-B 551 Independent Study (including summer)
- INFO-B 573 Programming for Science Informatics
- INFO-B 582 Health Information Exchange (fall)
- INFO-B 584 Practicum in Health Information Technology (including summer)
- INFO-B 585 Biomedical Analytics (fall)
- INFO-B 605 Social Foundations of Informatics (summer)
- INFO-B 626 Human Factors Engineering for Health Informatics (prerequisites: INFO-I 501 and INFO-B 535)
- INFO-B 641 Business of Health Informatics
- INFO-B 643 Natural Language Processing for Biomedical Records and Reports (spring)
- INFO-B 644 Consumer Health Informatics (spring)
- INFO-H 516 Cloud Computing for Data Science
- INFO-H 541 Interaction Design Practice (HCI)
- INFO-H 543 Interaction Design Methods (HCI)
- INFO-I 595 Internship

Other elective courses are possible upon approval of the program director. Some elective courses may have prerequisites. Students should check with the instructor before enrolling.

Last updated: 3/2024

MS Degree Programs

MS Degree Programs
Given the rapid and apparently unlimited growth of this new field at all levels of competence, each of the master's degree programs serves students who need education in the use of information technologies to enhance their job performance or employment prospects.

The Luddy School of Informatics, Computing, and Engineering offers **Master of Science** degrees in:

- Bioinformatics
- Computer Science
- Health Informatics
- Human-Computer Interaction
- Media Arts and Science

All Master of Science degrees require 36 credits, including the completion of common graduate core courses.

To learn more about the M.S. degree programs review the following information:

- Academic Regulations
- Admission to the M.S. Program
- Financial Assistance

Master of Library and Information Science

Master of Library and Information Science

Information literacy, metadata management, and other modern challenges are the focus of what we study as experts in library science and data technology.

Now you can expand your skills without putting your life on hold, by earning your Master of Library Science (M.L.I.S.) degree online through at the Luddy School of Informatics, Computing, and Engineering at IU Indianapolis. Graduates join a community of highly regarded professionals who

provide creative, data-driven ideas that empower library patrons, corporations, civic groups, and our communities.

IU Indianapolis' Department of Library and Information Science is 100% online and specializes in fostering collaborative learning from a distance. We create an environment that allows you to work from home or wherever you need to be.

Our Master of Library Science, the entry degree for a professional librarian, is accredited by the American Library Association (ALA-MLS). Universally required for professionals in academic libraries, the MLS is essential for leadership in public libraries and provides valuable management skills.

Degree Requirements (39 credits) - Generalist

Foundation (6 cr.)

- LIS-S 500 Methods and Tools for the Information Profession
- LIS-S 507 Tools and Technologies for the Information Professions

Specialization Core (9 cr.)

- LIS-S 501 Information Sources and Services
- LIS-S 502 Acquisitions and Management of Knowledge and Information
- LIS-S 503 Organization and Representation of Knowledge and Information

Specialization Core: Research and Evaluation (3 cr.)

Choose one:

- LIS-S 505 Evaluation of Information Sources and Services
- LIS-S 506 Introduction to Research

Specialization Core: Management (3 cr.)

Choose one:

- LIS-S 552 Academic Library Management
- LIS-S 553 Public Library Management
- LIS-S 555 Digital Services Management

Open Electives (18 cr.)

Choose 18 credit hours of coursework.

Plans of Study (Specializations)

Each specialization lists electives. However, these are recommendations or suggestions. Any course not listed under Foundations or Specialization Core for your specialization can be an elective. Pre-requisites required for a course but not for a specialization will count towards a student's electives.

- Generalist (No Specialization)
- Academic Librarianship Specialization
- Archives Management Specialization
- Digital Curation Specialization
- Facilitated Learning Specialization
-
- Public Librarianship/Adult Services Specialization
- School Library Specialization
- Technical Services Specialization
- Youth Services Specialization

Last updated: 3/2024

Applied Data Science with User Experience Specialization

Applied Data Science with User Experience Specialization

By earning an M.S. in Applied Data Science with a specialization in UX design, you'll understand client-server application development and the ethical and professional management of informatics projects. Through your classes under the direction of our highly regarded faculty, gain competency in the application of human-computer interaction (HCI) theory and user-centered practices to user experience research and design.

The plan of study is 30 credit hours. It includes eight core courses, one specialization course, and one elective course. Transfer students may be able to transfer in approved graduate courses from an accredited institution.

F-1 students can only take one online course per semester. They must take a minimum of 8 credit hours per semester; the exception being in their final semester. These limitations apply to fall and spring semesters but not summer sessions.

Applied Data Science Core Courses (18 credits)

- INFO-I 501 Introduction to Informatics
- LIS-S 511 Database Design
- INFO-H 510 Statistics for Data Science
- INFO-H 515 Statistical Learning (Prerequisite: Graduate Statistics course)
- INFO-H 516 Cloud Computing for Data Science (Prerequisites: Graduate Database course)
- INFO-H 518 Deep Learning Neural Networks

Students may test out of LIS-S 511. Students do not receive credit toward their required 30 credit hours by testing out of a course. However, they may instead replace the course with an approved elective.

UX Design Core Courses (6 credits)

- INFO-H 541 Interaction Design Practice
- INFO-H 543 Interaction Design Methods

UX Design Specialization Course (Pick one, 3 credits)

- INFO-H 517 Visualization Design, Analysis, and Evaluation (Prerequisite: Programming experience)
- INFO-H 561 Meaning and Form in HCI
- INFO-H 563 Psychology of HCI
- INFO-H 564 Prototyping Interactive Systems

Elective Courses (3 credits)

- INFO-B 505 Informatics Project Management
- INFO-H 517 Visualization Design, Analysis, and Evaluation (Prerequisite: Programming experience)
- INFO-H 519 Natural Language Processing with Deep Learning
- INFO-I 575 Informatics Research Design
- INFO-I 595 Professional Internship

- INFO-I 698 Research in Informatics (Independent Study)
- INFO-P 502 Modeling Crisis
- NEWM-N 510 Web Database Development

Last updated: 3/2024

Applied Data Science with Crisis Informatics Specialization

Applied Data Science (with Crisis Informatics Specialization)

In a crisis, information is a critical resource. It's what drives the response—analyzing scope, identifying resources, and deploying responders. Informatics informs the planning and preparedness needed to reduce the impact of a flood, tornado, or other disaster. To anticipate, mitigate, and manage a crisis, you need data. With the right skills, you can use that data to provide useful information and potentially life-saving knowledge.

Our trailblazing program is the first to offer a Master of Science in Applied Data Science with a specialization in Crisis Informatics. You'll learn methods of data mining, how to transform large data sets into usable knowledge, and ways to represent information visually.

This is a 30-credit hour program that may be completed in three semesters and one summer (1 ½ years).

Fall Admissions

Fall Year 1

- LIS-S 511 Database Design (3 cr.)
- PSY 60000 Statistical Inference (3 cr.)
- SPEA-J 520 Mapping and Analysis for Public Safety (3 cr.)

Spring Year 1

- INFO-I 501 Introduction to Informatics (3 cr.)
- INFO-H 515 Statistical Learning (3 cr.)
- INFO-H 516 Cloud Computing for Data Science (3 cr.)

Summer

Select one:

- INFO-H 695 Thesis/Project in Applied Data Science (3 cr.)
- INFO-I 595 Professional Internship (3 cr.)

Fall Year 2

- INFO-H 517 Visualization Design, Analysis, and Evaluation (3 cr.)
- INFO-P 502 Modeling Crisis (3 cr.)

Select one:

- GEOG-G 535 Environmental Remote Sensing (3 cr.)
- SPEA-J 524 Emergency Management (3 cr.)

Last updated: 3/2024

Bioinformatics

The Ph.D. in Bioinformatics is a 90-credit-hour program that includes core courses, research rotations, the choice of a minor, qualifying examinations, and a dissertation. Our curriculum provides a balance in wide-ranging fields, cutting-edge computing technology, state-of-the-art informatics skills, innovative research and scholarly activities, bioethics, effective teaching, and intellectual property, preparing graduates to succeed in post-doctoral careers. In addition to research and analytics, you'll learn how to:

- Perform novel research projects
- Publish original articles
- Present inspiring findings at national conferences
- Create visual representations of complex data
- Design database systems
- Write effective grant proposals

Plan of study

Prerequisite courses

Students may test out of these.

For students with a biology background:

- INFO-B 573 Programming for Chem/Life Science

For students with a computing background:

- K322 Genetics and Molecular Biology and K324 Cell Biology or
- BIOL 507 Molecular Biology

Qualifying courses (15 cr.)

- INFO-B 519 Introduction to Bioinformatics (3 cr.)
- INFO-B 529 Machine Learning in Bioinformatics (3 cr.)
- INFO-B 518 Applied Statistical Methods for Biomedical Informatics (3 cr.)
- INFO-B 556 Biological Database Management (3 cr.)
- INFO-B 528 Computational Methods for Analyzing High-Throughput Biological Data (3 cr.)

Required core courses (12 cr.)

- CSCI 59000 Algorithms in Bioinformatics (3 cr.)
- INFO-B 627 Advanced Seminar I – Bioinformatics (3 cr.)
- INFO-B 637 Advanced Seminar II – Bioinformatics (3 cr.)
- INFO-I 790 Independent Study/Rotation (3 cr.)

Elective core courses (15 cr.)

Students will select five of these courses.

- INFO-B 506 Biomedical Informatics
- INFO-B 619 Structural Bioinformatics (3 cr.)
- INFO-B 646 Computational System Biology (3 cr.)
- INFO-B 656 Translational Bioinformatics Applications (3 cr.)
- INFO-B 536 Computational Methods for Biomedical Informatics (3 cr.)
- INFO-B 636 Genomic Data Analytics and Precision Medicine (3 cr.)

- MGEN-G 788/INFO-I 590 Next Generation Sequencing (3 cr.)
- Other Bioinformatics courses (advisor approval required)

At most, one of the following courses can be counted toward the elective core.

- INFO-B 535 Clinical Information Systems (3 cr.)
- INFO-B 642 Clinical Decision Support Systems (3 cr.)
- INFO-B 585 Analytics of Biomedical Data (3 cr.)
- Other Health Informatics courses (advisor approval required)

Minor (minimum 12 cr.)

All students will be required to have an appropriate minor outside or partially inside the School of Informatics and Computing at IU Indianapolis for a minimum 12.0 credit hours. Minors will be selected with the advisor's recommendation. Some appropriate minors would include biology, chemistry, cognitive psychology, computer science, information science, or statistics. In all cases, the number of hours to be included in the minor will be consistent with the requirements of the unit granting the minor. Some of the courses included in the minor may also count toward the student's methodology or other requirements.

Electives

There are no minimum or maximum credits. Students may take other electives (subject to approval) at the graduate level as needed for their specific research.

Written qualifying examination

All students will take a written qualifying examination that covers the core courses (CORE A and B). The examination will be set by a group of faculty who are familiar with the content of the core courses. Examinations will be offered in August. Examinations must be completed by the beginning of the student's fourth year in the program but can be completed before that time when the core courses are completed. Students who do not successfully complete the examination can retake the examination a second time.

Oral qualifying examination

1. The oral examination will take place after the student successfully passes the written examination. Students must pass both the written and oral examination before passing on to candidacy. Only two attempts to pass the oral examination will be allowed.
2. The oral examination will be based on the student's response to the written examination and any material from the core courses.

Dissertation proposal

This is an oral review that covers in-depth knowledge of the student's primary research area and dissertation proposal. The research proposal for dissertation must be approved by the student's research committee. That committee may have the same membership as the program committee or the students may choose different members. The advisor for the dissertation will be a faculty member in the Luddy School of Informatics, Computing, and Engineering at IU Indianapolis and a member of the graduate faculty. At least one the three members of the committee will be based outside the school. The student will defend the thesis proposal at a public colloquium in the school. The review should be completed within one year after passing the Qualifying Examinations.

Dissertation (30 cr. minimum)

- INFO-I 890 Thesis/Project in Bioinformatics (1-6 cr.)

Last updated: 3/2024

Computer Science

Computer Science Ph.D

Degree Requirements

A total of 90 credit hours of graduate-level coursework is required for the Ph.D. in Computer Science from IU's Luddy School of Informatics, Computing, and Engineering in Indianapolis.

Ph.D. candidates must take at least 24 credit hours of courses in computer science at or above the 500 level. Courses for nonmajors (CSCI-A) do not count.

Six courses, from the list below, must be completed each with a minimum grade of B:

Foundations of Computing

Select at least one.

- CSCI-B 501 Theory of Computing
- CSCI-B 502 Computational Complexity
- CSCI-B 503 Algorithms Design and Analysis

Computer Systems

Select at least one.

- CSCI-B 534 Distributed Systems
- CSCI-P 536 Advanced Operating Systems
- CSCI-P 538 Computer Networks

Select at least one from either 3 or 4

Programming Languages

- CSCI-B 521 Programming Language Principles
- CSCI-B 522 Programming Language Foundations
- CSCI-P 523 Programming Language Implementation

Intelligent Systems

- CSCI-B 551 Elements of Artificial Intelligence
- CSCI-B 555 Machine Learning
- CSCI-B 561 Advanced Database Concepts
- CSCI-B 565 Data Mining

A grade average of B (3.0) is required for the 24 credit hours of required computer science courses. This is in addition to the Graduate School's requirement of a B (3.0) average for all courses taken.

Minor Area Requirement

The Ph.D. requires a 12-credit minor unless the student is a dual major with another department. There are three options to satisfy the minor requirement:

1. An external minor awarded by another Indiana University department or graduate program on campus that the Computer Science Program approves.

2. An individualized interdisciplinary minor: at least 12 credits spanning at least two Indiana University departments/degree programs in Indianapolis, or 12 credits from programs within the Luddy School in Indianapolis which fall outside the student's major. The minor courses should be recommended by the student's advisory committee and approved by the Computer Science Program in advance of any course work.

Qualifying Examination

The qualifying examination is given by the first semester of the student's third year in the program. This examination is administered by the advisory committee and is expected to have a written and an oral component. A student must have completed the 24 credit hours of courses in computer science as specified in the Computer Science Course Requirements before taking the qualifying exam. If failed, the exam may be retaken once, by the end of the third year. Students who fail the second exam cannot continue in the program.

Dissertation Defense

A written elaboration of significant original research must be successfully presented to the student's research committee in a public oral defense.

last updated: 3/2024

Data Science

The **Ph.D. in Data Science**

The Data Science Ph.D. Program at IU Indianapolis provides a world-class education and research opportunities. Ph.D. students in the program learn fundamental Data Science methods while pursuing independent, original research in a broad variety of topics, including:

- Novel techniques for Natural Language Processing and Text Analytics.
- Applications of AI to social welfare, digital governance, cultural heritage, biomedical sciences, and environmental sustainability.
- Intelligent conversational agents and models of Human-AI collaboration.
- Data Visualization and Human-Data Interaction.

Degree Requirements

Data Science Core (24 cr.)

- INFO-H 501 Introduction to Data Science Programming (3 cr.)
- INFO-H 515 Statistical Learning (3 cr.) or CSCI 57300 Data Mining (3 cr.)
- INFO-H 516 Cloud Computing for Data Science (3 cr.) or CSCI 59000 Cloud Computing (3 cr.)
- INFO-H 517 Visualization Design, Analysis, and Evaluation (3 cr.) or CSCI 55200 Data Visualization (3 cr.)
- INFO-I 575 Informatics Research Design (3 cr.)
- LIS-S 511 Database Design (3 cr.) or CSCI 54100 Database Systems (3 cr.)
- LIS-S 541 Information Policy (3 cr.)
- STAT 51100 Statistical Methods I or higher (3 cr. requires approval)

Methods Courses (18 cr.)

- CSCI 52000 Computational Methods in Analysis (prerequisites: CSCI 23000 Computing II or equivalent and MATH 35100 Elementary Linear Algebra OR MATH 511 Linear Algebra and Applications)
- CSCI 58000 Algorithm Design, Analysis, and Implementation
- NURS-L 650 Data Analysis for Clinical and Administrative Decision-Making (3 cr.)
- NURS-R 612 Interpretive Data Analysis (2 cr.)
- PBHL-B 515 Biostatistics Practicum (3 cr.)
- PBHL-B 527 Introduction to Clinical Trials (3 cr.)
- PBHL-B 546 Applied Longitudinal Data Analysis (3 cr.)
- PBHL-B 571 Biostatistics Method I: Linear Models in Public Health (4 cr.)
- PBHL-B 621 Advanced Statistical Computing (3 cr.)
- PBHL-B 636 Advanced Survival Analysis (3 cr.)
- PBHL-B 646 Advanced Generalized Linear Models (3 cr.)
- PSY 60000 Statistical Inference (3 cr.)
- PSY 60100 Experimental Design (3 cr.)
- PSY 60800 Measurement Theory and Interpret Data (3 cr.)
- PSY 64000 Survey of Social Psychology I (3 cr.)
- PSY-I 643 Field Methods & Experimentation (3 cr.)
- SOC-R 551 Quantitative Methods (3 cr.)
- SOC-R 559 Intermediate Soc. Statistics (3 cr.)
- STAT 51100 Statistical Methods 1 (3 cr.)
- STAT 51200 Applied Regression Analysis (3 cr.)
- STAT 51600 Basic Probability Applications (3 cr.)
- STAT 51900 Introduction to Probability (3 cr.)
- STAT 52100 Statistical Computing (3 cr.)
- STAT 52200 Sampling and Survey Techniques (3 cr.)
- STAT 52400 Applied Multivariate Analysis (3 cr.)
- STAT 52500 Generalized Linear Model (3 cr.)
- STAT 52800 Mathematical Statistics I (3 cr.)
- STAT 52900 Applied Decision Theory and Bayesian Statistics (3 cr.)
- STAT 53600 Introduction to Survival Analysis (3 cr.)
- STAT 61900 Probability Theory (3 cr.)
- STAT 62800 Advanced Statistical Inference (3 cr.)

May include up to 6 credit hours of INFO-I 790 Informatics Research Rotation.

Specialization (18 cr.)

1. Disciplinary Affinities (0–6 cr.)
2. Minor (12–18 cr.)

The student must complete a minor within a domain appropriate to the chosen specialization and/or research area. All courses must be graduate-level and taken outside the Data Science program.

Qualifying Examination, Written and Oral

A student must successfully complete a written and oral qualifying examination before the fifth semester of the program. The written exam has a breadth part and a depth part. The breadth part covers the program's core

courses. The depth part additionally covers material from the student's research.

The oral exam takes place shortly after the student passes the written exam. The oral exam is based on the student's response to the written exam and the core courses. The both the written and oral exams are prepared and evaluated by faculty in the school who are familiar with the content of the core courses.

The student must pass both the written exam and the oral exam before advancing to candidacy. The student may retake once either the written exam or oral exam, but not both, if they do not pass that part on the first attempt. For further details, consult with the data science program director.

Dissertation (30 cr.)

A dissertation is a written elaboration of original research that makes creative contributions to the student's chosen area of specialization. The student will enroll multiple times in INFO I890 Thesis Readings and Research (1-12 cr.) while completing the dissertation. All requirements must be completed within seven years of passing the qualifying exams. The dissertation process includes the following components:

- **Proposal:** This is an in-depth oral review undertaken by students who have made significant progress in their research. The proposal will be defended at a public colloquium. The student must complete the proposal within one year of passing the qualifying exams.
- **Defense:** The student must defend his or her dissertation in an open seminar scheduled when doctoral research is almost complete.

Last updated: 4/2025

Health Informatics

Degree Requirements

The Ph.D. in Health and Biomedical Informatics specialization is a 90-credit-hour program that integrates knowledge from informatics, health care, health information technology, and other disciplines. The program includes core courses, research rotations, your choice of minor, qualifying examinations, and a dissertation.

Year 1

Fall

- INFO I501 Introduction to Informatics
- INFO B530 Foundations of Health Informatics
- INFO I575 Informatics Research Design

Spring

- INFO B505 Project Management –for HI
- INFO B518 Statistics for Biomedical Informatics
- INFO B535 Clinical Information Systems

Summer

- INFO I790 Independent Study/Rotation or elective

Year 2

Fall

- GRAD G660 Clinical Research Methods
- INFO B581 Health Informatics Standards & Terminology
- INFO B585 Biomedical Data Analytics

Spring

- PBHL B562 Biostatistics for Public Health II
- INFO B642 Clinical Decision Support Systems
- INFO B667 Seminar in Interprofessional Collaboration

Summer

- Elective / minor course

Year 3

Fall

- INFO-B 668 Advanced Seminar in BioHealth Informatics
- Research Rotation or INFO I890 Dissertation
- Elective or minor course

Spring

- INFO I890 Dissertation

Summer

- INFO I890 Dissertation

Year 4

Fall

- INFO I890 Dissertation

Spring

- INFO I890 Dissertation

Summer

- INFO I890 Dissertation

Electives

Choose a minimum of 2 (maximum of 5) courses.

- INFO-B 512 Scientific and Clinical Data Management (Bioinformatics)
- INFO-B 551 Independent Study (including summer)
- INFO-B 513 The Design, Implementation, and Evaluation of Electronic Health Record Systems (Corequisite: INFO-B 642)
- INFO-B 573 Programming for Science Informatics
- INFO-B 582 Health Information Exchange
- INFO-B 585 Biomedical Analytics
- INFO-B 605 Social Foundations of Informatics (summer)
- INFO-B 626 Human Factors Engineering for Health Informatics (prerequisites: INFO-I 501 and INFO-B 535)
- INFO-B 641 Business of Health Informatics
- INFO-B 643 Natural Language Processing for Biomedical Records and Reports
- INFO-B 644 Consumer Health Informatics
- INFO-H 541 Interaction Design Practice (HCI)

- INFO-H 543 Interaction Design Methods (HCI)

Other elective courses are possible upon approval of your faculty advisor.

Human-computer interaction courses

- INFO H563 Psychology of Human-Computer Interaction
- INFO H564 Prototyping for Interactive Systems

Graduate school courses

- GRAD 610 Topic in Translation and Implementation of Research
- GRAD 661 Clinical Trials
- GRAD 653 Introduction to Applied Statistic Methods

Minor

All students will be required to have an appropriate minor outside or partially inside the school. Minors will be selected with the advisor's recommendation. The selected minor should be appropriate to the student's choice of subdiscipline within health informatics. Some appropriate minors include public health, dental informatics, cognitive psychology, communication sciences, biostatistics, and clinical research science. In all cases, the number of hours to be included in the minor will be consistent with the requirements of the unit granting the minor.

Qualifying examinations

Written exam

All students will take a written qualifying examination that covers the (1) core courses of the Master In Health Informatics Program and (2) critical review of Health Informatics Research. The examination will be set by a group of faculty who are familiar with the content of the core courses. Examinations will be offered in August. Examinations must be completed by the beginning of the student's third year in the program, but can be completed before that time when the core courses are completed. Students who do not successfully complete the examination can retake the examination a second time.

Oral exam

The oral examination will take place after the student successfully passes the written exam. Students must pass both the written and oral exam before passing on to candidacy. Only two attempts to pass the oral examination will be allowed.

The oral exam will be based on the student's response to the written exam and any material from the core courses.

Dissertation

Proposal (Required)

This is an oral exam that covers in-depth knowledge of the student's primary research area and dissertation proposal. The research proposal for dissertation must be approved by the student's research committee. That committee may have the same membership as the program committee, or the student may choose different members. The advisor for the dissertation will be a faculty member in the School of Informatics and Computing and a member of the graduate faculty. At least one of the three members of the committee will be based outside the school. The student will defend the thesis proposal at a public colloquium in the school. The examination should be completed within one year after passing the Qualifying Examinations. Only two attempts to pass this examination will be allowed.

Dissertation (21 to 30 cr.)

A written elaboration of significant original research, which must be successfully presented to the research committee in a public defense as described in the Graduate School Bulletin.

last updated: 3/2024

Human-Computer Interaction

The **Ph.D. in Human-Computer Interaction** specialization is 90-credit-hour program that integrates computing, usability, interface design, the social sciences and other disciplines in the design and development of user-friendly technologies, software and information systems.

The program includes core courses, research rotations, your choice of minor, qualifying examinations and a dissertation.

HCI Core (18 cr.)

- INFO H541 Interaction Design Practice
- INFO H564 Prototyping for Interactive Systems
- INFO H624 Advanced Seminar I in Human-Computer Interaction
- INFO H634 Advanced Seminar II in Human-Computer Interaction
- Select two HCI Research Area Selectives:
  - INFO I501 Introduction to Informatics
  - INFO H517 Visualization Design, Analysis, and Evaluation
  - INFO H543 Interaction Design Methods*(take online or in Year 3 if scheduling conflicts)*
  - INFO H563 Psychology of Human-Computer Interaction
  - INFO H565 Collaborative and Social Computing
  - INFO H566 Experience Design for Ubiquitous Computing
  - INFO H567 Internet-of-Things Interface Design for Business Innovation
  - INFO H570 Experience Design for Tangible and Embodied Systems
  - INFO H581 Experience Design and Evaluation of Access Technologies
  - INFO H582 User Experience Design Ethics
  - INFO H583 Conversational User Interfaces: Experience Design and Applications

Methods Courses (18 cr.)

- INFO I575 Informatics Research Design
- INFO I790 Informatics Research Rotation (Taken three times)
- Two Methods Electives:
  - PSY 608 Measurement Theory and Interpret Data
  - PSY 640 Survey of Social Psychology I
  - PSY 655 Cognitive Development
  - PSY-I 643 Field Methods & Exper
  - ANTH-E404 Field Meth in Ethnography

- COM 501 Qualitative Research
- COM 502 Applied Qualitative Research Methods
- EDU 520 Strategies for Educational Inquiry
- EDU 611 Qualitative Inquiry in Education
- NURS-L 650 Data Ana Clinical & Admin Dec.-Making
- NURS-R 612 Interpretive Data Analy (2 cr.)
- SOC-R 551 Quantitative Methods – Sociology
- SOC-R 551 Quantitative Methods Sociology
- SOC-R 559 Intermediate Soc Statistics
- STAT 511 Statistical Methods 1
- STAT 512 Applied Regression Analysis
- STAT 516 Basic Probability Appl.
- STAT 519 Intro to Probability
- STAT 521 Statistical Computing
- STAT-522 Sampling and Survey Techniques
- STAT 524 Applied Multivariate Analysis
- STAT 525 Intermediate Stat Methodology
- STAT 529 Applied Dec Theory and Bayesian Stat
- STAT 619 Probability Theory

Specialization (18 cr.)

- Disciplinary Affinities (0-6 cr.)
- Minor (12-18 cr.)

You must complete a minor within a domain appropriate to your choice of specialization and/or research area. All courses must be graduate-level and outside the HCI program.

Qualifying Examinations

1. **Written Exam** – You must successfully complete a written qualifying examination by the end of the program's second year. The exam is established by faculty and covers subject matter taken in the program's core courses. The exam may be retaken once.
2. **Oral Exam –** An oral examination takes place within weeks after successful completion of the written exam. You must pass both the written and oral exam before passing on to Ph.D. candidacy. The oral exam is based on the student's response to the written exam and core course material. The exam may be retaken once.

Dissertation (30 cr.)

A dissertation is a written elaboration of original research that makes creative contributions to your chosen area of specialization. Students will enroll multiple times in INFO I890 Thesis Readings and Research (1-12 cr.) as you work to complete your dissertation. All requirements must be completed within seven years of passing the qualifying exams. The dissertation process includes the following components:

1. **Proposal:** The research proposal for the dissertation must be approved by the student's research committee. The student will defend the dissertation proposal at a public colloquium in the school. The review should be completed within one-year after passing the Qualifying Examinations.
2. **Defense:** A written elaboration of significant original research must be successfully presented to the research committee in a public defense as described in the Graduate School Bulletin.

Last updated: 3/2024

PhD Degree Programs

Ph.D. Programs
The Luddy School of Informatics, Computing, and Engineering, the first of its kind in the country, was created as a place where innovative multidisciplinary programs could thrive, a program where students can apply the skills of technology to a range of other fields.

All Ph.D. candidates must meet with their academic and/or research advisor for course selection and plan of study.

The School of Informatics offers a **Doctoral (Ph.D.)** program with specializations in:

- Bioinformatics
- Computer Science
- Data Science
- Health and Biomedical Informatics
- Human-Computer Interaction

Information Science

The **Ph.D. in Information Science**

The 90 credit hours shall consist of courses in the Information Science core areas, theory and methodology, specializations, and dissertation work. Ph.D. students must take at least 18 credit hours of courses in Library and Information Science at or above the 500 level. Students will take a minimum of 36 hours of formal courses, reading courses, or directed research exclusive of the dissertation. Students who enter with no graduate background can expect to take additional hours of formal courses, reading courses, or directed research exclusive of the dissertation.

Degree requirements and process for the Information Science Ph.D.

All requirements for the degree must be completed within eight years from the date of first enrollment in the program. Candidacy expires seven 7 years from the date that the student passed the qualifying exam.

Core courses (18 credits)

- INFO-I 600 Professionalism and Pedagogy in Informatics
- LIS-S 690 Seminar in Information Science Research I
- LIS-S 691 Seminar in Information Science Research II
- LIS-S 608 Community Analysis and Engagement Strategies
- 2 Information Science electives

Methods courses (12 credits)

- INFO-I 575 Informatics Research Design
- LIS-S 609 Communty Engaged Research
- 2 methods electives

Research practice (9 credits)

- INFO-I 790 Research Rotation (take 3 times)

Minor/electives (15 credits)

All students shall be required to have a minor from either the Luddy School of Informatics, Computing and Engineering or another school at IU Indy. The minor must complement the student's degree but may not overlap with its coursework. Minors shall be selected with the advisor's recommendation. The selected minor should be appropriate for the student's focus or specialization within LIS. Some of the courses included in the minor may also be counted towards the student's Theory and Methodology requirement or other requirements.

Dissertation (36 credits)

- INFO-I 890 Thesis Reading and Research

Qualifying Examination, Written and Oral

A student must successfully complete a written and oral qualifying examination before the fifth semester of the program. The written exam has a breadth part and a depth part. The breadth part covers the program's core courses. The depth part additionally covers material from the student's research.

The oral exam takes place shortly after the student passes the written exam. The oral exam is based on the student's response to the written exam and the core courses. The both the written and oral exams are prepared and evaluated by faculty in the school who are familiar with the content of the core courses.

The student must pass both the written exam and the oral exam before advancing to candidacy. The student may retake once either the written exam or oral exam, but not both, if they do not pass that part on the first attempt. For further details, consult with the data science program director.

Dissertation (30 cr.)

A dissertation is a written elaboration of original research that makes creative contributions to the student's chosen area of specialization. The student will enroll multiple times in INFO I890 Thesis Readings and Research (1-12 cr.) while completing the dissertation. All requirements must be completed within seven years of passing the qualifying exams. The dissertation process includes the following components:

- **Proposal:** This is an in-depth oral review undertaken by students who have made significant progress in their research. The proposal will be defended at a public colloquium. The student must complete the proposal within one year of passing the qualifying exams.
- **Defense:** The student must defend his or her dissertation in an open seminar scheduled when doctoral research is almost complete.

Last updated: 3/2025

Graduate Degree Programs

Graduate Programs

The Luddy School of Informatics, Computing, and Engineering offers **Master of Science** degrees in:

- Applied Data Science (30 credit hours)
- Bioinformatics (36 credit hours)
- Computer Science (30 credit hours)
- Health Informatics (36 credit hours)
- Human-Computer Interaction (36 credit hours)
- Library and Information Science (39 credit hours)

The Luddy School of Informatics, Computing, and Engineering also offers a **Doctoral (Ph.D.)** program with specializations in:

- Bioinformatics
- Computer Science
- Data Science
- Health Informatics
- Human-Computer Interaction
- Information Science

All Ph.D. candidates must meet with their academic and/or research advisor for course selection and plan of study.

Finally, the Luddy School of Informatics, Computing, and Engineering offers a number of **Graduate Certificate Programs**:

- Archives Management
- Clinical Informatics
- Human-Computer Interaction
- Health Information Security
- School Library Certificate

Last updated: 3/2025

Certificate in Human-Computer Interaction

Certificate in Human-Computer Interaction
Graduates of the Human-Computer Interaction Graduate Certificate program will demonstrate expertise in the following core competencies essential to success:

1. Basic HCI theory, terms, principles, and conceptual models
2. User-centered design theory and practices related to interaction design
3. HCI design and development processes and life-cycle
4. User profiling to interaction design (needs and requirements)
5. System requirements and product assessments
6. Interface design principles and processes
7. Product usability evaluations and testing methods
8. The purpose of the graphic user interface
9. Usability theory, terms, and the applied techniques
10. Principles of the interface design and prototyping processes
11. Interface grids and typographical devices
12. Information architecture and content management
13. Classic user testing theory and tools
14. Advanced user requirements and profiling

15. Interface design standards / guidelines for cross cultural and disabled users
16. Interaction design styles and choosing interaction devices and elements
17. Develop an evaluative strategy; planning who, what, when, and where
18. Decide how to collect data and prepare for the final evaluation
19. Analysis and interpretation of the evaluation data
20. Inspect a user interface, including a range of evaluative processes
21. Prototype design basics: theory and practice; including basic terms
22. Psychological and behavioral science of HCI
23. Cognitive architecture, memory, problem-solving, mental models, perception, and action related to HCI
24. Impact the design and testing of interactive technologies

Graduates will also be able to apply HCI theory and principles to product development:

1. Apply HCI principles and a user-centered approach to interaction design
2. Analyze user needs and requirements
3. Design and develop prototypes based on user assessments (needs and requirements), while applying HCI principles and models.
4. Apply evaluation and usability testing methods to interactive products to validate design decisions
5. Develop pre-design and post-design usability testing techniques on the developed Web site
6. Assess user needs and requirements
7. Categorize, design, and develop information in proper architectural structures
8. Create interface design prototypes based on a range of design principles and user data, and user assessments
9. Apply prototype principles and a user-centered approach to interaction design
10. Apply evaluation and usability testing methods to prototypes to validate design decisions and to the Web product to validate design decisions using: a) Classic user testing, and b) Heuristic inspection
11. Analyze test data and write a comprehensive report on the product development process of their redesigned Web site, i.e. of the stages of pre-design, design, and post-design, testing, and data analysis
12. Implement a HCI research proposal, including research questions, collecting the relevant literature and methodology
13. Develop a general framework, with a hierarchy of concepts and topics, including a refinement of the research question
14. Understand and apply the various research methods regarding qualitative and quantitative data

Last updated: 02/04/2014

Certificate in Informatics in Health Information Management and Exchange

Certificate in Informatics in Health Information Management and Exchange
Individuals graduating from this program will support the collection, management, retrieval, exchange, and/or analysis of information in electronic form, in healthcare and public health organizations.

1. Understanding Technology and Methodologies for processing data, information and knowledge in Health Care
    - Explain concepts of information and communication technologies.
    - Elaborate basic informatics terminology like data, information, knowledge, hardware, software, networks, information systems, information systems management, databases.
    - Implement standards and terminologies for documenting health events and exchanging protected health information.
2. Information Literacy for Health Care
    - Determine the nature and extent of the information needed to build effective health information exchange services.
    - Propose infrastructure needed for health information exchange effectively and efficiently.
    - Evaluate information and its sources critically and incorporates selected information into health information exchange services.
    - Evaluate outcomes of health information exchange services on health care outcomes.
3. Information Management
    - Verbalize the importance of health information exchange to health care outcomes.
    - Have knowledge of various types of health information exchange services.
    - Assure confidentiality of protected patient health information when using health information exchange.
    - Assure access control in the use of health information exchange.
    - Assure the security of health information exchange.
    - Possess the skills as outlined in supportive functions component of the HL7 model applicable to health information exchange.
    - Understand the principles upon which organizational and professional Health Information System for providers and consumers are based.

Last updated: 02/04/2014

Certificate of Informatics in Health Information Security

Certificate of Informatics in Health Information Security
Graduates of the Graduate Certificate in Informatics in Health Information Security program will be qualified to serve as institutional/organizational information privacy or security officers:

1. Understanding Technology and Methodologies for Processing Information in Healthcare:
    - Explain concepts of information and communication technologies
    - Analyze network service management (i.e. DNS/DHCP, web, email, spam filtering, resource sharing, database, directory services and authentication), network communication and security (i.e. network devices, firewalls, intrusion detection systems, and incident response/forensics), and administration (i.e. shell scripting, documentation/request management, policy and procedure management, data center considerations, and virtualization)
    - Implement standards and terminologies for maintaining privacy and security of protected health information
2. Information Literacy for Healthcare:
    - Determine the nature and extent of the privacy and security needed to protect health information
    - Propose infrastructure needed to safeguard protected health information effectively and efficiently
    - Evaluate administrative, technical and physical safeguards critically
    - Access privacy and security regulations for healthcare information transactions including policy, procedures, guidelines, security architectures, risk assessments, disaster recovery, and business continuity; particular attention given to the Health Insurance Portability and Accountability Act (HIPAA) and the Health Information Technology for Economic and Clinical Health (HITECH) Act
3. Information Management:
    - Verbalize the importance of health information exchange to healthcare outcomes
    - Have knowledge of various types of health information exchange services
    - Assure confidentiality of protected patient health information when using health information exchange
    - Assure access control in the use of health information exchange
    - Assure the security of health information exchange
    - Possess the skills as outlined in supportive functions component of the HL7 model applicable to health information exchange
    - Understand the principles upon which organizational and professional health information systems for providers and consumers are based

    Last update: 02/04/2014

Certificate of Informatics in Health Information Systems Architecture

Certificate of Informatics in Health Information Systems Architecture

Graduates of the Graduate Certificate in Informatics in Health Information Systems Architecture will be the architects and developers of advanced health IT solutions. These individuals will be cross-trained in IT and health domains, thereby possessing a high level of familiarity with health domains to complement their technical skills in computer and information science:

1. Understanding Technology and Methodologies for Processing Information Healthcare:
    - Explain health informatics and design and develop health information systems
    - Recommend usability and usefulness measures to evaluate health information systems
    - Discern principles of informatics that govern communication systems, health decisions, information retrieval, telemedicine, bioinformatics and evidence-based medicine, as well as ways in which information science and computer technology can enhance evidence-based practice in healthcare
2. Information Literacy for Health Care:
    - Inspect solutions for management and mining of data generated in scientific laboratories and clinical trials for data mining and knowledge discovery, which include knowledge discovery techniques and databases, extraction of data/ metadata stored in data warehouses using Storage Area Networks and dealing with issues of handling this data
    - Design approaches to access needed information effectively and efficiently
    - Analyze the principles and methodologies underlying most standards for healthcare data interchange and practical issues of reading and understanding specifications, implementing and translating between standards
3. Information Management:
    - Analyze theoretical and practical models for the delivery of consumer health information and implement them in the design and development of consumer health information resources

    Last updated: 02/04/2014

Certificate in Clinical Informatics

Certificate in Clinical Informatics

Graduates of the Graduate Certificate in Clinical Informatics program will be able to lead the successful deployment and use of health IT to achieve transformational improvement in the quality, safety, outcomes and, thus, the value of health services in clinical areas:

1. Understanding technology and methodologies for processing data, information and knowledge in Health Care
    - Explain concepts of information and communication technologies.

- Integrate data from disparate systems found in hospitals and clinics.
- Implement standards and terminologies for documenting health events and exchanging protected health information.

2. Information Literacy for Health Care
   - Determine the nature and extent of the information needed.
   - Access needed information effectively and efficiently.
   - Evaluate outcomes of the use of information in clinical practice.
3. Information Management
   - Verbalize the importance of health information systems to clinical practice.
   - Have knowledge of various types of health information systems and their clinical and administrative uses.
   - Assure confidentiality of protected patient health information when using health information systems.
   - Assure access control in the use of health information systems
   - Assure the security of health information systems

Last updated: 02/04/2014

Certificate in Informatics for Public Health Professionals

Certificate in Informatics for Public Health Professionals
Individuals graduating from this program will be able to lead the successful deployment and use of health IT to achieve transformational improvement in the quality, safety, outcomes, and thus in the value of public health services.

1. Understanding Technology and Methodologies for processing data, information and knowledge in Healthcare
   - Explain concepts of information and communication technologies.
   - Integrate data from disparate systems such as clinical data, surveillance data, etc. for public health decision making.
   - Implement standards and terminologies for documenting public health events and exchanging protected health information for improved surveillance.
2. Information Literacy for Healthcare
   - Determine the nature and extent of the information needed for public health decisions.
   - Access needed information effectively and efficiently.
   - Evaluate outcomes of the use of information in public health.
3. Information Management
   - Verbalize the importance of health information systems to public health surveillance.
   - Have knowledge of various types of health information systems and their potential use in public health surveillance.
   - Evaluate when confidentiality of protected patient health information is superseded by public health needs.
   - Assure access control in the use of health information systems for public health needs.
   - Assure the security of health information systems.

Last updated: 02/04/2014

Student Learning Outcomes

Student Learning Outcomes

Informatics is an applied, professional computing discipline. It responds to society's need to solve increasingly complex problems in all fields of human endeavor by acquiring, managing and interpreting data. Informatics studies the ways in which people, information and digital technologies interact.

Nearly all fields benefit from the rapidly evolving fields of computing and information science. Informatics graduates solve problems through the application of computing to their domains of expertise.

Computing and information technology are evolving rapidly. The student learning outcomes articulated here are central to educating Informatics graduates who possess both the technological and human-centered design skills necessary to develop and deploy useful digital tools that acquire and manage data for informed decision-making. They incorporate intellectual and ethical standards that every Luddy School of Informatics, Computing, and Engineering graduate should attain.

Master of Library and Information Science: graduates will demonstrate competency in connecting core values and professional ethics to practics, facilitate engagement in the information ecosystem, curate collections for designated communities, lead and manage libraries, archives and other information organizations, organize and represent information, conduct systematic research to inform decisions and innovate professional practice with information services and technology.

Master of Science

- **Applied Data Science**: graduates will demonstrate competency in data analytics, data management, infrastructure and the data science life cycle. Additionally, competency will be demonstrated in the management of massive high-throughput data stores and cloud computing and data visualization. Students will learn methods of data mining, to transform large datasets into usable knowledge, and how to represent information visually.
- **Bioinformatics:** graduates will analyze biological data and apply the analytical skills and those analyses to pioneer research and use computational tools and develop applications that bridge the gap between data and discovery.
- **Computer Science:** graduates will learn problem-solving, critical thinking, and algorithmic proficiency and software development and engineering mastery.

Students will also learn systems, architecture, and hardware integration as well as data management analysis and visualization. Networking proficiency and security assurance along with ethical responsibility and effective communication will be taught and finishing with reserach mastery.

Health Informatics: graduates will demonstrate competency in fundamental and profesisonal interdisciplinary skills, health and health care systems skills, technological skills and human and social context. Students will apply, analyze, evaluate biomedical information in all of these areas.

Health Informatics recognizes that people are the end users of biomedical information, draws on the social and behavioral sciences to inform the design, development, and evaluation of technical solutions, policies, and economic, ethical, social, educational, and organizational systems.

- **Human-Computer Interaction:** graduates will be able to evaluate and create interfaces by applying HCI theories, terms, principles, and methods, apply psychological and cognitive principles and theories to human factors and user experience design, research and develop interactive collaborative systems by applying social computing theories and frameworks, design novel ubiquitous computing systems by researching and applying relevant HCI and informatics theories and frameworks, design effective, usable, and human-centered interactive systems using prototypes and proof of concepts,critique interaction designs on their usability, human-centeredness, and satisfaction of requirements; evaluate the fitness of requirements, goals, and research methods; make recommendations; and create and defend alternative designs, effectively communicate in digital, oral, and written form the processes, ideas, outcomes, and implications of HCI projects, articulate decisions and reasoning behind decisions made related to interaction design choices, design and research methods,exhibit sound judgment, ethical behavior, and professionalism in applying HCI concepts and value-sensitive design to serve stakeholders and society, especially in ethically challenging situations,collaborate in teams fairly, effectively, and creatively, applying group decision-making and negotiation skills.

Doctor of Philosophy

- **Bioinformatics:** graduates will be able to design computational tools and data science applications that make sense of staggering amounts of data, developing solutions that can improve health and save lives by immersing students in course projects, independent research investigations, and lab rotations that integrate informatics, technology, statistics, machine learning, computational biology, genetics, genomics, proteomics, other life science fields—and many other disciplines—in new ways.
- **Computer Science:** graduates will be able to pursue careers in research or academia or use their expertise for industry or government researchers to develope projects in artificial intelligence, machine learning, computer security and robotics. Students can be future entrepreneurs to start high tech ventures requiring advanced knowledge and expertise in computer science research.
- **Data Science:** graduates learn to define and investigate relevant research problems of data science using deep technical skills and the ability to formulate and test hypotheses using massive and heterogeneous data which provides the foundation for graduates who can become successful researchers either in academic settings or in industrial research and development laboratories.
- **Health and Biomedical Informatics:** graduates will help to design electronic health record systems to deliver genomic and genetic information, harness the power of social media to identify, monitor, and respond to disease outbreaks and create technology to improve health care outcomes. Students will be immersed in these challenges and address them with research questions and approaches and managing and integrating systems for electronic health records and examining how we interact with technology.
- **Human-Computer Interaction:** graduates will be able to identify new problems in HCI and generate new knowledge to solve them by collaborating in research labs and be mentored by faculty with real-world expertise in UX research, social computing, accessibility, interaction design for health, android science, and other emerging HCI areas. Students will conduct HCI and usability research that spans disciplines including computing, communication, robotics/android science, biomedical devices, and human and social sciences. Students will integrate computing, usability, interface design, the social sciences and other disciplines in the design and development of user-friendly technologies, software and information systems**.**
- **Information Science:** Students are expected to synthesize the body of knowledge and research methods in relation to the interdisciplinary study of information science, given the interdisciplinary nature of the Ph.D. program. Students will demonstrate the ability to conduct original, independent, ethical, and interdisciplinary research with theoretical and practical knowledge to advance Information Science. Leadership and community engagement: Students will learn how to build sustainable relationships with local, national, and global communities through research, outreach, and services, to address social challenges relevant to data, information, and knowledge. Students will demonstrate a depth of knowledge in Information Science foundations, as well as the student's chosen area of study, critically analyze published research in the student's area of study, demonstrate an ability to conduct ethically responsible original research in an independent manner on a significant information science problem and effectively communicate and defend results of research to interdisciplinary scientific audiences, as well as community stakeholders.

Graduate Certificates

- **Archives Management:** graduates will demonstrate identifying and preserving essential parts of society's cultural heritage, organizing and maintaining the documentary record of institutions, groups, and

individuals, assisting in the process of remembering the past through authentic and reliable primary sources, serving a broad range of people, who seek to locate and use valuable evidence and information.
- **Clinical Informatics:** graduates will demonstrate understanding technology and methodologies for processing information in health care, information literacy for health care, and information management.
- **Human-Computer Interaction:** graduates will demonstrate an understanding of the Internet of Things as well as HCI and UX theory with the introduction of UX design principles.
- **Health Information Security:** graduates will demonstrate understanding technology and methodologies for processing information in health care, information literacy for health care and information management.
- **School Librarianship Certificate:** core learning concept include: collaborative instruction, design, delivery, and assessment, integrated technology, student inquiry, 21S Century skills and processes, collection development, library program administration, basic resources and ILS management, PK-12 youth literature, and advocacy and leadership. (for certified teachers interested in adding to their license).

Last updated: 3/2025

Master of Science in Bioinformatics

Graduates of the Bioinformatics program will demonstrate expertise in the following core competencies essential to success:

1. Extract information from different types of bioinformatics data (gene, protein, disease, etc.) including their biological characteristics and relationships.
2. Employ different data representation models and formats used for bioinformatics data representation including markup languages, such as SBML and CellML, and ontologies, such as GO ontology.
3. Apply the different approaches used for data integration and data management, including data warehouse and wrapper approaches.
4. Master computational techniques and diversified bioinformatics tools for processing data including statistical, machine learning and data mining techniques.
5. Analyze processed data in particular with the support of analytical and visualization tools.
6. Carry out bioinformatics research under advisement including systems biology, structural bioinformatics and proteomics.
7. Interact with non-bioinformatics professionals, such as biologists and biomedical researchers in order to better understand their bioinformatics needs for better support and service delivery.
8. Design and develop bioinformatics solutions by adapting existing tools, designing new ones, or a combination of both.

Last updated: 02/04/2014

Master of Science in Human-Computer Interaction

Graduates of the Human-Computer Interaction program will demonstrate expertise in the following core competencies essential to success:

1. Human-Computer Interaction Theory and Usability Terms, Principles, and Practices
   - Problem space definition and conceptual models
   - Social mechanisms used in communication
   - User-centered approaches to interaction design
   - User profiling and user needs and requirements
   - Interface design principles and processes
   - Cognitive and information processing
   - Product assessments related to a market analysis
   - Processes and life-cycles of interaction design
   - Interface design and related areas of visual design and aesthetics
   - Product evaluation and testing methods, both qualitative and quantitative
2. Develop and Apply Human-Computer Interation Principles and Practices Related to the Design and Evaluation of Interactive Products:
   - Produce interface designs and prototypes based on user and needs assessments.
   - Apply HCI theory, principles, and a user-centered approach to interaction design.
   - Design interactive products up to the prototype.
   - Apply evaluation and usability testing methods to interactive products to validate design decisions.

   Last updated: 02/04/2014

Master of Science in Health Informatics

Graduates of the Health Informatics program will master health informatics knowledge and skills, as well as acquire practical experience in three domains:

1. **Understanding technology and methodologies for processing data, information and knowledge in Health Care**
   - Explain concepts of information and communication technologies.
   - Elaborate basic informatics terminology like data, information, knowledge, hardware, software, networks, information systems, information systems management, databases.
   - Execute queries on large databases using data mining and testing hypothesis approaches.
   - Integrate data from disparate systems found in hospitals and clinics.
   - Implement standards and terminologies for documenting health events and exchanging protected health information.
2. **Information Literacy for Health Care**
   - Determine the nature and extent of the information needed.

- Access needed information effectively and efficiently.
- Evaluate information and its sources critically and incorporates selected information into his or her knowledge base and value system.
- Either individually or as a member of a group, use information effectively to accomplish a specific health care purpose.
- Propose/justify Decision Support Systems algorithm to support care delivery.
- Integrate Natural Language Processing (NLP) with standards and terminologies used in healthcare.
- Evaluate outcomes of the use of information in clinical practice.

3. **Information Management**
   - Verbalize the importance of health information systems to clinical practice.
   - Have knowledge of various types of health information systems and their clinical and administrative uses.
   - Assure confidentiality of protected patient health information when using health information systems.
   - Assure access control in the use of health information systems.
   - Assure the security of health information systems.
   - Estimate the Return of Investment (ROI) of health information technology applications for healthcare.
   - Possess the skills as outlined in direct care component of the HL7 EHRS model, which such as navigation, Decision Support, output reports and more.
   - Understand the principles upon which organizational and professional Health Information System for providers and consumers are based.

   Last updated: 02/04/2014

Master of Science in Media Arts and Science

Graduates of the Media Arts and Science graduate program will demonstrate expertise in the following core competencies essential to success as an informatics, computing and information technology professional specializing in new and interactive media:

1. Design and create digital media products that are targeted to a specific purpose and that meet professional standards for quality.
2. Plan a coordinated collection of multi-media or trans-media communications and/or experiences, using each medium to good advantage.
3. Assess media communications and/or experiences, discriminating among features that influence effectiveness.
4. Recommend strategies, practices, and/or tools appropriate to a problem.
5. Predict future trends and developments in digital media, based on examination of the history, tradition, and current drivers in the field.
6. Communicate in written and oral form to a range of audiences.

Last updated: 02/05/2014

Doctor of Philosophy in Informatics - Bioinformatics

Upon completion of the Bioinformatics PhD program, students will be able to:

1. Analyze different types of bioinformatics data (gene, protein, disease, etc.) including their biological characteristics and relationships.
2. Formulate steps involved in transforming the data to knowledge, as well as introducing different techniques used at each step
3. Impact informatics on other disciplines such as biology from several perspectives including the social and economic aspects.
4. Establish different data representation models and formats used for bioinformatics data representation including markup languages, such as SBML and CellML, and ontologies, such as GO ontology.
5. Master different approaches used for data integration and data management, including data warehouse and wrapper approaches.
6. Develop computational techniques and employ diversified bioinformatics tools for data processing including statistical, machine learning and data mining techniques.
7. Analyze processed data in particular with the support of analytical and visualization tools.
8. Perform bioinformatics research in area of interest.
9. Interact with non-bioinformatics professionals, such as biologists and biomedical researchers in order to better understand their bioinformatics needs for better support and service delivery.
10. Develop the ability to design and develop bioinformatics solutions by adapting existing tools, designing new ones, or a combination of both.

Last updated: 02/05/2014

Doctor of Philosophy in Informatics - General

Graduates of the Ph.D. in Informatics program will demonstrate expertise in the following core competencies:

1. Identify, discuss, and apply the fundamental concepts, theory and practices in informatics such as information representation and architecture, retrieval, structured query language, information extraction and integration from disparate data sources, information visualization and security, and data mining including the relevant tools and methodologies.
2. Identify and practice the knowledge of beginning statistics, including sampling and correlations, research paradigms such as constructivism and pragmatism, distinctions and limitations of qualitative, quantitative, and mixed method research designs, understanding validity and reliability.
3. Apply research proposals, conduct peer reviews, create an annotated bibliography, create and present a high-level presentation pertaining to research, and use SPSS.

4. Acquire and apply the ability to read and critique scientific articles by analyzing the problem presented, solutions proposed, and critically looking at the solutions and the results, as well as learn how organize and write a scientific article through critical thinking and discussion.
5. Write research proposals by examining NSF and NIH case studies, including style and grant specific requirements.
6. Develop and deliver class-room lectures, including processes for critically evaluating class-room lectures and how to prepare effective teaching materials.
7. Apply research methods and acquire more advanced knowledge in different areas of research through apprenticeship and mentorship.

Concentrations will have the above general outcomes plus additional ones.

Last updated: 2/05/2014

Doctor of Philosophy in Informatics - Human Computer Interaction

Graduates of the Human-Computer Interaction track will gain the additional and specific expertise described below:

1. Identify and explain HCI domain knowledge in the areas of both basic and applied research with considerable depth, including:
    - HCI theory and usability terms, principles and practices
    - Problem space definition and conceptual models
    - Social mechanisms used in communication,
    - User-centered approaches to interaction design
    - User profiling and user needs and requirements
    - Interface design principles and processes, as well as related areas of visual design and aesthetics
    - Cognitive and information processing
    - Product assessments related to a market analysis, as well as processes and life-cycles of interaction design
    - Product evaluation and testing methods, both qualitative and quantitative
2. Identify and apply HCI principles and practices during product design and evaluation (*development and usability testing*) of interactive products, including:
    - Producing interface designs and prototypes based on user and needs assessments
    - Validate design decisions through a user-centered approach to interaction design and the final analysis, evaluation and usability testing methods of interactive products
3. Identify and explain the broader HCI connections and associations among technology, theory, social analysis and application domains to arrive at a set of questions in preparation for final research and dissertation, as well as the broader significance of work within the context of past and current HCI research

Last updated: 02/05/2014

Doctor of Philosophy in Informatics - Health Informatics

Graduates of the Health Informatics track will gain the additional and specific expertise described below:

1. Become skilled in the analysis, design and implementation of information systems that support and expand the delivery of health care
2. Function as a translator between clinicians and information technology personnel
3. Ensure that information systems capture and present critical health information
4. Interact with non-health care professionals, such as computer science, information science, cognitive science and other researchers to better understand how their knowledge advances health informatics science
5. Demonstrate in-depth knowledge on health informatics research approaches
6. Propose innovative approaches to the development of health informatics knowledge

Last updated: 02/05/2014

Contact Information

Contact Information:

Luddy School of Informatics, Computing, and Engineering 535 W. Michigan Street
Indianapolis, IN 46202Phone: 317-278-4636
LuddyIN@iu.edu

Parking

Visitors can park in the IU Indianapolis Gateway Garage located across the street.

Front Desk & Student Services IT 400

Department of BioHealth Informatics IT 475G

Department of Computer Science IT 317B

Department of Human-Centered Computing IT 593

Department of Library and Information Science IT 552

Last updated: 3/2025

Tuition & Financial Aid

Tuition & Financial Aid
IU Indianapolis is an exceptional value and a world-class institution, recently ranked 8th on the list of Best Public Colleges in the Midwest by *Forbes Magazine* and the Center for College Affordability and Productivity.

And a Luddy School of Informatics, Computing, and Engineering graduate degree from Indiana University will make you even *more* valuable with its unique integration of computing, social science and information systems design that can be applied in any number of fields as an industry professional, faculty member or researcher.

The IU Indianapolis Office of the Bursar maintains current tuition and detailed fee information, including a Tuition and Fee Estimator. They also accept several methods for payment designed to make paying for college as convenient as possible.

The Office of Student Financial Services provides current information for costs of attendance for full-time, resident and non-resident graduate students.

International students' costs of attendance are slightly different and include manadatory health insurance. Please consult with the IU Indianapolis Office of International Affairs.

Financial Aid
As a master's or Ph.D. student, you have access to a wide range of financial assistance, including scholarships, grants, loans and work-study that help reduce costs. We encourage you to investigate and pursue all options for which you may be eligible.

The Luddy School of Informatics, Computing, and Engineering offers assistantships and fellowships to qualified Ph.D. and master's students. To be automatically considered for such support, you must submit the following by January 15 (Ph.D. students) or March 15 (master's and certificate students):

- A completed application with application fee;
- Your GRE score from within the past five years.

Direct financial support from the Luddy School of Informatics, Computing, and Engineering is reserved for qualified, full-time students matriculating in the fall semester. Direct financial support is rarely available for students matriculating in the spring.

To learn more about financial aid opportunities from the university or external sources, such as the federal government, please consult the IU Indianapolis Office of Financial Aid and the IU Indianapolis Graduate Office.

International Students
For information about specific financial resources for international students, please contact the IU Indianapolis Office of International Affairs.

Last updated: 02/11/2014

Graduate Programs

Graduate Programs

The Luddy School of Informatics, Computing, and Engineering offers **Master of Science** degrees in:

- Applied Data Science
- Bioinformatics
- Computer Science
- Health Informatics
- Human-Computer Interaction
- Library and Information Science

The Luddy School of Informatics, Computing, and Engineering also offers a **Doctoral (Ph.D.)** program with specializations in:

- Bioinformatics
- Computer Science
- Data Science
- Health and Biomedical Informatics
- Human-Computer Interaction
- Information

And finally, in addition to Master's and PhD degree programs, the Luddy School of Informatics, Computing, and Engineering offers a number of **Graduate Certificate** programs:

- Archives Management
- Clinical Informatics
- Health Information Security
- Human-Computer Interaction
- School Library Certificate

last updated: 3/2025

Courses

Informatics

INFO-B 505 Informatics Project Management (3 cr.) This course introduces standard project management concepts and capabilities, in the context of innovative and creative knowledge-work projects involving computers. These are targeted as a common ground for all members of a successful team, not only for the Project Manager. Through lecture, reading, discussion, computer lab exercises, and projects, students will become more proficient with basic project management terminology, techniques and technologies. Students will apply industry-standard project management in a framework of productive team dynamics, consumer frame of reference, and organizational change and optionally continuing to professional certification.

INFO-B 574 Next-Generation Sequencing Data Analysis (3 cr.) This course covers concepts of genomic sequencing datasets from several sequencing platforms, including how the data motivates computational needs and tasks for analysis. Students learn how to devise approaches for analyzing massive clinical and biomedical sequencing datasets and for developing sound hypotheses and making predictions.

INFO-B 519 Introduction to Bioinformatics (3 cr.) In this course, students learn fundamental concepts and methods in bioinformatics, a field at the intersection of biology and computing. It surveys a wide range of topics including computational sequence analysis, sequence homology

searching and motif finding, gene finding and genome annotation, protein structure analysis and modeling, genomics and SNP analysis, DNA microarrays and gene expression analysis, Proteomics, network/systems biology, and biological knowledge discovery. It serves a gateway course for all entry-level bioinformatics graduate students. Prerequisite: students should be enrolled in the graduate program of bioinformatics, or have advanced training in at least one of the following areas: computer science, applied mathematics, quantitative biomedical sciences, bioengineering, biotechnology, and biostatistics.

INFO-B 528 Computational Analysis of High-Throughput Biomedical Data (3 cr.) Course covers advanced concepts of genomics, molecular biology, and systems biology and explores computational methods for analyzing their high-throughput datasets. Problems in biology and biomedicine will motivate the development of algorithms to apply to these datasets.

INFO-B 529 Machine Learning for Bioinformatics (3 cr.) P: B519 The course covers advanced topics in bioinformatics with a focus on machine learning. The course will review existing techniques such as hidden Markov models, artificial neural network, decision trees, stochastic grammars, and kernel methods. Examine application of these techniques to current bioinformatics problems including: genome annotation and comparison, gene finding, RNA secondary structure prediction, protein structure prediction, gene expression analysis, proteomics, and integrative functional genomics.

INFO-B 536 Computational Methods for Biomedical Informatics (3 cr.) P: None This course covers algorithm design, algorithm analysis, and complexity analysis and their applications in biomedical informatics.

INFO-B 552 Independent Study in Bioinformatics (1-3 cr.) Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. Total credit for seminars and independent study courses may not exceed 9 hours.

INFO-B 556 Biological Database Management (3 cr.) This course studies database management and its application to bioinformatics. Topics include data modeling, data indexing and query optimization with a bioinformatics perspective, and database issues arising from the complex nature of bioinformatics data. The course also involves the study of current challenges related to bioinformatics data management, data integration, and the Semantic Web.

INFO-B 573 Programming for Science Informatics (3 cr.) Students will receive a thorough understanding of software development for chem- and bioinformatics, and broaden experience of working in a scientific computing group. Topics include programming for the web, depiction of chemical and biological structures in 2D and 3D, science informatics tool kits, software APIS, AI and machine-learning algorithm development, high-performance computing, database management, managing a small software development group, and design and usability of science informatics software.

INFO-B 636 Genomic Data Analytics and Precision Medicine (3 cr.) This advanced course covers how massive clinical and biomedical genomic sequencing datasets from various sequencing platforms motivate computational needs and tasks for analysis, how to devise approaches for analyzing these datasets, how to develop sound hypotheses and predictions from them, and related ethical, privacy, and legal issues.

INFO-I 575 Informatics Research Design (3 cr.) Full spectrum of research concepts, designs, and methodologies used in informatics research, from quantitative to qualitative research; from deterministic, hypothesis-driven experimental designs to a posteriori discovery through data mining. Philosophical foundations to practical applications. Provides the conceptual framework in which the informatics graduate student may develop their own research agenda.

INFO-B 572 Computational Chemistry and Molecular Modeling (3 cr.) P: INFO-I 571. Computer models of molecules and their behavior in gas and condensed phases; implicit and explicit solvation models; quantum and molecular mechanics; search strategies for conformational analysis; geometry optimization methods; information content from Monte Carlo and molecular dynamics simulations; QSAR; CoMFO; docking.

INFO-B 576 Structural Approaches to Systems Biology (3 cr.) Computational approaches to characterizing and predicting tertiary protein configuration, based on known data of atomic, intramolecular and intermolecular interactions. The course presents a balanced and integrative outlook at the various molecular components that determine biological function, sub-cellular organization, dysfunction and even disease examined at the nanoscale.

INFO-B 585 Biomedical Analytics (3 cr.) Course introduces the use of patient data, genomic databases, and electronic health records (EHR) to improve patient care and to achieve greater efficiencies in public and private healthcare systems. The course explores clinical intelligence and the role of analytics in supporting a data-driven learning healthcare system. Topics include the value-driven healthcare system, measuring health system performance, existing quality/performance measurement frameworks (NQF, HEDIS), comparing healthcare delivery, attributes of high performing healthcare systems, and the IT infrastructure and human capital needed to leverage analytics for health improvement.

INFO-B 619 Structural Bioinformatics (3 cr.) This course covers the function of biological macromolecules (DNA, RNA, protein) and informatics approaches based on their sequence and 3D structure. Topics include molecular visualization, structure determination and alignment, and the prediction of protein structure, interactions, and function.

INFO-B 621 Computational Techniques in Comparative Genomics (3 cr.) Course will summarize computational techniques for comparing genomes on the DNA and protein sequence levels. Topics include state-of-the-art computational techniques and their applications: understanding of hereditary diseases and cancer, genetic mobile elements, genome rearrangements, genome evolution, and the identification of potential drug targets in microbial genomes.

INFO-B 627 Advanced Seminar I–Bioinformatics (3 cr.) Introduce students to major historical, contemporary, and emerging theories, methods, techniques, technologies

and applications in the field of Bioinformatics. Students will explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests. The course will focus on research approaches in bioinformatics, emerging technologies in biology and chemistry, and basic computational techniques.

INFO-B 637 Advanced Seminar II – Bioinformatics (3 cr.) P: Advanced graduate standing or consent of instructor. Introduces students to major historical contemporary and emerging theories, methods, and techniques in the field of Bioinformatics. Students will examine and explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design and independent research program in relation to their individual research fields and personal interests. The course will focus on research approaches in bioinformatics, emerging technologies in biology and chemistry, and basic computational techniques.

INFO-B 646 Computational Systems Biology (3 cr.) Introduction of how Omics data are generated, managed, analyzed from large-scale computational perspectives, exploring computational resources, especially biological pathways for integrative mining and computational analysis representing and modeling multiscale biological networks, relating static/dynamic properties to the understanding phenotypic functions at the molecular systems level.

INFO-B 656 Translational Bioinformatics Applications (3 cr.) This course entails a cohesive approach to the theory and practice of bioinformatics applications in translational medicine (TM). It includes topics related to the complexities of low, medium and high-throughput applications in TM and powerful solutions to TM data management problems by employing various informatics frameworks.

INFO-B 667 Seminar in Interprofessional Collaboration (3 cr.) This seminar provides graduate students with in depth experiences in interprofessional thinking and collaboration when implementing informatics applications. Biohealth Informatics applications are developed an interprofessional learning laboratory rooted in real-life innovation, discovery, and collaboration related to health and wellbeing.

INFO-B 668 Advanced Seminar in BioHealth Informatics (3 cr.) Course provides graduate students with knowledge on a wide range of current topics in health informatics from faculty and professionals engaged in cutting edge research and practice. Students connect with innovative faculty while learning through a combination of lectures, practicums, and discussions. The topics and presenters will be different each semester.

INFO-B 690 Topics in Informatics (3 cr.) Variable topic. Course is intended for Ph.D. students in the School of Informatics. Can be repeated with different topics, subject to approval of the dean.

INFO-B 692 Thesis/Project in Bioinformatics (1-6 cr.) The student prepares and presents thesis or project in an area of bioinformatics. The product is substantial, typically a multi-chapter paper or carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between student and sponsoring faculty member.

INFO-B 698 Research in Informatics (1-12 cr.) Research under the direction of a member of the graduate faculty that is not dissertation related. Can be repeated for credit for a total of 30 credit hours.

INFO-H 504 Social Dimensions of Science Informatics (3 cr.) Course will examine ethical, legal, and social issues surrounding contemporary research and practice in science informatics. Topics include the nature of science and technology, the ramifications of recent advances in science informatics, and relevant science policy and research ethics. General knowledge of science informatics is assumed.

INFO-H 559 MEDIA AND TECHNOLOGY ENTREPRENEURSHIP (3 cr.) This course is intended for students who are interested in starting their own company or who anticipate joining a start-up company. It will provide students with a solid foundation on a variety of legal and business matters that need to be considered when starting a new company, such as selecting a business structure (sole proprietorship, partnership, corporation, etc.), financing and credit, drafting business plans, preparing appropriate paperwork such as articles of incorporation and bylaws, tax implications, marketing and public relations, bankruptcy and other pitfalls, insurance, planning for growth, resources for entrepreneurs, contracts, real and personal property, shareholder and governance issues and working with professionals such as attorneys, accountants and insurance agents.

INFO-I 501 Introduction to Informatics (3 cr.) Basic information representation and processing; searching and organization; evaluation and analysis of information. Internet-based information access tools; ethics and economics of information sharing.

INFO-I 590 Topics in Informatics (3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated with different topics, subject to approval of the Dean.

INFO-I 595 Professional Internship (1-6 cr.) An experiential learning course where students apply classroom theory and learning in degree-related work experience under the supervision of a mentoring supervisor and course instructor.

INFO-I 600 Professionalism and Pedagogy in Informatics (3 cr.) This course introduces students to topics and skills necessary for entering careers in industry or the academy. Topics covered include career planning, curriculum development, effective teaching, research ethics, scholarly and trade publishing, grantsmanship, and intellectual property consideration.

INFO-I 699 Independent Study in Informatics (1-3 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 790 Informatics Research Rotation (3 cr.) Work with faculty, investigate research opportunities. Can be repeated for a total of 6 credit hours.

INFO-I 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation. Can be repeated for credit for a total of 30 credit hours.

INFO-B 518 Applied Statistical Methods for Biomedical Informatics (3 cr.) In this course, students learn the ability to understand, analyze, and interpret biomedical data is integral to biomedicine. This course provides in- demand data analysis skills and hands-on experience in analyzing genomic, proteomic, and health data. Students solve cutting-edge biomedical problems by applying statistical methods, packages, and toolkits.

INFO-B 506 Biomedical Informatics (3 cr.) This course covers the latest biomedical informatics concepts, technologies, policies, and skills, including infrastructure and data management, image analytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer the outcomes of data processing and analysis, and master the tools required for biomedical data analytics.

Graduate Course Descriptions

Media Arts and Science

INFO-I 605 Social Foundations of Informatics (3 cr.) Topics include the economics of information businesses and information societies, legal and regulatory factors that shape information and information technology use, the relationship between organization cultures and their use of information and information technology, and ownership of intellectual property.

NEWM-N 500 Principles of Multimedia Technology (3 cr.) This course examines issues related to digital media communication in the context of e-commerce and the information industry, especially its impact on the cultural, economic, social, and ethical dimensions of local and global communities. Topics also include: usability, intellectual property, and a diversity of user markets for new media products.

NEWM-N 501 Foundations of Digital Arts Production (3 cr.) This course examines the production process and management of digital multimedia. Students investigate and produce projects by researching foundations in the use of digital video with special emphasis on production process of storytelling. Skills learned will include: project development and video production. Students will develop presentation skills through research papers.

NEWM-N 502 Digital Media Motion and Simulation Methods (3 cr.) Applications in animation/ simulation design and creation using computer desktop tools. Examines the fundamentals of three-dimensional animation through storyboards and planning, modeling, texturing, lighting, rendering, and composite techniques. Topics will include nurbs design development, texture mapping for realism and stylistic output, keyframe and path animation, and cinematography lighting techniques. Skills will be developed through design and modeling of individual or team multidisciplinary projects.

NEWM-N 503 Digital Media Application Design Processes (3 cr.) Presents the principles and fundamentals of design techniques using authoring tools on PC, Macintosh, and emerging computer platforms. Included are storyboarding, planning and organization of scripts, use of current technology, computers, video and digital arts equipment; computer-assisted design and project planner software tools and management of design team concepts.

NEWM-N 504 Advanced Interactive Design Applications (3 cr.) Incorporates extensive analysis and use of computer and multimedia authoring tools intended for character simulation design. The course will study the concepts of physics-based bipedal movement in relation to gravity, balance, anticipation, potential energy, personality constructs, and locomotion. Assessment modeling for character depiction and animation will be planned and storyboarded. Other topics include more advanced facets of computer animation including paint tube modeling, layered texture mapping, and track and block animation for cyclical actions.

NEWM-N 506 Media Arts Project or Thesis (1-6 cr.) Students prepare a thesis or project that includes supporting documentation, as well as a final public defense. In either case, students are required to prepare a proposal that is approved by their advisor or committee chair before beginning their research.

NEWM-N 510 Web Database Development (3 cr.) P: CSCI 54100 or LIS-S 511 or INFO-B 512 or INFO-B 556 and prior programming experience Addresses diverse issues arising when designing World Wide Web interface. Basic database concepts will be presented but the course will focus on discussion of interface issues specific to Web databases, technologies for linking databases to Web servers for delivery, discussion of various Web-database applications, case studies, and industry trends.

NEWM-N 553 Independent Study (1-3 cr.) Research and/or production related to a particular theme or topic in media arts. Course topic, learning outcomes, and a plan of study must be developed by the student, with guidance from the instructor, prior to registration. Course can be repeated multiple times. Approval by the program advisor is required for registration.

NEWM-N 585 Seminars in Media Arts and Science (3 cr.) Current trends, problems, best practices and developments in new media. Students pursue a special interest and share information and experience with the group. This course is an in-depth exploration of topics and issues at the forefront of new media. Seminar format with research papers and class discussion/presentations.

NEWM-N 595 Internship in Media Arts and Technology (3 cr.) An internship program for students to work with and learn from experts in media (digital arts) technology fields who are developing and using new applications in commercial and educational settings. Requirements for interns include the development of a technology project proposal; interview, resume, and project presentation; on-site intern residency; project report; oral and media presentation of project outcomes.

Informatics

INFO-B 505 Informatics Project Management (3 cr.) This course introduces standard project management

concepts and capabilities, in the context of innovative and creative knowledge-work projects involving computers. These are targeted as a common ground for all members of a successful team, not only for the Project Manager. Through lecture, reading, discussion, computer lab exercises, and projects, students will become more proficient with basic project management terminology, techniques and technologies. Students will apply industry-standard project management in a framework of productive team dynamics, consumer frame of reference, and organizational change and optionally continuing to professional certification.

INFO-B 510 Data Acquisition and Laboratory Automation (3 cr.) This course covers the entire process by which signals from laboratory instruments are turned into useful data: (1) fundamentals of signal conditioning and sampling; (2) interfacing, communications, and data transfer; (3) markup languages and capability systems datasets; (4) general lab automation; (5) robotics. A significant portion of this course is devoted to practical learning using LabVIEW.

INFO-B 512 Scientific and Clinical Data Management (3 cr.) Management and mining of data generated in scientific laboratories and clinical trials for data mining and knowledge discovery requires robust solutions that include knowledge discovery techniques and databases, extraction of data/metadata stored in data warehouses that use Storage Use Networks and dealing with security issues of handling this data.

INFO-B 519 Introduction to Bioinformatics (3 cr.) In this course, students learn fundamental concepts and methods in bioinformatics, a field at the intersection of biology and computing. It surveys a wide range of topics including computational sequence analysis, sequence homology searching and motif finding, gene finding and genome annotation, protein structure analysis and modeling, genomics and SNP analysis, DNA microarrays and gene expression analysis, Proteomics, network/systems biology, and biological knowledge discovery. It serves a gateway course for all entry-level bioinformatics graduate students. Prerequisite: students should be enrolled in the graduate program of bioinformatics, or have advanced training in at least one of the following areas: computer science, applied mathematics, quantitative biomedical sciences, bioengineering, biotechnology, and biostatistics.

INFO-B 529 Machine Learning for Bioinformatics (3 cr.) P: B519 The course covers advanced topics in bioinformatics with a focus on machine learning. The course will review existing techniques such as hidden Markov models, artificial neural network, decision trees, stochastic grammars, and kernel methods. Examine application of these techniques to current bioinformatics problems including: genome annotation and comparison, gene finding, RNA secondary structure prediction, protein structure prediction, gene expression analysis, proteomics, and integrative functional genomics.

INFO-B 532 Seminar in Bioinformatics (1-3 cr.) Presentation and discussion of new topics in bioinformatics. Concentration on a particular area each semester to be announced before registration. Total credit for seminars and independent study courses may not exceed 9 credit hours.

INFO-B 552 Independent Study in Bioinformatics (1-3 cr.) Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. Total credit for seminars and independent study courses may not exceed 9 hours.

INFO-B 556 Biological Database Management (3 cr.) This course studies database management and its application to bioinformatics. Topics include data modeling, data indexing and query optimization with a bioinformatics perspective, and database issues arising from the complex nature of bioinformatics data. The course also involves the study of current challenges related to bioinformatics data management, data integration, and the Semantic Web.

INFO-B 572 Computational Chemistry and Molecular Modeling (3 cr.) P: I571 Computer models of molecules and their behavior in gas and condensed phases; implicit and explicit solvation models; quantum and molecular mechanics; search strategies for conformational analysis; geometry optimization methods; information content from Monte Carlo and molecular dynamics simulations; QSAR; CoMFO; docking.

INFO-B 573 Programming for Science Informatics (3 cr.) Students will receive a thorough understanding of software development for chem- and bioinformatics, and broaden experience of working in a scientific computing group. Topics include programming for the web, depiction of chemical and biological structures in 2D and 3D, science informatics tool kits, software APIS, AI and machine-learning algorithm development, high-performance computing, database management, managing a small software development group, and design and usability of science informatics software.

INFO-B 576 Structural Approaches to Systems Biology (3 cr.) Computational approaches to characterizing and predicting tertiary protein configuration, based on known data of atomic, intramolecular and intermolecular interactions. The course presents a balanced and integrative outlook at the various molecular components that determine biological function, sub-cellular organization, dysfunction and even disease examined at the nanoscale.

INFO-B 601 Introduction to Complex Systems (3 cr.) This course is an introduction to dynamic complex systems and complexity management, using the basic mathematical notions of dynamical system theory, without being highly technical mathematically. The course provides an evaluation of models, theories, methods and research from an operational and disciplined approach. Students will be introduced with a new way of making sense of each of these and other issues by exploring how other complex adaptive systems behave. The course will revolve around some cardinal topics including but not limited to reductionism versus system biology, chaos theory, fractal networks, self similarity, agent-based models, discrete and continuous simulation, evolution, artificial life, social network theory, etc. each one introduced by specific examples and abstracted thereby.

INFO-B 605 Social Foundations of Informatics (3 cr.) Topics include the economics of information businesses and information societies, legal and regulatory factors that shape information and information technology use, the

relationship between organization cultures and their use of information and information technology, and ownership of intellectual property.

INFO-B 619 Structural Bioinformatics (3 cr.) This course covers the function of biological macromolecules (DNA, RNA, protein) and informatics approaches based on their sequence and 3D structure. Topics include molecular visualization, structure determination and alignment, and the prediction of protein structure, interactions, and function.

INFO-B 621 Computational Techniques in Comparative Genomics (3 cr.) Course will summarize computational techniques for comparing genomes on the DNA and protein sequence levels. Topics include state-of-the-art computational techniques and their applications: understanding of hereditary diseases and cancer, genetic mobile elements, genome rearrangements, genome evolution, and the identification of potential drug targets in microbial genomes.

INFO-B 627 Advanced Seminar I–Bioinformatics (3 cr.) Introduce students to major historical, contemporary, and emerging theories, methods, techniques, technologies and applications in the field of Bioinformatics. Students will explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests. The course will focus on research approaches in bioinformatics, emerging technologies in biology and chemistry, and basic computational techniques.

INFO-B 637 Advanced Seminar II – Bioinformatics (3 cr.) P: Advanced graduate standing or consent of instructor. Introduces students to major historical contemporary and emerging theories, methods, and techniques in the field of Bioinformatics. Students will examine and explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design and independent research program in relation to their individual research fields and personal interests. The course will focus on research approaches in bioinformatics, emerging technologies in biology and chemistry, and basic computational techniques.

INFO-B 646 Computational Systems Biology (3 cr.) Introduction of how Omics data are generated, managed, analyzed from large-scale computational perspectives, exploring computational resources, especially biological pathways for integrative mining and computational analysis representing and modeling multiscale biological networks, relating static/dynamic properties to the understanding phenotypic functions at the molecular systems level.

INFO-B 656 Translational Bioinformatics Applications (3 cr.) This course entails a cohesive approach to the theory and practice of bioinformatics applications in translational medicine (TM). It includes topics related to the complexities of low, medium and high-throughput applications in TM and powerful solutions to TM data management problems by employing various informatics frameworks.

INFO-B 691 Thesis/Project in Health Informatics (1-6 cr.) The student prepares and presents a thesis or project in the area of health informatics. The product is substantial, typically multi-chapter paper or carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member.

INFO-B 692 Thesis/Project in Bioinformatics (1-6 cr.) The student prepares and presents thesis or project in an area of bioinformatics. The product is substantial, typically a multi-chapter paper or carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between student and sponsoring faculty member.

INFO-G 599 Thesis Research (0 cr.) Master's students who have enrolled in 30 or more hours of graduate course work applicable to the degree and who have completed all other requirements of the degree except the thesis of final project of performance may enroll in G599. Requires section authorization.

INFO-H 504 Social Dimensions of Science Informatics (3 cr.) Course will examine ethical, legal, and social issues surrounding contemporary research and practice in science informatics. Topics include the nature of science and technology, the ramifications of recent advances in science informatics, and relevant science policy and research ethics. General knowledge of science informatics is assumed.

INFO-H 559 MEDIA AND TECHNOLOGY ENTREPRENEURSHIP (3 cr.) This course is intended for students who are interested in starting their own company or who anticipate joining a start-up company. It will provide students with a solid foundation on a variety of legal and business matters that need to be considered when starting a new company, such as selecting a business structure (sole proprietorship, partnership, corporation, etc.), financing and credit, drafting business plans, preparing appropriate paperwork such as articles of incorporation and bylaws, tax implications, marketing and public relations, bankruptcy and other pitfalls, insurance, planning for growth, resources for entrepreneurs, contracts, real and personal property, shareholder and governance issues and working with professionals such as attorneys, accountants and insurance agents.

INFO-H 611 Mathematical and Logical Foundations of Informatics (3 cr.) An introduction to mathematical methods for information modeling, analysis, and manipulation. The topics include proof methods in mathematics, models or computation, counting techniques and discrete probability, optimization, statistical inference and core advanced topics that include, but are not limited to, Markov chains and random walks, random graphs, and Fourier analysis.

INFO-I 501 Introduction to Informatics (3 cr.) Basic information representation and processing; searching and organization; evaluation and analysis of information. Internet-based information access tools; ethics and economics of information sharing.

INFO-I 575 Informatics Research Design (3 cr.) Full spectrum of research concepts, designs, and methodologies used in informatics research, from quantitative to qualitative research; from deterministic,

hypothesis-driven experimental designs to a posteriori discovery through data mining. Philosophical foundations to practical applications. Provides the conceptual framework in which the informatics graduate student may develop their own research agenda.

INFO-I 590 Topics in Informatics (3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated with different topics, subject to approval of the Dean.

INFO-I 600 Professionalism and Pedagogy in Informatics (3 cr.) This course introduces students to topics and skills necessary for entering careers in industry or the academy. Topics covered include career planning, curriculum development, effective teaching, research ethics, scholarly and trade publishing, grantsmanship, and intellectual property consideration.

INFO-I 690 Topics in Informatics (3 cr.) Variable topic. Course is intended for Ph.D. students in the School of Informatics. Can be repeated with different topics, subject to approval of the dean.

INFO-I 698 Research in Informatics (1-12 cr.) Research under the direction of a member of the graduate faculty that is not dissertation related. Can be repeated for credit for a total of 30 credit hours.

INFO-I 699 Independent Study in Informatics (1-3 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 790 Informatics Research Rotation (3 cr.) Work with faculty, investigate research opportunities. Can be repeated for a total of 6 credit hours.

INFO-I 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation. Can be repeated for credit for a total of 30 credit hours.

Applied Data Science

INFO-B 505 Informatics Project Management (3 cr.) This course introduces standard project management concepts and capabilities, in the context of innovative and creative knowledge-work projects involving computers. These are targeted as a common ground for all members of a successful team, not only for the Project Manager. Through lecture, reading, discussion, computer lab exercises, and projects, students will become more proficient with basic project management terminology, techniques and technologies. Students will apply industry-standard project management in a framework of productive team dynamics, consumer frame of reference, and organizational change and optionally continuing to professional certification.

INFO-G 599 Thesis Research (0 cr.) Master's students who have enrolled in 30 or more hours of graduate course work applicable to the degree and who have completed all other requirements of the degree except the thesis of final project of performance may enroll in G599. Requires section authorization.

INFO-H 500 Fundamental Comp Concepts Info (3 cr.) An introduction to fundamental principles of computer concepts for Informatics study, including an overview of computer architecture, computer algorithms, fundamentals of operating systems, data structure, file organization and database concepts.

INFO-H 502 Human-Centered Research Methods in Informatics (3 cr.) This course surveys a broad range of research methods employed in Informatics, exploring their meta-theoretical underpinnings and exemplifying their application to specific research questions. This course is intended for students in Informatics graduate programs, especially PhD students, who need a grounding in research methods.

INFO-H 503 Social Impact of Information Technologies (3 cr.) An overview of important social, legal, and ethical issues raised by information technology.

INFO-H 504 Social Dimensions of Science Informatics (3 cr.) Course will examine ethical, legal, and social issues surrounding contemporary research and practice in science informatics. Topics include the nature of science and technology, the ramifications of recent advances in science informatics, and relevant science policy and research ethics. General knowledge of science informatics is assumed.

INFO-H 506 Globalization and Information (3 cr.) Explores the processes that promote and impede movement of human action and informational activities to the most general levels, e.g., the level of the world as a whole. Surveys diverse theories of globalization to identify the best approaches for professional informatics career planning and making information globally accessible.

INFO-H 525 Organizational Informatics and Economics Security (3 cr.) Organizational process embed implicit and explicit decisions and information control. Security technologies and implementations make explicit organizational choices that determine individual autonomy within an organization. Security implementations allocate risk, determine authority over processes, make explicit relationships in overlapping hierarchies, and determine trust extended to organizational participants.

INFO-H 534 Seminar in Human-Computer Interaction (1-3 cr.) Topics vary yearly and include the following: information visualization, immersive technologies, designing hypermedia for educational applications, user-centered design techniques and tools, formal methods and cognitive modeling in HCI.

INFO-H 536 Foundational Mathematics of Cybersecurity (3 cr.) Students will learn mathematical tools necessary to understand modern cyber security. The course will cover introductory mathematical material from a number of disparate fields, including probability theory, computational theory, complexity theory, group theory, and information theory.

INFO-H 537 Legal and Social Informatics of Security (3 cr.) This is a case-based course on privacy and security in social contexts. Cases will particularly address the specific designs of technologies (e.g., P3P, PICS) and discuss how different technically feasible design choices would result in distinct regulatory regimes, business strategies, or support different forms of social interaction. This course will focus on specific security and privacy technologies as socio-technical systems.

INFO-H 538 Introduction to Cryptography (3 cr.) Introduction to the foundational primitives of cryptography and implementations. A primary goal of this course will be to understand the security definitions for each primitive and how they are used in cryptographic protocols. The ethics of insecure or on-the-fly protocol design will be discussed.

INFO-H 539 Cryptographic Protocols (3 cr.) The class teaches a basic understanding of computer security by looking at how things go wrong, and how people abuse the system. The focus of the class is on how computer systems are attacked, and once this is understood it is possible to propose ways to make the system secure.

INFO-H 540 Data Mining for Security (3 cr.) The objective of this course is to provide an understanding of the impact of data mining in security with a particular focus on intrusion detection. There will be an introduction to data mining where data mining techniques including association rules, clustering and classification are described. Security basics will be presented, focusing on topics such as authentication and access control that are relevant to data mining. This seminar course will explore recent research work in this area and intrusion detection.

INFO-H 541 Interaction Design Practice (3 cr.) Human-computer interaction design (HCID) describes the way a person or group accomplishes tasks with a computer: what the individual or group does and how the computer responds; what the computer does and how the individual or group responds. Sometimes known as 'interface design,' HCID becomes increasingly important as computing intelligence and connectivity spread ubiquitously to home, work, and play environments. This course will be organized around a collection of readings and several design projects concerned with applying human-computer interaction principles to the design, selection, and evaluation of interactive systems.

INFO-H 543 Interaction Design Methods (3 cr.) Students will learn basic concepts and methods for usability studies and evaluation of interactive systems as well as apply those methods to actual system design evaluations. This course is not only for understanding the basics and traditional approaches in this area, but also for exploring new ways of evaluating the usability of state-of-the-art technology-based systems such as systems in ubiquitous computing, CSCW, tangible and social computing areas.

INFO-H 554 Independent Study in Human-Computer Interaction (1-3 cr.) Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. Total credit for seminars and independent study courses may not exceed nine 9 hours.

INFO-H 559 MEDIA AND TECHNOLOGY ENTREPRENEURSHIP (3 cr.) This course is intended for students who are interested in starting their own company or who anticipate joining a start-up company. It will provide students with a solid foundation on a variety of legal and business matters that need to be considered when starting a new company, such as selecting a business structure (sole proprietorship, partnership, corporation, etc.), financing and credit, drafting business plans, preparing appropriate paperwork such as articles of incorporation and bylaws, tax implications, marketing and public relations, bankruptcy and other pitfalls, insurance, planning for growth, resources for entrepreneurs, contracts, real and personal property, shareholder and governance issues and working with professionals such as attorneys, accountants and insurance agents.

INFO-H 561 Meaning and Form in HCI (3 cr.) As a continuation of HCI1 (H541), students will learn methodologies and principles for two types of core activities in human-computer interaction design: a) requirements analysis, contextual inquiry and ethnography as applied to the design of interactive systems in the social context? b) conceptual design for the modeling of the interactive structure of web, hypermedia and software applications. Weekly readings on the text books will be integrated with academic and professional articles and online media.

INFO-H 563 Psychology of Human Computer Interaction (3 cr.) Covers the psychological and behavioral science of human computer interaction, including cognitive architecture, memory, problem-solving, mental models, perception, action, and language. Emphasis is placed on developing an understanding of the interaction between human and machine systems and how these processes impact the design and testing of interactive technologies.

INFO-H 564 Prototyping for Interactive Systems (3 cr.) The course covers methodologies for designing and prototyping graphic user interfaces, including rapid (paper) and dynamic (interactive) prototypes. Principles of design research and visual communication are discussed in the context of interaction design, cognition and user behavior, as well as usability testing techniques for concept validation.

INFO-H 604 Human Computer Interaction Design Theory (3 cr.) The course will explore, analyze, and criticize underlying assumptions and the rational rationale behind some of the most influential theoretical attempts in HC and related fields. The purpose of the course is to make students aware of how theories can influence practice and to develop critical thinking around the role, purpose, and function of theories.

INFO-H 611 Mathematical and Logical Foundations of Informatics (3 cr.) An introduction to mathematical methods for information modeling, analysis, and manipulation. The topics include proof methods in mathematics, models or computation, counting techniques and discrete probability, optimization, statistical inference and core advanced topics that include, but are not limited to, Markov chains and random walks, random graphs, and Fourier analysis.

INFO-H 624 Advanced Seminar I–Human-Computer Interaction (3 cr.) P: Advanced graduate standing or consent of instructor. Introduces students to major historical, contemporary, and emerging theories, methods, techniques, technologies, and applications in the field of human-computer interaction. Students will explore relevant and influential research, results, and application. Students will design an independent research program in relation to their individual research fields and personal interests.

INFO-H 628 Advanced Seminar I in Compex Systems (3 cr.) Introduces students to major historical

contemporary and emerging theories, methods, and techniques in the field of complex systems. Students will examine and explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests. The course will focus on the theory of complex systems, systems science and artificial life.

INFO-H 634 Advanced Seminar II – Human Computer Interaction (3 cr.) P: Advanced graduate standing or consent of instructor. Introduces students to major historical, contemporary, and emerging theories, methods, techniques, technologies, and applications in the field of human-computer interaction. Students will explore relevant and influential research, results, and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests.

INFO-H 628 Advanced Seminar II in Compex Systems (3 cr.) Introduces students to major historical contemporary and emerging theories, methods, and techniques in the field of complex systems. Students will examine and explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests. The course will be an exposition of "the science at the edge" and the forefront of research to complex systems.

INFO-H 651 The Ethnography of Informatics (3 cr.) Introduces ethnography as a social science methodology and way of knowing with which to study information and its social contexts. Places ethnography in relation to other research methodologies relevant to the production of the informatics knowledge base. Trains students in the use of a broad range of ethnographic techniques relevant to the study of automated information technology in use. Designed to be open to students from other programs with sufficient methodological and substantive background.

INFO-H 680 Human-Computer Interaction Professional Practice I (3 cr.) P: INFO H541, H561, H543, H563, H564 This course represents Part One of a two-part course series, which fulfills the final HCI MS project requirement. Part One should showcase the accumulative knowledge of the student in the areas of product design and development. Students will explore relevant and applied research concepts, while considering various HCI design approaches. Final outcomes will include the completion of the first half of the final project, i.e., the completion of a final product.

INFO-H 681 Human Computer Interaction Professional Practice II (3 cr.) P: INFO H680 This course represents part two of a two-part course series, which fulfills the final HCI MS project requirement. The project will showcase the accumlative knowledge of the student in the areas of product assessment and documentation. Final outcomes will include the completion of the second half of the final project, i.e. product testing and analysis and writing of the paper.

INFO-H 694 Thesis/Project in Human-Computer Interaction (1-6 cr.) The student prepares and presents a thesis or project in an area of human-computer interaction. The product is substantial, typically multi-chapter paper, or a carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member.

INFO-I 501 Introduction to Informatics (3 cr.) Basic information representation and processing; searching and organization; evaluation and analysis of information. Internet-based information access tools; ethics and economics of information sharing.

INFO-I 575 Informatics Research Design (3 cr.) Full spectrum of research concepts, designs, and methodologies used in informatics research, from quantitative to qualitative research; from deterministic, hypothesis-driven experimental designs to a posteriori discovery through data mining. Philosophical foundations to practical applications. Provides the conceptual framework in which the informatics graduate student may develop their own research agenda.

INFO-I 590 Topics in Informatics (3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated with different topics, subject to approval of the Dean.

INFO-I 600 Professionalism and Pedagogy in Informatics (3 cr.) Course will introduce students to topics and skills necessary for entering careers in industry or the academy. Topics covered will include career planning, curriculum development, effective teaching, research ethics, scholarly and trade publiching, grantsmanship, and intellectual property consideration.

INFO-I 605 Social Foundations of Informatics (3 cr.) Topics include the economics of information businesses and information societies, legal and regulatory factors that shape information and information technology use, the relationship between organization cultures and their use of information and information technology, and ownership of intellectual property.

INFO-I 690 Topics in Informatics (3 cr.) Variable topic. Emphasis on new developments and research in informatics. Course is intended for Ph.D. students in the School of Informatics. Can be repeated with different topics, subject to approval of the dean.

INFO-I 698 Research in Informatics (1-12 cr.) Research under the direction of a member of the graduate faculty that is not dissertation related. Can be repeated for credit for a total of 30 credit hours.

INFO-I 699 Independent Study in Informatics (1-3 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 790 Informatics Research Rotation (3 cr.) Work with faculty, investigate research opportunities. Can be repeated for a total of 6 credit hours.

INFO-I 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate

faculty leading to a Ph.D. dissertation. Can be repeated for credit for a total of 30 credit hours.

Masters Level Courses

LIS-S 501 Reference (3 cr.) P: or Corequisite S500 This course enables students to identify and evaluate a wide variety of information sources and services. It examines the nature of reference work, human information needs, and information literacy. It includes search principles and techniques in major information retrieval systems as well as web search engines. Provides practice experience in evaluation and use of bibliographic materials, reference interviewing, and search techniques, in finding answers to real world questions reflecting the multidisciplinary and multicultural interests and characteristics of library users.

LIS-S 502 Acquisitions and Management of Knowledge and Information (3 cr.) C: S500 This course examines the principles and techniques that guide the acquisition, management, and evaluation of collections and the selection of knowledge and information resources for various types of libraries and information centers. The course provides students with experience in the major phases involved in developing collections with a diversity of formats: the formulation of collection development plans and policies, the selection of materials, vendor relationships, and the evaluation of collections. It enables students to recognize and respond to challenges and opportunities of special interest to collection developers: intellectual freedom, new information formats, copyright, and resource sharing.

LIS-S 503 Organization and Representation of Knowledge and Information (3 cr.) C: S500 Introduces students to various disciplines' approaches to the understanding, organization, representation (summarizing), and use of knowledge and information. This survey looks for commonality among the approaches taken in information science, cognitive psychology, semiotics, and artificial intelligence, among others. The goal is to identify criteria for evaluation and improvement of ways to organize and represent information for future retrieval. Information systems currently used in libraries and information centers will be studied as examples. Emphasis in the course is on concepts and ideas, with appropriate attention to terminology and technology.

LIS-S 504 Cataloging (3 cr.) P: S500 and S503 Historical development and principles essential to the understanding of the conceptual foundations of providing bibliographic access and control of materials and information. Discussion and examples in the application of AACR2r will be presented to illustrate and reflect current practice. Emphasis is on monographic publications.

LIS-S 505 Evaluation of Information Sources and Services (3 cr.) P: S500, S501, S502 and S503 Theory and practice of the design, collection, and analysis of systematic data for managerial decision-making concerning information resources, services, facilities, and organizations. Covers techniques of social science and information science qualitative and quantitative methods; includes communicating to internal and external audiences.

LIS-S 506 Introduction to Research (3 cr.) P: LIS S500, S501, S502, S503 Introduces the research process, including concepts, design, conduct, and evaluation. Examines the principles and characteristics of approaches and methodologies relevant to research in the field. Examples of data sources and introduction to methods of statistical description and analysis; ethical issues.

LIS-S 511 Database Design (3 cr.) P: LIS S500 and S503 Concerned with a comprehensive view of the processes involved in developing formal access to information from a user-centered point of view. Considers various database models (such as flat file, hierarchical, and relational), and hypertext (in terms of text, sound, numeric, image, and geographic data). Students will design and implement databases using several commercial database management systems.

LIS-S 516 Human-Computer Interaction (3 cr.) P: LIS S500 and S501 Examines the human factors associated with information technology and seeks to provide students with knowledge of the variables likely to influence the perceived usability, and hence the acceptability, of any information technology. In so doing, it will enable students to progress further toward specialist work in the important field of human-computer interaction.

LIS-S 517 Web Programming (3 cr.) P: LIS S500 Introduces basic skills for programming and manipulation of data structures for bibliographic and full text information systems.

LIS-S 519 Evaluation of Information Systems (3 cr.) P: LIS S500 and S503 Theoretical and practical exploration of the issues surrounding contemporary information systems. A specific focus will be on evaluating information systems from the user perspective. This evaluation approach will cut across disciplinary frameworks: behavioral, cognitive, and social sciences. The approach will also touch on multiple research methods: online surveys, sense-making, critical incident, and network analysis.

LIS-S 521 Humanities Information (3 cr.) P: LIS S500, S501 and S502 Introduction to information sources and services in the disciplines of performing arts, music, fine arts, literature, language, philosophy, and religion. In addition, the course addresses information needs and behavior patterns of users seeking these types of information.

LIS-S 522 Social Science Information (3 cr.) P: LIS S500, S501 and S502 Study of the core information tools in the fields of anthropology, economics, history, political science, psychology, and sociology. Includes key bibliographic databases and electronic network tools. Evaluation of research dealing with information channels in these fields.

LIS-S 523 Science and Technology Information (3 cr.) P: LIS S500, S501 and S502 General materials, reference books, periodicals, government documents, nonbook media in the individual literature of individual disciplines; patents and report literature. Examination of production, publication, distribution, and forms of scientific and technical literature.

LIS-S 524 Adult Readers Advisory (3 cr.) P: LIS S500, S501 and S502 A review and discussion of trends reflected in subject content and use of book and nonbook materials for patrons in secondary school and public

libraries in relation to changing young adult and adult needs and the role of libraries in meeting such needs.

LIS-S 525 Government Information (3 cr.) P: LIS S500, S501 and S502 Survey of government information dissemination in all formats and at all levels of government. Consideration of government information policy. Primary emphasis given to U.S. government information but some consideration given to state and local publications in the United States, and those of international organizations.

LIS-S 526 Business Information (3 cr.) P: LIS S500, S501 and S502 Introduction to basic business materials. Includes resources, research methods, current developments, automated systems, and databases.

LIS-S 532 Information Architecture for the Web (3 cr.) P: LIS S500 and S503 Focuses on website development. Students study information architecture as an approach for site organization and design, and learn about product management for complex web development tasks. In lab sessions, students work with markup languages and scripting and develop sites, typically for real clients.

LIS-S 533 Online Searching (3 cr.) P: LIS S500 and S501 Principles, methods, and techniques of advanced online information retrieval (IR). Characteristics of and search strategies for the use of bibliographic, referral, citation, fact, numeric, and full text databases and search systems. Considers standards, use of communications software, front-ends and micro-based IR systems, and creation of in-house databases.

LIS-S 541 Information Policy (3 cr.) P: INFO I501 or B506 or B519 or B530 or H541 or S503 Data creation, publication, dissemination, and use occur in a complex social context. Legal and regulatory structures continue to evolve to control these processes. This course explores international and U.S. principles, laws, and regulations affecting the information industry. Focus varies with the topic; for example, copyright of electronic information sources or transborder data flow. May be repeated for credit when topic varies.

LIS-S 550 Perspectives on the Information Professions (3 cr.) P: LIS S500 Students are introduced to the dynamic and shifting information professions, complex organizations, and emerging careers in the field. Issues in information management, social impact of modern information management and dissemination, and the development of professional identity are major themes for the course.

LIS-S 551 Library Management (3 cr.) P: LIS S500, S501 and S502 Management and administration of all types of libraries. Covers basics of organizational structure, planning, budget management, human resources issues and skills, and an understanding of the manager in the context of the organization.

LIS-S 552 Academic Library Management (3 cr.) P: LIS S500, S501 and S502 Background and current trends in the management of academic libraries.

LIS-S 553 Public Library Management (3 cr.) P: LIS S500, S501 and S502 Background and current trends in the management of public libraries.

LIS-S 554 Library Systems (3 cr.) P: LIS S500 This course intends to provide students with an understanding of the concepts and applications of computer automation in libraries and information centers. The workload is designed to simulate the challenges of working in library systems: juggling multiple priorities simultaneously in a team-based environment. Students will learn skills that can be applied on the job in both technical and broader administrative capacities. Students will gain confidence in their abilities to support technology initiatives.

LIS-S 556 Systems Analysis and Design (3 cr.) P: LIS S500 and S511 Using a behavioral approach to information systems, this course covers information systems designed to conform to the needs of users.

SLIS-S 571 Materials for Youth (3 cr.) Evaluation and use of books, magazines, recordings, films, radio and television broadcasts, and other sources of information and recreation.

SLIS-S 572 Youth Services (3 cr.) P: S571 or consent of instructor. This course emphasizes the history, philosophy, and description of children and young adult library services. It takes a holistic look at the role of the youth services librarian from planning and evaluation to specific services and programs, and examines the current and future outlook for this type of librarianship. Emphasis is on the public library, but cooperation with appropriate services and programs, such as school media centers, is also discussed.

SLIS-S 573 Education of Information Users (3 cr.) P: S401, S501 or S516.
Introduces students to the roles of librarians in adult education in university and college libraries and in public libraries. The course explores information literacy, library instructional models, education and training theories, and practical approaches for optimizing learning opportunities in library-based settings. Information literacy standards from the Association of College and Research Libraries (ACRL) and others are explored and applied to instructional design and practice. S573 also introduces students to outcomes-based planning and evaluation, a process for planning library-based educational programs with outcomes, or specific learning objectives in-mind.

SLIS-S 574 Information Inquiry for School Teachers (3 cr.) Information Inquiry for School Teachers (3 cr.; formerly L551) This course is intended to be an opportunity for teachers and future teachers (including school library media specialists as teachers) to practice methods in critically thinking about information/media, and to use the inquiry process as a means to teach their students to be critical reviewers and communicators as well. Application of national and state standards for information literacy K - 12. Offered over the Internet.

SLIS-S 580 History of Libraries (3 cr.) Development of libraries and information service from earliest times to the present, with emphasis on the library in relation to social, economic, cultural, and political trends.

SLIS-S 581 Archives and Records Management (3 cr.) Introduces basic theories, methods, and significant problems in archives and records management. The course also discusses how archivists are responding

to the challenge of managing and preserving electronic records.

SLIS-S 582 Preservation (3 cr.) Examines causes of library and archival materials deterioration. Develops conceptual framework and management perspective for preservation programs using technical standards, program development tools, scientific and administrative research reports, and advocacy literature. Explores the new information technologies and media as both preservation tools and challenges.

SLIS-S 601 Directed Readings (1-4 cr.) P: Consent of instructor. Readings and study in any area of library or information science having an extensive literature. A student may enroll for this course twice in the same semester under different instructors. Normally S601 is completed under the direction of a full-time faculty member. Readings done under S601 shall not duplicate the content of any course now in the curriculum of the School of Library and Information Science. Proposal Form due by March 15th.

SLIS-S 602 Directed Research (1-3 cr.) P: Proposal form and consent of instructor and 15 SLIS graduate credit hours completed including S505 or S506. Individual research in a problem in the field of library and information science.

SLIS-S 603 Workshop in Library and Information Science (1-3 cr.) Group study of specific problems in the library and information field. Generally includes a hands-on element. No more than 6 hours of S603 credit may be used toward the requirements for any SLIS degree.

SLIS-S 604 Topics in Library and Information Science (1-4 cr.) Study of specific topics in librarianship and preservation. May be repeated for credit when topic varies. Same course number used for different courses.

SLIS-S 605 Internship in Library and Information Science (2-6 cr.) P: Permission of faculty advisor. Graded S/F. Supervised internship in an information management environment. Professionals in library and information management mentor each graduate student. Sixty on-site hours must be completed for each credit earned. Students document their experiences through journals, abstracts of related publications, and a final presentation. Normally, at least 18 credits must be completed before enrollment*. Guidelines and placement listings are available on the SLIS website.

SLIS-S 621 Audio and Video Sources (3 cr.) P: S401 concurrent or consent of instructor. User-focused approach to decision making in the digital audio and video information environment. Emphasizes collection development in support of user services, including access to remote collections and evaluation of multimedia materials and delivery mechanisms, and issues related to emerging technologies. Scope includes adult and young adult audiences.

SLIS-S 622 Resources and Services for People with Disabilities (3 cr.) Access to information is essential for sustained independence of people with disabilities. This course studies materials, services, and assistive technologies to support this access.

SLIS-S 623 Genealogy and Local History (3 cr.) P: S401, S501, & S502. This course is designed to focus on two specific collection areas: Genealogy Resources and Indiana Resources. Students will work on developing collection policies creating collections with limited funding, and evaluating existing special collections. The class will also look at the pros and cons of several issues (staffing issues, volunteers, integrated collections, circulating/non-circulating, limited resources, material types).

SLIS-S 631 Advanced Cataloging (3 cr.) P: S504. Provides extensive background in description and access for electronic and non-book resources.

SLIS-S 632 Technical Services (3 cr.) C: S553, S551, S552 or consent of instructor
Principles of organization and function of library technical services, including acquisition, cataloging, serials, circulation. Special emphasis on research and development in library systems and technology. Includes file organization, documentation system development, analysis, and evaluation for manual, mechanical, and automated applications.

SLIS-S 640 Seminar in Intellectual Freedom (3 cr.) P: 9 hours of SLIS graduate credit or permission of instructor. Beginning with a history of and alternative philosophical justifications for censorship, the student is introduced to constraints, obligations, and problems relating to intellectual freedom.

LIS-S 644 Consumer Health Informatics (3 cr.) P: S401, S501 or consent of instructor. This is a consumer health informatics course in which students will learn about how technologies are used to deliver healthcare to the public.

SLIS-S 650 Library Philanthropy (3 cr.) Introduces the role of private giving in support of libraries. Examines personal and corporate philanthropy and their applicability in libraries and information centers.

SLIS-S 652 Digital Libraries (3 cr.) This course introduces digital libraries — networked information servers that provide access to multimedia data for local and remote users. Primary emphasis is on developing digital libraries, based on understanding tools for presentation and manipulation of multimedia as well as analysis of user needs.

SLIS-S 653 Health Science Librarianship (3 cr.) P: S401, S501or consent of instructor;
Explores the roles of health sciences libraries, librarianship and informationists in academia and hospital libraries, health information technology and information services environments, and in research and administrative teams. This course provides an introduction to the healthcare industry, health sciences schools and education (medicine, nursing, dentistry, public health, pharmacy, allied health and others), and the culture of healthcare in the United States. Student gain extensive experience with popular reference resources, and searching MEDLINE, PubMed, and speciality bibliographic databases in the health sciences. Students will increase their understanding of librarian and informationist roles in information literacy education, evidence based practice, health literacy, and other issues

SLIS-S 654 Law Librarianship (3 cr.) P: S501 or consent of instructor. An introduction to basic legal materials and law librarianship. Primary and secondary resources; indexes; digests and citators; specialized research methods; current developments in automated legal research. History of law libraries in the U.S., their organization and administration. The role of law librarians in law schools and law firms.

SLIS-S 671 School Media (3 cr.) P: S501, S571, and S574 or concurrent or consent of instructor. Establishes the professional teaching and administrative role of the certified school library media specialist in K-12 settings. Situations are examined that pertain specifically to policy development, budgeting, collection development, instructional design, support staff training, facility design, district supervision, and information networking within the modern school corporation. Students make site visits to leading school information centers, conferences, and media fairs.

SLIS-S 672 Seminar on Literature for Youth (3 cr.) P: S571 or consent of instructor. An advanced seminar, addresses such topics as: images of minority groups, societal problems (e.g., poverty and family patterns), or informational needs and materials including access and availability of print, nonprint, and computer resources. May be repeated for credit when topic varies.

SLIS-S 681 The Book 1450 to the Present (3 cr.) A survey of the book from 1450 to the present, with emphasis on the development of the book in the West. Focuses on the physical aspects of the book from the mid-fifteenth through the twentieth centuries, and on some of the many roles of the book in society during this period; also increases awareness of current scholarly trends in the history of the book.

Informatics

INFO-B 505 Informatics Project Management (3 cr.) This course introduces standard project management concepts and capabilities, in the context of innovative and creative knowledge-work projects involving computers. These are targeted as a common ground for all members of a successful team, not only for the Project Manager. Through lecture, reading, discussion, computer lab exercises, and projects, students will become more proficient with basic project management terminology, techniques and technologies. Students will apply industry-standard project management in a framework of productive team dynamics, consumer frame of reference, and organizational change and optionally continuing to professional certification.

INFO-B 510 Data Acquisition and Laboratory Automation (3 cr.) This course covers the entire process by which signals from laboratory instruments are turned into useful data: (1) fundamentals of signal conditioning and sampling; (2) interfacing, communications, and data transfer; (3) markup languages and capability systems datasets; (4) general lab automation; (5) robotics. A significant portion of this course is devoted to practical learning using LabVIEW.

INFO-B 512 Scientific and Clinical Data Management (3 cr.) Management and mining of data generated in scientific laboratories and clinical trials for data mining and knowledge discovery requires robust solutions that include knowledge discovery techniques and databases, extraction of data/metadata stored in data warehouses that use Storage Use Networks and dealing with security issues of handling this data.

INFO-B 530 Foundations of Health Informatics (3 cr.) This course will introduce the foundation of health informatics. It will review how information sciences and computer technology can be applied to enhance research and practice in healthcare. The basic principles of informatics that govern communication systems, clinical decisions, information retrieval, telemedicine, bioinformatics and evidence based medicine will be explored.

INFO-B 531 Seminar in Health Informatics (1-3 cr.) Variable topic. Emphasis is on advanced topics and research in health informatics.

INFO-B 535 Clinical Information Systems (3 cr.) Clinical Information Systems includes: human computer interface and systems design; healthcare decision support and clinical guidelines; system selection; organizational issues in system integration; project management for information technology change; system evaluation; regulatory policies; impact of the Internet; economic impacts of e-health; distributed healthcare information technologies and future trends.

INFO-B 551 Independent Study in Health Informatics (1-3 cr.) Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. Total credit for seminars and independent study courses may not exceed 9 hours.

INFO-B 578 Data Analysis for Clinical Administrative Decision Making (3 cr.) P: INFO I575 Focuses on understanding, manipulating, and analyzing quantitative data in nursing and healthcare. Includes use of computer-based systems for data management and statistical analysis. Application and interpretation of multivariate statistical models for decision making.

INFO-B 581 Health Informatics Standards and Terminologies (3 cr.) Health information standards specify representation of health information for the purpose of communication between information systems. Standards not only standardize data formats, but also the conceptualizations underlying the data structures. The design process of data standards, domain analysis, conceptualization, modeling, and the methods and tools commonly used are explored.

INFO-B 582 Health Information Exchange (3 cr.) This course describes the drivers and challenges, the data and services of electronic health information exchange (HIE). The five focus areas of HIE are reviewed relative to strategies and actions: Aligning Incentives; Engaging Consumers; Improving Population Health; Managing Privacy, Security and Confidentiality; and, Transforming Care Delivery.

INFO-B 583 Security and Privacy Policies and Regulations for Health Care (3 cr.) This course discusses privacy and security regulations for health care information transactions including policy, procedures, guidelines, security architectures, risk assessments, disaster recovery, and business continuity. Particular attention is given to the Health Insurance Portability and

Accountability Act (HIPAA) and the Health Information Technology for Economic and Clinical Health (HITECH) Act.

INFO-B 584 Practicum in Health Information Technology (3 cr.) This course provides an opportunity for the learner to synthesize all previous coursework and to demonstrate beginning competency in Health Information Technology (HIT) applications. The course employs an application focus in which the learner demonstrates comprehension, critical thinking, and problem-solving abilities within the context of a real-world environment.

INFO-B 605 Social Foundations of Informatics (3 cr.) Topics include the economics of information businesses and information societies, legal and regulatory factors that shape information and information technology use, the relationship between organization cultures and their use of information and information technology, and ownership of intellectual property.

INFO-B 641 Business of Health Informatics (3 cr.) This class focuses on the economic importance of healthcare information technology adoption for value realization, as a strategic asset, as an investment, and transformation toward integrated decision making. Topics covered include but are not limited to implementation of Decision Support System, barcode tracking, Electronic Health Records, pay-for-performance incentives for e-prescribing.

INFO-B 642 Clinical Decision Support Systems (3 cr.) This course provides an overview of the background and state-of-the-art Clinical Decision Support Systems (CDSS). Topics include: the design principles behind clinical decision support systems, mathematical foundations of the knowledge-based systems and pattern recognition systems, clinical vocabularies, legal and ethical issues, patient centered clinical decision support systems, and the applications of clinical decision support systems in clinical practice.

INFO-B 643 Natural Language Processing and Text Mining for Biomedical Records and Reports (3 cr.) This course familiarizes students with applications of Natural Language Processing and text mining in health care. While the course provides a short introduction to commonly used algorithms, techniques and software, the focus is on existing health care applications including clinical records and narratives, biomedical literature and claims processing.

INFO-B 667 Seminar in Health Informatics I (3 cr.) This course provides graduate students with advanced knowledge on a wide range of technical and analytical topics in health informatics. The course involves a combination of lectures, practicums, and discussions to engage students in the various aspects of an informatisist's role. The topics and presenters will be different each semester.

INFO-B 668 Seminar in Health Informatics II (3 cr.) This course provides graduate students with knowledge on a wide range of current topics in health informatics from faculty and professionals engaged in cutting edge research and practice. Students connect with innovative faculty while learning through a combination of lectures, practicums, and discussions. The topics and presenters will be different each semester.

INFO-B 691 Thesis/Project in Health Informatics (1-6 cr.) The student prepares and presents a thesis or project in the area of health informatics. The product is substantial, typically multi-chapter paper or carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member.

INFO-G 599 Thesis Research (0 cr.) Master's students who have enrolled in 30 or more hours of graduate course work applicable to the degree and who have completed all other requirements of the degree except the thesis of final project of performance may enroll in G599. Requires section authorization.

INFO-H 559 MEDIA AND TECHNOLOGY ENTREPRENEURSHIP (3 cr.) This course is intended for students who are interested in starting their own company or who anticipate joining a start-up company. It will provide students with a solid foundation on a variety of legal and business matters that need to be considered when starting a new company, such as selecting a business structure (sole proprietorship, partnership, corporation, etc.), financing and credit, drafting business plans, preparing appropriate paperwork such as articles of incorporation and bylaws, tax implications, marketing and public relations, bankruptcy and other pitfalls, insurance, planning for growth, resources for entrepreneurs, contracts, real and personal property, shareholder and governance issues and working with professionals such as attorneys, accountants and insurance agents.

INFO-H 611 Mathematical and Logical Foundations of Informatics (3 cr.) An introduction to mathematical methods for information modeling, analysis, and manipulation. The topics include proof methods in mathematics, models or computation, counting techniques and discrete probability, optimization, statistical inference and core advanced topics that include, but are not limited to, Markov chains and random walks, random graphs, and Fourier analysis.

INFO-I 501 Introduction to Informatics (3 cr.) Basic information representation and processing; searching and organization; evaluation and analysis of information. Internet-based information access tools; ethics and economics of information sharing.

INFO-I 575 Informatics Research Design (3 cr.) Full spectrum of research concepts, designs, and methodologies used in informatics research, from quantitative to qualitative research; from deterministic, hypothesis-driven experimental designs to a posteriori discovery through data mining. Philosophical foundations to practical applications. Provides the conceptual framework in which the informatics graduate student may develop their own research agenda.

INFO-I 590 Topics in Informatics (3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated with different topics, subject to approval of the Dean.

INFO-I 600 Professionalism and Pedagogy in Informatics (3 cr.) This course introduces students to topics and skills necessary for entering careers in industry

or the academy. Topics covered include career planning, curriculum development, effective teaching, research ethics, scholarly and trade publishing, grantsmanship, and intellectual property consideration.

INFO-I 690 Topics in Informatics (3 cr.) Variable topic. Course is intended for Ph.D. students in the School of Informatics. Can be repeated with different topics, subject to approval of the dean.

INFO-I 698 Research in Informatics (1-12 cr.) Research under the direction of a member of the graduate faculty that is not dissertation related. Can be repeated for credit for a total of 30 credit hours.

INFO-I 699 Independent Study in Informatics (1-3 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 790 Informatics Research Rotation (3 cr.) Work with faculty, investigate research opportunities. Can be repeated for a total of 6 credit hours.

INFO-I 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation. Can be repeated for credit for a total of 30 credit hours.

Human-Centered Computing

INFO-B 505 Informatics Project Management (3 cr.) This course introduces standard project management concepts and capabilities, in the context of innovative and creative knowledge-work projects involving computers. These are targeted as a common ground for all members of a successful team, not only for the Project Manager. Through lecture, reading, discussion, computer lab exercises, and projects, students will become more proficient with basic project management terminology, techniques and technologies. Students will apply industry-standard project management in a framework of productive team dynamics, consumer frame of reference, and organizational change–optionally continuing to professional certification.

INFO-G 599 Thesis Research (0 cr.) Master's students who have enrolled in 30 or more hours of graduate course work applicable to the degree and who have completed all other requirements of the degree except the thesis of final project of performance may enroll in G599. Requires section authorization.

INFO-H 500 Fundamental Comp Concepts Info (3 cr.) An introduction to fundamental principles of computer concepts for Informatics study, including an overview of computer architecture, computer algorithms, fundamentals of operating systems, data structure, file organization and database concepts.

INFO-H 502 Human-Centered Research Methods in Informatics (3 cr.) This course surveys a broad range of research methods employed in Informatics, exploring their meta-theoretical underpinnings and exemplifying their application to specific research questions. This course is intended for students in Informatics graduate programs, especially PhD students, who need a grounding in research methods.

INFO-H 503 Social Impact of Information Technologies (3 cr.) An overview of important social, legal, and ethical issues raised by information technology.

INFO-H 504 Social Dimensions of Science Informatics (3 cr.) Course will examine ethical, legal, and social issues surrounding contemporary research and practice in science informatics. Topics include the nature of science and technology, the ramifications of recent advances in science informatics, and relevant science policy and research ethics. General knowledge of science informatics is assumed.

INFO-H 506 Globalization and Information (3 cr.) Explores the processes that promote and impede movement of human action and informational activities to the most general levels, e.g., the level of the world as a whole. Surveys diverse theories of globalization to identify the best approaches for professional informatics career planning and making information globally accessible.

INFO-H 525 Organizational Informatics and Economics Security (3 cr.) Organizational process embed implicit and explicit decisions and information control. Security technologies and implementations make explicit organizational choices that determine individual autonomy within an organization. Security implementations allocate risk, determine authority over processes, make explicit relationships in overlapping hierarchies, and determine trust extended to organizational participants.

INFO-H 534 Seminar in Human-Computer Interaction (1-3 cr.) Topics vary yearly and include the following: information visualization, immersive technologies, designing hypermedia for educational applications, user-centered design techniques and tools, formal methods and cognitive modeling in HCI.

INFO-H 536 Foundational Mathematics of Cybersecurity (3 cr.) Students will learn mathematical tools necessary to understand modern cyber security. The course will cover introductory mathematical material from a number of disparate fields, including probability theory, computational theory, complexity theory, group theory, and information theory.

INFO-H 537 Legal and Social Informatics of Security (3 cr.) This is a case-based course on privacy and security in social contexts. Cases will particularly address the specific designs of technologies (e.g., P3P, PICS) and discuss how different technically feasible design choices would result in distinct regulatory regimes, business strategies, or support different forms of social interaction. This course will focus on specific security and privacy technologies as socio-technical systems.

INFO-H 538 Introduction to Cryptography (3 cr.) Introduction to the foundational primitives of cryptography and implementations. A primary goal of this course will be to understand the security definitions for each primitive and how they are used in cryptographic protocols. The ethics of insecure or on-the-fly protocol design will be discussed.

INFO-H 539 Cryptographic Protocols (3 cr.) The class teaches a basic understanding of computer security by looking at how things go wrong, and how people abuse the system. The focus of the class is on how computer

systems are attacked, and once this is understood it is possible to propose ways to make the system secure.

INFO-H 540 Data Mining for Security (3 cr.) The objective of this course is to provide an understanding of the impact of data mining in security with a particular focus on intrusion detection. There will be an introduction to data mining where data mining techniques including association rules, clustering and classification are described. Security basics will be presented, focusing on topics such as authentication and access control that are relevant to data mining. This seminar course will explore recent research work in this area and intrusion detection.

INFO-H 541 Interaction Design Practice (3 cr.) Human-computer interaction design (HCID) describes the way a person or group accomplishes tasks with a computer: what the individual or group does and how the computer responds; what the computer does and how the individual or group responds. Sometimes known as 'interface design,' HCID becomes increasingly important as computing intelligence and connectivity spread ubiquitously to home, work, and play environments. This course will be organized around a collection of readings and several design projects concerned with applying human-computer interaction principles to the design, selection, and evaluation of interactive systems.

INFO-H 543 Interaction Design Methods (3 cr.) Students will learn basic concepts and methods for usability studies and evaluation of interactive systems as well as apply those methods to actual system design evaluations. This course is not only for understanding the basics and traditional approaches in this area, but also for exploring new ways of evaluating the usability of state-of-the-art technology-based systems such as systems in ubiquitous computing, CSCW, tangible and social computing areas.

INFO-H 554 Independent Study in Human-Computer Interaction (1-3 cr.) Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. Total credit for seminars and independent study courses may not exceed nine 9 hours.

INFO-H 559 MEDIA AND TECHNOLOGY ENTREPRENEURSHIP (3 cr.) This course covers legal and business aspects of starting a media or technology company, including selecting the business structure, financing and credit, drafting business plans, articles of incorporation, and bylaws, tax implications, marketing and public relations, shareholders and governance, bankruptcy, insurance, contracts, property, and working with attorneys, accountants, and insurance agents.

INFO-H 561 Meaning and Form in HCI (3 cr.) As a continuation of HCI1 (H541), students will learn methodologies and principles for two types of core activities in human-computer interaction design: a) requirements analysis, contextual inquiry and ethnography as applied to the design of interactive systems in the social context? b) conceptual design for the modeling of the interactive structure of web, hypermedia and software applications. Weekly readings on the text books will be integrated with academic and professional articles and online media.

INFO-H 563 Psychology of Human Computer Interaction (3 cr.) Covers the psychological and behavioral science of human computer interaction, including cognitive architecture, memory, problem-solving, mental models, perception, action, and language. Emphasis is placed on developing an understanding of the interaction between human and machine systems and how these processes impact the design and testing of interactive technologies.

INFO-H 564 Prototyping for Interactive Systems (3 cr.) The course covers methodologies for designing and prototyping graphic user interfaces, including rapid (paper) and dynamic (interactive) prototypes. Principles of design research and visual communication are discussed in the context of interaction design, cognition and user behavior, as well as usability testing techniques for concept validation.

INFO-H 604 Human Computer Interaction Design Theory (3 cr.) The course will explore, analyze, and criticize underlying assumptions and the rational rationale behind some of the most influential theoretical attempts in HC and related fields. The purpose of the course is to make students aware of how theories can influence practice and to develop critical thinking around the role, purpose, and function of theories.

INFO-H 611 Mathematical and Logical Foundations of Informatics (3 cr.) This course reviews mathematical methods for data modeling, analysis, and manipulation. Topics include differential calculus, partial derivatives, solving systems of equations, matrices and matrix operations, vector spaces, linear transformations, determinants, inner product spaces, eigenvalues, probability, probability distributions, random variables, and their applications.

INFO-H 624 Advanced Seminar I–Human-Computer Interaction (3 cr.) P: Advanced graduate standing or consent of instructor. Introduces students to major historical, contemporary, and emerging theories, methods, techniques, technologies, and applications in the field of human-computer interaction. Students will explore relevant and influential research, results, and application. Students will design an independent research program in relation to their individual research fields and personal interests.

INFO-H 628 Advanced Seminar I in Compex Systems (3 cr.) Introduces students to major historical contemporary and emerging theories, methods, and techniques in the field of complex systems. Students will examine and explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests. The course will focus on the theory of complex systems, systems science and artificial life.

INFO-H 634 Advanced Seminar II – Human Computer Interaction (3 cr.) P: Advanced graduate standing or consent of instructor. Introduces students to major historical, contemporary, and emerging theories, methods, techniques, technologies, and applications in the field of human-computer interaction. Students will explore relevant and influential research, results, and applications. Students will develop an understanding of leading

research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests.

INFO-H 628 Advanced Seminar II in Compex Systems (3 cr.) Introduces students to major historical contemporary and emerging theories, methods, and techniques in the field of complex systems. Students will examine and explore relevant and influential research, results and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests. The course will be an exposition of "the science at the edge" and the forefront of research to complex systems.

INFO-H 651 The Ethnography of Informatics (3 cr.) Introduces ethnography as a social science methodology and way of knowing with which to study information and its social contexts. Places ethnography in relation to other research methodologies relevant to the production of the informatics knowledge base. Trains students in the use of a broad range of ethnographic techniques relevant to the study of automated information technology in use. Designed to be open to students from other programs with sufficient methodological and substantive background.

INFO-H 680 Human-Computer Interaction Professional Practice I (3 cr.) P: INFO H541, H561, H543, H563, H564 This course represents Part One of a two-part course series, which fulfills the final HCI MS project requirement. Part One should showcase the accumulative knowledge of the student in the areas of product design and development. Students will explore relevant and applied research concepts, while considering various HCI design approaches. Final outcomes will include the completion of the first half of the final project, i.e., the completion of a final product.

INFO-H 681 Human Computer Interaction Professional Practice II (3 cr.) P: INFO H680 This course represents part two of a two-part course series, which fulfills the final HCI MS project requirement. The project will showcase the accumlative knowledge of the student in the areas of product assessment and documentation. Final outcomes will include the completion of the second half of the final project, i.e. product testing and analysis and writing of the paper.

INFO-H 695 Thesis/Project in Data Science (1-6 cr.) P: NFO-I 575 Informatics Research Design or LIS-S 506 Introduction to Research or another approved graduate-level course on research design and methods The student prepares and presents a thesis or project in applied data science. The thesis is a substantial multi-chapter paper or carefully designed and evaluated application, based on well-planned research or a scholarly project. Details are worked out between the student and an advising faculty member.

INFO-I 501 Introduction to Informatics (3 cr.) P: Prior programming experience Basic information representation and processing; searching and organization; evaluation and analysis of information. Internet-based information access tools; ethics and economics of information sharing.

INFO-I 575 Informatics Research Design (3 cr.) Full spectrum of research concepts, designs, and methodologies used in informatics research, from quantitative to qualitative research; from deterministic, hypothesis-driven experimental designs to a posteriori discovery through data mining. Philosophical foundations to practical applications. Provides the conceptual framework in which the informatics graduate student may develop their own research agenda.

INFO-I 595 Professional Internship (1-6 cr.) An experiential learning course where students apply classroom theory and learning in degree-related work experience under the supervision of a mentoring supervisor and course instructor.

INFO-I 600 Professionalism and Pedagogy in Informatics (3 cr.) Course will introduce students to topics and skills necessary for entering careers in industry or the academy. Topics covered will include career planning, curriculum development, effective teaching, research ethics, scholarly and trade publiching, grantsmanship, and intellectual property consideration.

INFO-I 605 Social Foundations of Informatics (3 cr.) Topics include the economics of information businesses and information societies, legal and regulatory factors that shape information and information technology use, the relationship between organization cultures and their use of information and information technology, and ownership of intellectual property.

INFO-I 690 Topics in Informatics (3 cr.) Variable topic. Emphasis on new developments and research in informatics. Course is intended for Ph.D. students in the School of Informatics. Can be repeated with different topics, subject to approval of the dean.

INFO-I 698 Research in Informatics (1-12 cr.) Research under the direction of a member of the graduate faculty that is not dissertation related. Can be repeated for credit for a total of 30 credit hours.

INFO-I 699 Independent Study in Informatics (1-3 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 790 Informatics Research Rotation (3 cr.) Work with faculty, investigate research opportunities. Can be repeated for a total of 6 credit hours.

INFO-I 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation. Can be repeated for credit for a total of 30 credit hours.

INFO-B 512 Scientific and Clinical Data Management (3 cr.) This course concerns management and mining of data generated in scientific laboratories and clinical trials for data mining and knowledge discovery requires robust solutions that include knowledge discovery techniques and databases, extraction of data/metadata stored in data warehouses that use Storage Use Networks and dealing with security issues of handling this data.

INFO-H 515 Statistical Learning (3 cr.) P: ECON E570 or HPER T591 or PBHL B561 or PSY 60000 or STAT 51100 This course applies statistical learning methods for data mining and inferential and predictive analytics to informatics-related fields. The course also introduces

techniques for exploring and visualizing data, assessing model accuracy, and weighing the merits of different methods for a given real-world application. This course provides an essential toolset for transforming large, complex informatics datasets into actionable knowledge.

INFO-H 516 Cloud Computing for Data Science (3 cr.) P: CSCI 54100, LIS S511, INFO B512, or INFO B556; prior programming experience required Course covers data science concepts, techniques, and tools to support big data analytics, including cloud computing, parallel algorithms, nonrelational databases, and high-level language support. The course applies the MapReduce programming model and virtual-machine utility computing environments to data-driven discovery and scalable data processing for scientific applications.

INFO-H 517 Visualization Design, Analysis, and Evaluation (3 cr.) P: Prior programming experience required This is an introductory course in design and evaluation of interactive visualizations for data analysis. Topics include human visual perception, visualization design, interaction techniques, and evaluation methods. Students develop projects to create their own web-based visualizations and develop competence to undertake independent research in visualization and visual analytics.

INFO-H 518 Deep Learning Neural Networks (3 cr.) P: Linear algebra, probability and statistics, partial derivatives, and programming. Note: Programming is in Python Deep learning has resurged with the availability of massive datasets and affordable computing, enabling new applications in computer vision and natural language processing. This course introduces convolutional, recurrent, and other neural network architectures for deep learning. Students design, implement, and train these models to solve real-world problems.

INFO-B 573 Programming for Science Informatics (3 cr.) Students will receive a thorough understanding of software development for chem- and bioinformatics, and broaden experience of working in a scientific computing group. Topics include programming for the web, depiction of chemical and biological structures in 2D and 3D, science informatics toolkits, software APIs, AI and machine-learning algorithm development, high-performance computing, database management, managing a small software development group, and design and usability of science informatics software.

INFO-B 530 Foundation of Health Informatics (3 cr.) This course will introduce the foundation of Health Informatics. It will review how information sciences and computer technology can be applied to enhance research and practice in healthcare. The basic principles of informatics that govern communication systems, clinical decisions, information retrieval, telemedicine, bioinformatics and evidence based medicine will be explored

INFO-H 519 Natural Language Processing with Deep Learning (3 cr.) This course covers natural language processing using deep learning and its applications. Students learn recent advances by evaluating the literature, implementing methods in Python, and conducting a research project. Topics include machine translation, automated image captioning, and document summarization.

INFO-H 564 Prototyping for Interactive Systems (3 cr.) The course covers methodologies for designing and prototyping graphic user interfaces, including rapid (paper) and dynamic (interactive) prototypes. Principles of design research and visual communication are discussed in the context of interaction design, cognition and user behavior, as well as usability testing techniques for concept validation.

INFO-P 502 Modeling Crisis (3-3 cr.) P: None. (SPEA-J 520 Mapping and Analysis for Public Safety or GEOG-G 538 Geographic Information Systems or equivalent experience recommended) Models employed by geographic information systems characterize the physical, economic, social, and environmental impact of natural and human caused disasters. This course surveys geospatial models and their capabilities and technologies. Students learn to use models for disaster mitigation, preparedness, and response. The course prepares students for research on modeling crisis.

INFO-H 694 Thesis/Project in Human-Computer Interaction (1-6 cr.) The student prepares and presents a thesis or project in an area of human-computer interaction. The product is substantial, typically multi-chapter paper, or a carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member.

Informatics

INFO-B 505 Informatics Project Management (3 cr.) This course introduces standard project management concepts and capabilities, in the context of innovative and creative knowledge-work projects involving computers. These are targeted as a common ground for all members of a successful team, not only for the Project Manager. Through lecture, reading, discussion, computer lab exercises, and projects, students will become more proficient with basic project management terminology, techniques and technologies. Students will apply industry-standard project management in a framework of productive team dynamics, consumer frame of reference, and organizational change and optionally continuing to professional certification.

INFO-B 506 Biomedical Informatics (3 cr.) The course covers the latest biomedical informatics concepts, technologies, policies, and skills, including infrastructure and data management, image analytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer the outcomes of data processing and analysis, and master the tools required for biomedical data analytics.

INFO-B 510 Data Acquisition and Laboratory Automation (3 cr.) This course covers the entire process by which signals from laboratory instruments are turned into useful data: (1) fundamentals of signal conditioning and sampling; (2) interfacing, communications, and data transfer; (3) markup languages and capability systems datasets; (4) general lab automation; (5) robotics. A significant portion of this course is devoted to practical learning using LabVIEW.

INFO-B 512 Scientific and Clinical Data Management (3 cr.) Management and mining of data generated in scientific laboratories and clinical trials for data mining

and knowledge discovery requires robust solutions that include knowledge discovery techniques and databases, extraction of data/metadata stored in data warehouses that use Storage Use Networks and dealing with security issues of handling this data.

INFO-B 513 The Design, Implementation, and Evaluation of Electronic Health Record Systems (3 cr.) Students learn how to design, implement, and evaluate electronic health record (EHR) system and how to use technology to support their data acquisition, storage, reuse, interoperability, exchange, and analysis. They also evaluate their legal, ethical, and regulatory implications and learn how to build teams to manage their implementation in healthcare organizations.

INFO-B 530 Foundations of Health Informatics (3 cr.) This course will introduce the foundation of health informatics. It will review how information sciences and computer technology can be applied to enhance research and practice in healthcare. The basic principles of informatics that govern communication systems, clinical decisions, information retrieval, telemedicine, bioinformatics and evidence based medicine will be explored.

INFO-B 531 Seminar in Health Informatics (1-3 cr.) Variable topic. Emphasis is on advanced topics and research in health informatics.

INFO-B 535 Clinical Information Systems (3 cr.) Clinical Information Systems includes: human computer interface and systems design; healthcare decision support and clinical guidelines; system selection; organizational issues in system integration; project management for information technology change; system evaluation; regulatory policies; impact of the Internet; economic impacts of e-health; distributed healthcare information technologies and future trends.

INFO-B 536 Computational Methods for Biomedical Informatics (3 cr.) Course covers algorithm design, algorithm analysis, and complexity analysis and their applications in biomedical informatics.

INFO-B 559 Media and Technology Entrepreneurship (3 cr.) This course covers legal and business aspects of starting a media or technology company, including selecting the business structure, financing and credit, drafting business plans, articles of incorporation, and bylaws, tax implications, marketing and public relations, shareholders and governance, bankruptcy, insurance, contracts, property, and working with attorneys, accountants, and insurance agents.

INFO-B 543 Professional Practicum in Health Information Management I (1-6 cr.) Course provides professional practice experience. Students complete the project-based practicum under the direction of the assigned site supervisor. The student develops a project and presentation for the site. The student conducts all necessary research and applies project management tools and skills in completing the project.

INFO-B 544 Professional Practicum in Health Information Management II (1-6 cr.) Course provides professional practice experience. Students complete the project-based practicum under the direction of the assigned site supervisor. The student develops a project and presentation for the site. The student conducts all necessary research and applies project management tools and skills in completing the project.

INFO-B 551 Independent Study in Health Informatics (1-3 cr.) Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. Total credit for seminars and independent study courses may not exceed 9 hours.

INFO-B 578 Data Analysis for Clinical Administrative Decision Making (3 cr.) P: INFO I575 Focuses on understanding, manipulating, and analyzing quantitative data in nursing and healthcare. Includes use of computer-based systems for data management and statistical analysis. Application and interpretation of multivariate statistical models for decision making.

INFO-B 581 Health Informatics Standards and Terminologies (3 cr.) Health information standards specify representation of health information for the purpose of communication between information systems. Standards not only standardize data formats, but also the conceptualizations underlying the data structures. The design process of data standards, domain analysis, conceptualization, modeling, and the methods and tools commonly used are explored.

INFO-B 582 Health Information Exchange (3 cr.) This course describes the drivers and challenges, the data and services of electronic health information exchange (HIE). The five focus areas of HIE are reviewed relative to strategies and actions: Aligning Incentives; Engaging Consumers; Improving Population Health; Managing Privacy, Security and Confidentiality; and, Transforming Care Delivery.

INFO-B 583 Security and Privacy Policies and Regulations for Health Care (3 cr.) This course discusses privacy and security regulations for health care information transactions including policy, procedures, guidelines, security architectures, risk assessments, disaster recovery, and business continuity. Particular attention is given to the Health Insurance Portability and Accountability Act (HIPAA) and the Health Information Technology for Economic and Clinical Health (HITECH) Act.

INFO-B 584 Practicum in Health Information Technology (3 cr.) This course provides an opportunity for the learner to synthesize all previous coursework and to demonstrate beginning competency in Health Information Technology (HIT) applications. The course employs an application focus in which the learner demonstrates comprehension, critical thinking, and problem-solving abilities within the context of a real-world environment.

INFO-B 605 Social Foundations of Informatics (3 cr.) Topics include the economics of information businesses and information societies, legal and regulatory factors that shape information and information technology use, the relationship between organization cultures and their use of information and information technology, and ownership of intellectual property.

INFO-B 626 Human Factors Engineering for Health Informatics (3 cr.) Students review and critique traditional and emerging human factors engineering approaches,

concepts, and methods and apply them to contemporary health informatics problems. Class activities include discussions and interactive peer review of articles, presentations, and original research proposals.

INFO-B 641 Business of Health Informatics (3 cr.) This class focuses on the economic importance of healthcare information technology adoption for value realization, as a strategic asset, as an investment, and transformation toward integrated decision making. Topics covered include but are not limited to implementation of Decision Support System, barcode tracking, Electronic Health Records, pay-for-performance incentives for e-prescribing.

INFO-B 642 Clinical Decision Support Systems (3 cr.) This course provides an overview of the background and state-of-the-art Clinical Decision Support Systems (CDSS). Topics include: the design principles behind clinical decision support systems, mathematical foundations of the knowledge-based systems and pattern recognition systems, clinical vocabularies, legal and ethical issues, patient centered clinical decision support systems, and the applications of clinical decision support systems in clinical practice.

INFO-B 643 Natural Language Processing and Text Mining for Biomedical Records and Reports (3 cr.) This course familiarizes students with applications of Natural Language Processing and text mining in health care. While the course provides a short introduction to commonly used algorithms, techniques and software, the focus is on existing health care applications including clinical records and narratives, biomedical literature and claims processing.

INFO-B 644 Consumer Health Informatics (3 cr.) This is a consumer health informatics course in which we learn about how technologies are used to deliver healthcare to the public.

INFO-B 668 Seminar in Health Informatics II (3 cr.) This course provides graduate students with knowledge on a wide range of current topics in health informatics from faculty and professionals engaged in cutting edge research and practice. Students connect with innovative faculty while learning through a combination of lectures, practicums, and discussions. The topics and presenters will be different each semester.

INFO-B 690 Topics in Informatics (3 cr.) Variable topic. Course is intended for Ph.D. students in the School of Informatics. Can be repeated with different topics, subject to approval of the dean.

INFO-B 691 Thesis/Project in Health Informatics (1-6 cr.) The student prepares and presents a thesis or project in the area of health informatics. The product is substantial, typically multi-chapter paper or carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member.

INFO-H 559 MEDIA AND TECHNOLOGY ENTREPRENEURSHIP (3 cr.) This course is intended for students who are interested in starting their own company or who anticipate joining a start-up company. It will provide students with a solid foundation on a variety of legal and business matters that need to be considered when starting a new company, such as selecting a business structure (sole proprietorship, partnership, corporation, etc.), financing and credit, drafting business plans, preparing appropriate paperwork such as articles of incorporation and bylaws, tax implications, marketing and public relations, bankruptcy and other pitfalls, insurance, planning for growth, resources for entrepreneurs, contracts, real and personal property, shareholder and governance issues and working with professionals such as attorneys, accountants and insurance agents.

INFO-I 501 Introduction to Informatics (3 cr.) Basic information representation and processing; searching and organization; evaluation and analysis of information. Internet-based information access tools; ethics and economics of information sharing.

INFO-I 575 Informatics Research Design (3 cr.) Full spectrum of research concepts, designs, and methodologies used in informatics research, from quantitative to qualitative research; from deterministic, hypothesis-driven experimental designs to a posteriori discovery through data mining. Philosophical foundations to practical applications. Provides the conceptual framework in which the informatics graduate student may develop their own research agenda.

INFO-I 590 Topics in Informatics (3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated with different topics, subject to approval of the Dean.

INFO-I 595 Professional Internship (1-6 cr.) An experiential learning course where students apply classroom theory and learning in degree-related work experience under the supervision of a mentoring supervisor and course instructor.

INFO-I 600 Professionalism and Pedagogy in Informatics (3 cr.) This course introduces students to topics and skills necessary for entering careers in industry or the academy. Topics covered include career planning, curriculum development, effective teaching, research ethics, scholarly and trade publishing, grantsmanship, and intellectual property consideration.

INFO-I 699 Independent Study in Informatics (1-3 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 790 Informatics Research Rotation (3 cr.) Work with faculty, investigate research opportunities. Can be repeated for a total of 6 credit hours.

INFO-I 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation. Can be repeated for credit for a total of 30 credit hours.

Health Information Management

INFO-B 430 Introduction to Health Informatics (3 cr.) Course introduces the foundations of health informatics. It reviews how information science and computer technology can be applied to enhance research and practice in healthcare. The basic principles of informatics that govern communication systems, clinical decisions, information retrieval, telemedicine, bioinformatics and evidence-based medicine will be explored.

INFO-B 435 Clinical Information Systems (3 cr.) Course covers human-computer interface and systems design, healthcare decision support and clinical guidelines, system selection, organizational issues in system integration, project management for information technology change, system evaluation, regulatory policies, impact of the Internet, economic impacts of e-health, distributed healthcare information technologies, and future trends.

INFO-B 481 Health Information Standards and Terminologies (3 cr.) Health information standards specify representation of health information for communication between information systems. Standards not only standardize data formats, but also the conceptualizations underlying the data structures. The design process of data standards, domain analysis, conceptualization, modeling, and the methods and tools commonly used are explored.

HIM-M 108 Introduction to Health Information Management (3 cr.) Course introduces the health information management profession and healthcare delivery systems. Topics include healthcare settings, the patient record, electronic health records (EHRs), data collection standards, legal aspects of health information, coding, and reimbursement. Students gain hands-on experience with a virtual EHR and examine the impact of EHRs on healthcare.

HIM-M 110 Computer Concepts for Health Information (3 cr.) Course provides an overview of applications for the health and medical professionals. Topics include: audit trails, generating, quantifying and analyzing medical reports, word processing, computer hardware, medical software, copyright and fair usage. Students retrieve and present medical data.

HIM-M 120 Data Organization and Presentation in the Healthcare Environment (3 cr.) P: HIM-M110 Students will study and apply problem solving, decision analysis and data presentation techniques used in healthcare data representation for both internal and external users. ICD and CPT classification systems will be modeled and analyzed utilizing spreadsheets.

HIM-M 200 Database Design for Health Information Management (3 cr.) Introduction to database design with an emphasis on managing data in the health information environment. Topics and concepts include creating data table relationships and normalization. Utilizing Microsoft Access to create user forms and reports. Students will be required to create a large group project.

HIM-M 220 Healthcare Informatics for Decision Support (3 cr.) P: HIM-M200 This course provides an overview of essential information technology tools necessary for quantitative and qualitative decision making in a healthcare environment. Students will learn effective methods to analyze patient data including ICD and CPT classification systems as they relate to decision processes in a healthcare environment.

HIM-M 275 Effective Communication for the Healthcare Environment (3 cr.) Course is designed to develop effective interaction among internal and external customers in a healthcare environment. Emphasis is placed on professional communications with superiors, peers and subordinates in all areas of healthcare. Topics include: policy creation, HIM job descriptions, information technology proposal requests, e-mail etiquette and presentation skills.

HIM-M 325 Health Care Information Requirements and Standards I (3 cr.) Course outlines the essential documents/data content required for maintaining legal health records using paper and electronic media. Federal, state and local law, accreditation standards and regulatory requirements for maintaining patient data examined. Documentation in acute care, psychiatric and other healthcare settings. Students begin to explore the health information management professions.

HIM-M 327 Healthcare Information Requirements and Standards II (3 cr.) This course is a continuation of HIA-M 325 and includes the ongoing review of health record documentation, in particular secondary data bases such as cancer registry, long term care and other healthcare settings. Healthcare information resources, both in print and on the World Wide Web are researched and examined extensively.

HIM-M 328 Laboratory Enrichment for Healthcare Information Requirements and Standards II (1 cr.) P: HIM-M 325. This course consists of exercises that reinforce the lectures in HIA-M 327. Students explore Web resources used in the healthcare field and perform extensive database searches.

HIM-M 330 Medical Terminology (3 cr.) The purpose of this course is to further develop a student's understanding and use of medical terminology. There is a focus on spelling and pronunciation, abbreviations, analyzing words based on their root, prefix or suffix as well as identifying common mistakes within medical terminology.

HIM-M 345 Healthcare Law, Ethics, and Information Release (3 cr.) Course covers legal and ethical concepts in medicine and healthcare as applied to physicians, healthcare workers, hospitals, and other institutions. It focuses on confidentiality and privacy in the release of information and the privacy and security of electronic healthcare transactions and code sets under the Health Insurance Portability and Accountability Act.

HIM-M 350 Pathophysiology & Pharmacology for HIM I (3 cr.) P: HIM-M330 This course will cover pathophysiology and pharmacology associated with the body systems.

HIM-M 351 Pathophysiology & Pharmacology for HIM II (3 cr.) P: HIM-M350 This course is a continuation of HIM-M350. Course will cover pathophysiology and pharmacology associated with the body systems.

HIM-M 355 ICD-9-CM Coding (3 cr.) P: HIM-M330 Course covers both diagnosis and procedure classification systems, namely the International Classification of Diseases, Tenth Revision, Clinical Modification and Procedure Coding System (ICD-10-CM/PCS). Students learn accurate coding guidelines to code, index, and sequence diagnoses and procedures for medical documentation. Ethical coding guidelines are examined.

HIM-M 358 CPT Coding (3 cr.) P: HIM-M 355. Focus on Current Procedural Terminology coding. Sequence of procedures as they relate to correct coding guidelines.

Study of Health Care Common Procedure Coding System (HCPCS) will also be included.

HIM-M 370 Health information Management (3 cr.) This course will focus on human resources management in a Health information Department. Work scheduling, work flow and work design will be discussed. Other issues in managing an HIM department will be addressed such as education and training, establishing productivity standards, developing a budget and managing contracts.

HIM-M 400 Health Information Research and Analysis Methods (3 cr.) Course introduces methods of research and data analysis for inquiry in health information management. Students develop skills in planning, conducting, reporting, and assessing research and data analysis. These skills are then applied to biomedical data to support healthcare related decision making.

HIM-M 420 Health Information Project Management (3 cr.) This course weaves together theory and practice and presents an understandable, integrated view of the many concepts skills, tools, and techniques involved in project management. Students will receive up-to-date information on how good project management and effective use of software can help you manage projects, especially information technology projects.

HIM-M 425 Quantitative Analysis of Health Information (3 cr.) This course will outline the procedures associated with vital statistics in health care (birth/death certificates). The student will learn about the statistics associated with health care. The research portion will focus on data search and access techniques, national research policy making, biomedical and health research investigation, and research protocol data management.

HIM-M 443 Professional Practicum in Health Information Management I (1-8 cr.) This course is designed to provide professional practice experience in an approved clinical site under the direction of an HIA faculty member and an onsite clinical instructor. Students also receive didactic and practicum experience in the classroom. Emphasis on clinical science, health information management, business administration and information systems.

HIM-M 444 Professional Practicum in Health Information Management II (1-8 cr.) P: HIM-M 443. This course is a continuation of HIM-M 443 and includes professionally supervised experience in an approved clinical site as well as practicum experience in the classroom.

HIM-M 457 Practicum in Medical Coding (4 cr.) Course is designed for students completing the Certificate in Medical Coding. Students will participate in a supervised laboratory practicum focusing on the coding of complex medical records using both the ICD and CPT coding systems. Onsite observations related to coding function in approved clinical settings are included in the course content.

HIM-M 462 Healthcare Quality Improvement (3 cr.) This course will identify quality/performance improvement methods and techniques for health care professionals. Interpretation of data appropriate to user needs and presentation of information will also be covered.

HIM-M 470 Healthcare Reimbursement Systems (3 cr.) P: HIM-M355 Course will present data elements that apply to prospective payment systems. It will allow the student to gain the knowledge of correct reimbursement systems and to identify issues and patient types in meeting medical necessity guidelines.

HIM-M 485 Health Information Administration Enrichment Internship (4 cr.) This course is designed to provide professional internship experience. Students will complete the project-based internship under the direction of the assigned site supervisor. The student will provide a deliverable project to the site in a presentation format. The student will conduct all necessary research and apply project management tools and skills in completing the project work.

HIM-M 490 RHIA Exam Preparation (3 cr.) This course reviews technical and administrative aspects of domain topics required to pass of the Registered Health Information Administrator (RHIA) examination. (Students enrolled in this course are expected to take the RHIA exam concurrently.)

INFO-B 405 Social Foundations of Biomedical Informatics (3 cr.) This course introduces the economics of information businesses and societies. It examines how the use of information and information technology is influenced by laws and regulations, the ownership of intellectual property, and organizational culture.

INFO-B 413 The Design, Implementation, and Evaluation of Electronic Health Record Systems (3 cr.) Students learn how to design, implement, and evaluate electronic health record (EHR) system and how to use technology to support their data acquisition, storage, reuse, interoperability, exchange, and analysis. They also evaluate their legal, ethical, and regulatory implications and learn how to build teams to manage their implementation in healthcare organizations.

INFO-B 441 Business of Health Informatics (3 cr.) This course examines the economic impact of the adoption of healthcare information technology. Students explore its role as a strategic asset and analyze its return on investment to make a case for investment. Topics include decision support system, barcode tracking, electronic health records, and pay-for-performance incentives.

INFO-B 442 Clinical Decision Support Systems (3 cr.) This course examines clinical decision support systems (CDSS), both the current state of the art and their historical development. Topics include the application of CDSS to clinical practice, patient-centered CDSS, clinical vocabularies, legal and ethical issues, and mathematical foundations of the knowledge-based and pattern recognition systems.

INFO-B 481 Health Information Standards and Terminologies (3 cr.) Health information standards specify representation of health information for communication between information systems. Standards not only standardize data formats, but also the conceptualizations underlying the data structures. The design process of data standards, domain analysis, conceptualization, modeling, and the methods and tools commonly used are explored.

INFO-B 482 Health Information Exchange (3 cr.) This course introduces health information exchange (HIE), the electronic transfer of administrative and clinical information among healthcare organizations. Students examine strategic, organizational, legal, technical, and sociopolitical aspects of HIE initiatives in the U.S. and abroad, including their impact on healthcare quality, safety, efficiency, and cost.

INFO-B 483 Security and Privacy Policies and Regulations for Healthcare (3 cr.) This course discusses privacy and security regulations for healthcare information transactions including policy, procedures, guidelines, security architectures, risk assessments, disaster recovery, and business continuity. Particular attention is given to the Health Insurance Portability and Accountability Act (HIPAA) and the Health Information Technology for Economic and Clinical Health (HITECH) Act.

HIM-M 475 Health information Technology (3 cr.) Introduction to health information standards that have been developed for the electronic health record and information interoperability and standards in development. Emphasis on understanding healthcare organization networks, intranets, the role of the Internet in patient data access, differences between clinical and administrative information systems used in healthcare organizations and the management and maintenance of those systems.

Human-Centered Computing

INFO-B 505 Informatics Project Management (3 cr.) This course introduces standard project management concepts and capabilities, in the context of innovative and creative knowledge-work projects involving computers. These are targeted as a common ground for all members of a successful team, not only for the Project Manager. Through lecture, reading, discussion, computer lab exercises, and projects, students will become more proficient with basic project management terminology, techniques and technologies. Students will apply industry-standard project management in a framework of productive team dynamics, consumer frame of reference, and organizational change and optionally continuing to professional certification.

INFO-H 503 Social Impact of Information Technologies (3 cr.) An overview of important social, legal, and ethical issues raised by information technology.

INFO-H 504 Social Dimensions of Science Informatics (3 cr.) Course will examine ethical, legal, and social issues surrounding contemporary research and practice in science informatics. Topics include the nature of science and technology, the ramifications of recent advances in science informatics, and relevant science policy and research ethics. General knowledge of science informatics is assumed.

INFO-H 506 Globalization and Information (3 cr.) Explores the processes that promote and impede movement of human action and informational activities to the most general levels, e.g., the level of the world as a whole. Surveys diverse theories of globalization to identify the best approaches for professional informatics career planning and making information globally accessible.

INFO-H 515 Statistical Learning (3 cr.) P: ECON E570 or HPER T591 or PBHL B561 or PSY 60000 or STAT 51100
This course applies statistical learning methods for data mining and inferential and predictive analytics to informatics-related fields. The course also introduces techniques for exploring and visualizing data, assessing model accuracy, and weighing the merits of different methods for a given real-world application. This course provides an essential toolset for transforming large, complex informatics datasets into actionable knowledge.

INFO-H 516 Cloud Computing for Data Science (3 cr.) P: CSCI 54100, LIS S511, INFO B512, or INFO B556; prior programming experience required Course covers data science concepts, techniques, and tools to support big data analytics, including cloud computing, parallel algorithms, nonrelational databases, and high-level language support. The course applies the MapReduce programming model and virtual-machine utility computing environments to data-driven discovery and scalable data processing for scientific applications.

INFO-H 517 Visualization Design, Analysis, and Evaluation (3 cr.) P: Prior programming experience required This is an introductory course in design and evaluation of interactive visualizations for data analysis. Topics include human visual perception, visualization design, interaction techniques, and evaluation methods. Students develop projects to create their own web-based visualizations and develop competence to undertake independent research in visualization and visual analytics.

INFO-H 525 Organizational Informatics and Economics Security (3 cr.) Organizational process embed implicit and explicit decisions and information control. Security technologies and implementations make explicit organizational choices that determine individual autonomy within an organization. Security implementations allocate risk, determine authority over processes, make explicit relationships in overlapping hierarchies, and determine trust extended to organizational participants.

INFO-H 534 Seminar in Human-Computer Interaction (1-3 cr.) Topics vary yearly and include the following: information visualization, immersive technologies, designing hypermedia for educational applications, user-centered design techniques and tools, formal methods and cognitive modeling in HCI.

INFO-H 538 Introduction to Cryptography (3 cr.) Introduction to the foundational primitives of cryptography and implementations. A primary goal of this course will be to understand the security definitions for each primitive and how they are used in cryptographic protocols. The ethics of insecure or on-the-fly protocol design will be discussed.

INFO-H 539 Cryptographic Protocols (3 cr.) The class teaches a basic understanding of computer security by looking at how things go wrong, and how people abuse the system. The focus of the class is on how computer systems are attacked, and once this is understood it is possible to propose ways to make the system secure.

INFO-H 540 Data Mining for Security (3 cr.) The objective of this course is to provide an understanding of the impact of data mining in security with a particular

focus on intrusion detection. There will be an introduction to data mining where data mining techniques including association rules, clustering and classification are described. Security basics will be presented, focusing on topics such as authentication and access control that are relevant to data mining. This seminar course will explore recent research work in this area and intrusion detection.

INFO-H 541 Interaction Design Practice (3 cr.) This course covers human computer interaction theory and application from an integrated-approach of knowledge domains, i.e., the cognitive, behavioral, and social aspects of users and user context, relevant to the design and usability testing of interactive systems. Topics include: basic HCI theory, terms, principles, and conceptual modelsUser experience (UX) design theory and practices, interface design principles and processes, product design and development processes and lifecycle, needs, requirements, and formative user research,prototype design theory and practice and product usability evaluations and testing methods.

INFO-H 543 Interaction Design Methods (3 cr.) Students will learn basic concepts and methods for usability studies and evaluation of interactive systems as well as apply those methods to actual system design evaluations. This course is not only for understanding the basics and traditional approaches in this area, but also for exploring new ways of evaluating the usability of state-of-the-art technology-based systems such as systems in ubiquitous computing, CSCW, tangible and social computing areas.

INFO-H 554 Independent Study in Human-Computer Interaction (1-3 cr.) Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. Total credit for seminars and independent study courses may not exceed nine 9 hours.

INFO-H 559 MEDIA AND TECHNOLOGY ENTREPRENEURSHIP (3 cr.) This course is intended for students who are interested in starting their own company or who anticipate joining a start-up company. It will provide students with a solid foundation on a variety of legal and business matters that need to be considered when starting a new company, such as selecting a business structure (sole proprietorship, partnership, corporation, etc.), financing and credit, drafting business plans, preparing appropriate paperwork such as articles of incorporation and bylaws, tax implications, marketing and public relations, bankruptcy and other pitfalls, insurance, planning for growth, resources for entrepreneurs, contracts, real and personal property, shareholder and governance issues and working with professionals such as attorneys, accountants and insurance agents.

INFO-H 561 Meaning and Form in HCI (3 cr.) As a continuation of HCI1 (H541), students will learn methodologies and principles for two types of core activities in human-computer interaction design: a) requirements analysis, contextual inquiry and ethnography as applied to the design of interactive systems in the social context? b) conceptual design for the modeling of the interactive structure of web, hypermedia and software applications. Weekly readings on the text books will be integrated with academic and professional articles and online media.

INFO-H 563 Psychology of Human Computer Interaction (3 cr.) Covers the psychological and behavioral science of human computer interaction, including cognitive architecture, memory, problem-solving, mental models, perception, action, and language. Emphasis is placed on developing an understanding of the interaction between human and machine systems and how these processes impact the design and testing of interactive technologies.

INFO-H 564 Prototyping for Interactive Systems (3 cr.) The course covers methodologies for designing and prototyping graphic user interfaces, including rapid (paper) and dynamic (interactive) prototypes. Principles of design research and visual communication are discussed in the context of interaction design, cognition and user behavior, as well as usability testing techniques for concept validation.

INFO-H 565 Collaborative and Social Computing (3 cr.) This is a seminar course in which students will engage with seminal research in collaborative and social computing through a series of genealogical threads linking ‘big ideas’ in the social sciences to the ways in which they have been appropriated in collaborative and social computing research. Through their synthesis of the course readings, students will connect these big ideas to the design and use of seminal ‘historic’ and contemporary social and computing technologies.

INFO-H 566 Experience Design for Ubiquitous Computing (3 cr.) An introduction to research topics in ubiquitous and pervasive computing, including sensors, ambient displays, tangibles, middleware, mobility, and location and context awareness. These topics are explored from a user-centered design perspective, focusing on how a situated and embedded model of computing affects requirements gathering, interaction design, prototyping, and evaluation techniques. Students gain expertise with contemporary ubiquitous and pervasive computing technologies and learning to incorporate them into a user-centered research and design process.

INFO-H 604 Human Computer Interaction Design Theory (3 cr.) The course will explore, analyze, and criticize underlying assumptions and the rational rationale behind some of the most influential theoretical attempts in HC and related fields. The purpose of the course is to make students aware of how theories can influence practice and to develop critical thinking around the role, purpose, and function of theories.

INFO-H 624 Advanced Seminar I–Human-Computer Interaction (3 cr.) P: Advanced graduate standing or consent of instructor. Introduces students to major historical, contemporary, and emerging theories, methods, techniques, technologies, and applications in the field of human-computer interaction. Students will explore relevant and influential research, results, and application. Students will design an independent research program in relation to their individual research fields and personal interests.

INFO-H 634 Advanced Seminar II – Human Computer Interaction (3 cr.) P: Advanced graduate standing

or consent of instructor. Introduces students to major historical, contemporary, and emerging theories, methods, techniques, technologies, and applications in the field of human-computer interaction. Students will explore relevant and influential research, results, and applications. Students will develop an understanding of leading research approaches and paradigms, and will design an independent research program in relation to their individual research fields and personal interests.

INFO-H 651 The Ethnography of Informatics (3 cr.) Introduces ethnography as a social science methodology and way of knowing with which to study information and its social contexts. Places ethnography in relation to other research methodologies relevant to the production of the informatics knowledge base. Trains students in the use of a broad range of ethnographic techniques relevant to the study of automated information technology in use. Designed to be open to students from other programs with sufficient methodological and substantive background.

INFO-H 680 Human-Computer Interaction Professional Practice I (3 cr.) P: INFO H541, H561, H543, H563, H564 This course represents Part One of a two-part course series, which fulfills the final HCI MS project requirement. Part One should showcase the accumulative knowledge of the student in the areas of product design and development. Students will explore relevant and applied research concepts, while considering various HCI design approaches. Final outcomes will include the completion of the first half of the final project, i.e., the completion of a final product.

INFO-H 681 Human Computer Interaction Professional Practice II (3 cr.) P: INFO H680 This course represents part two of a two-part course series, which fulfills the final HCI MS project requirement. The project will showcase the accumlative knowledge of the student in the areas of product assessment and documentation. Final outcomes will include the completion of the second half of the final project, i.e. product testing and analysis and writing of the paper.

INFO-H 690 Topics in Informatics (3 cr.) Variable topic. Emphasis on new developments and research in informatics. Course is intended for Ph.D. students in the School of Informatics. Can be repeated with different topics, subject to approval of the dean.

INFO-H 694 Thesis/Project in Human-Computer Interaction (1-6 cr.) The student prepares and presents a thesis or project in an area of human-computer interaction. The product is substantial, typically multi-chapter paper, or a carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member.

INFO-I 698 Research in Informatics (1-12 cr.) Research under the direction of a member of the graduate faculty that is not dissertation related. Can be repeated for credit for a total of 30 credit hours.

INFO-I 501 Introduction to Informatics (3 cr.) P: Prior Programming Experience Basic information representation and processing; searching and organization; evaluation and analysis of information. Internet-based information access tools; ethics and economics of information sharing.

INFO-I 575 Informatics Research Design (3 cr.) Full spectrum of research concepts, designs, and methodologies used in informatics research, from quantitative to qualitative research; from deterministic, hypothesis-driven experimental designs to a posteriori discovery through data mining. Philosophical foundations to practical applications. Provides the conceptual framework in which the informatics graduate student may develop their own research agenda.

INFO-I 590 Topics in Informatics (3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated with different topics, subject to approval of the Dean.

INFO-I 600 Professionalism and Pedagogy in Informatics (3 cr.) Course will introduce students to topics and skills necessary for entering careers in industry or the academy. Topics covered will include career planning, curriculum development, effective teaching, research ethics, scholarly and trade publiching, grantsmanship, and intellectual property consideration.

INFO-I 699 Independent Study in Informatics (1-3 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 790 Informatics Research Rotation (3 cr.) Work with faculty, investigate research opportunities. Can be repeated for a total of 6 credit hours.

INFO-I 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation. Can be repeated for credit for a total of 30 credit hours.

NEWM-N 595 Internship in Media Arts and Technology (1-6 cr.) An internship program for students to work with and learn from experts in media (digital arts) technology fields who are developing and using new applications in commercial and educational settings. Requirements for interns include the development of a technology project proposal; interview, resume, and project presentation; on-site intern residency; project report; oral and media presentation of project outcomes.

INFO-H 567 Internet-of-Things Interface Design for Business Innovation (3 cr.) P: INFO-H541 Students employ human-machine interface design principles and practices as an innovation engine for Internet-of-things (IoT) ecosystems. Through design challenges, they develop and refine IoT interfaces and their corresponding business models, drawing on case studies and a review of the literature.Students acquire design-as-strategy skills through team-based, industry specific design projects.

INFO-H 570 Experience Design for Tangible and Embodied Systems (3 cr.) P: INFO H541 This course covers the user experience design of systems and installations that respond to hand gestures, body movements, and tangible interaction. It introduces theories of embodiment and their practical application. The course includes lectures, discussions on recent literature, and a project to design and implement a tangible or gestural system

INFO-H 581 Experience Design and Evaluation of Access Technologies (3 cr.) P: INFO H541 This

course covers access technologies and user experience design for users with disabilities. Students learn to apply accessible design techniques to create and evaluate assistive technologies and inclusive products and critique existing user experience design approaches to accessibility.

INFO-H 582 User Experience Design Ethics (3 cr.) This course explores ways to integrate ethics into the professional practice of a user experience designer. Students discuss and interrogate ethical concerns and situations related to the design, development, evaluation, and use of computing technology through different ethical frameworks, lenses, and perspectives, examining their strengths and weaknesses.

INFO-H 583 Conversational User Interfaces: Experience Design and Applications (3 cr.) This course covers how to design, prototype, and evaluate conversational user interfaces. Students learn the tools and methods of experience design in this modality, exploring through their projects the cognitive, experiential, and social aspects of user interaction. They also examine emerging application areas and research trends.

INFO-I 595 Professional Internship (1-6 cr.) An experiential learning course where students apply classroom theory and learning in degree-related work experience under the supervision of a mentoring supervisor and course instructor.

Informatics

INFO-B 444 Consumer Health Informatics (3 cr.) This course explores how technologies are used to deliver healthcare to the public. Topics include access to patient data and privacy issues, consumer access to clinical information and current research, the design and development of consumer health information resources, health literacy and health information literacy, information quality, and models for information delivery, including the Internet.

INFO-B 436 Computational Methods for Biomedical Informatics (3 cr.) This course covers algorithm design, algorithm analysis, and complexity analysis and their applications in biomedical informatics.

INFO-B 406 Biomedical Informatics (3 cr.) The course covers the latest biomedical informatics concepts, technologies,policies, and skills, including infrastructure and data management, imageanalytics, visualization, and API design and implementation for healthcare.Students analyze healthcare and biomedical information, infer outcomes fromdata processing and analysis, and master the tools required for biomedicaldata analytics.

INFO-I 100 First Year Experience (1 cr.) This course introduces specific survival skills for success in college and beyond, while reconciling personal learning skills with instructor-based teaching styles. Master the art of inquiry and elevate your sense of integrity while sharpening your personal edge by exploring critical thinking, project management and current/future job market trends. Required by all informatics and media arts and science majors.

INFO-I 101 Introduction to Informatics (4 cr.) Problem solving with information technology; introductions to information representation, relational databases, system design, propositional logic, cutting-edge technologies: CPU, operation systems, networks, laboratory emphasizing information technology including web page design, word processing, databases, using tools available on campus.

INFO-I 112 Basic Tools of Informatics - Programming and Database Concepts (3 cr.) Introduction to programming and database design concepts. Emphasis on problem-solving and information gathering techniques. The lecture will discuss general concepts and syntax. The lab will focus on the use of software, including a programming language, modifying and accessing data using visual tools, and building database applications using forms and development tools.

INFO-I 201 Mathematical Foundations of Informatics (4 cr.) P: MATH-M118 or higher An introduction to the suite of mathematical and logical tools used in information sciences, including finite mathematics, automata and computability theory, elementary probability and statistics, and basics of classical information theory. Cross listed with COGS-Q 250. Credit given for either INFO-I 201 or COGS-Q 250.

INFO-I 202 Social Informatics (3 cr.) Introduction to key social research perspectives and literatures on the use of information and communication technologies. Discusses current topics such as information ethics, relevant legal frameworks, popular and controversial uses of technology (e.g. peer-to-peer file sharing), digital divides, etc. Outlines research methodologies for social informatics.

INFO-I 210 Information Infrastructure I (4 cr.) The software architecture of information systems. Basic concepts of systems and applications programming.

INFO-I 211 Information Infrastructure II (4 cr.) P: INFO-I 210. The systems architecture of distributed applications. Advanced programming, including an introduction to the programming of graphical systems.

INFO-I 219 Software Bots for Cognitive Automation (3 cr.) P: None This course introduces the development of software bots for process and cognitive automation. Students learn how organizations adopt artificial intelligence and related technologies to process unstructured and uncurated data in various industries. The course also examines the disruptive effects of process and cognitive automation on social, economic, and global environments.

INFO-I 220 The Social Impact of Bots and Automation (3 cr.) P: None This course examines the disruptive effects of process automation on social, economic, and global environments and how organizations adopt artificial intelligence and other technologies to process unstructured and uncurated data. The course also introduces applications of cognitive automation with bots in various industries and their implications.

INFO-I 223 Data Fluency (3 cr.) Pervasive, vast, and growing describe data in today’s environment. This course introduces fundamental skills for extracting from data actionable knowledge. Students create, access, munge, analyze, and visualize data to draw inferences and make predictions. The course uses real datasets from a variety of disciplines including healthcare, business, and the humanities.

INFO-I 270 Introduction to Human-Computer Interaction Principles and Practices (3 cr.) Students learn the fundamental principles and practices of human-computer interaction (HCI) and evaluation. Specific focus is given to the introductory knowledge of HCI methods, tools, and techniques for designing and evaluating user interfaces through the use of low and high fidelity prototypes for the Web and software.

INFO-I 275 Introduction to Human-Computer Interaction Theory (3 cr.) Students will learn the fundamental theories of human-computer interaction (HCI) and user-centered design. This course is both a survey of HCI research and an introduction to the psychological, behavioral, and other social science knowledge and techniques relevant to the design of interactive and ubiquitous computing systems.

INFO-I 300 Human-Computer Interaction (3 cr.) The analysis of human factors and the design of computer application interfaces. A survey of current HCI designs with an eye toward what future technologies will allow. The course will emphasize learning HCI based on implementation and testing interfaces.

INFO-I 302 Human-Centered Research Methods in Informatics (3 cr.) P: INFO-I211 or instructor permission Course surveys a broad range of research methods employed in Informatics, exploring their meta-theoretical underpinnings and exemplifying their application to specific research questions. This course is intended for Informatics students who need a grounding in research methods.

INFO-I 303 Organizational Informatics (3 cr.) P: INFO-I202 Examines the various needs, uses, and consequences of information in organizational contexts. Topics include organizational types and characteristics, functional areas and business processes, information-based products and services, the use of and redefining role of information technology, the changing character of work life and organizational practices, sociotechnical structures, and the rise and transformation of information-based industries. Credit given for either INFO-I 303 or SPEA-V 369.

INFO-I 305 Introduction to Research in Informatics (3 cr.) P: PBHL-B 302 (or other approved statistics) This course presents a broad overview of research philosophy, designs and methods. Its focus is on social science research methods and the content is specifically tailored to reflect the rapidly emerging field of informatics. The course will include major methods that are the core of contemporary approaches to research in informatics.

INFO-I 308 Information Representation (3 cr.) This course covers information representation in computer systems. Topics include relational databases in the ER model; SQL commands; database design, implementation, and normalization; database triggers; backup, security, and other data management tasks; data extraction from JSON and XML and their use for transmitting objects between browser and server; and social and ethical issues. You cover basic principles of database development from conception to completion. Although you review different systems, the emphasis will be on MySQL databases, which will support your work in future information roles.

INFO-I 310 Multimedia Arts: History, Criticism and Technology (3 cr.) This course studies how the paradigm shift to a digital world will affect humanity. The course will consider the evolution of media arts and its underlying principles of communications. Students will study application development paradigms in current practice. Readings, lectures, class discussions, and research papers.

INFO-I 319 Cognitive Automation and Bots Development (3 cr.) P: INFO-I 220 This course covers how to develop robotic process automation and cognitive automation for various kinds of organizations. Students apply artificial intelligence and bot platforms and frameworks to automate organizational processes from end to end.

INFO-I 320 Distributed Systems and Collaborative Computing (3 cr.) P: CSCI 23000 or CIT 21500 or INFO-I210 An introductory treatment of distributed systems and programming. Topics range from the distributed and object models of computation to advanced concepts, such as remote method invocations, object brokers, object services, open systems, and future trends for distributed information systems.

INFO-I 330 Legal and Social Informatics of Security (3 cr.) This course will examine that set of ethical and legal problems most tightly bound to the issues of information control. The interaction and technology changes, but the core issues have remained: privacy; intellectual property; Internet law; concepts of jurisdiction; speech anonymity versus accountability; and ethical decision-making in the network environment.

INFO-I 340 Collaborative Human–AI Systems (3 cr.) This course introduces human–AI interaction design for systems that solve problems neither humans nor artificial intelligence could solve separately.Topics include interpretability, transparency, trust, and AI ethics. Student projects focus on developing applications where AI provides cognitive and perceptual augmentation to humans.

INFO-I 350 Foundations in Legal Informatics (3 cr.) This course examines the basic concepts of the design, evaluation and use of technology in the study and practice of law. The course provides an overview of the application of a variety of emerging informatics and new media technologies to the field of law. Will cover technology for law office management, legal research, litigation support, document management, imaging and animations, case management, and electronic court filing.

INFO-I 391 Internship in Informatics Professional Practice (1-3 cr.) P: Approval of the dean and completion of 100- and 200-level requirements in informatics. Students gain professional work experience in an industry or research organization setting, using skills and knowledge acquired in informatics course work. May be repeated for a maximum of three credit hours.

INFO-I 398 Project-Based Learning (1-3 cr.) This course engages students in faculty-vetted projects through job simulations created by industrial partners. Students develop applied knowledge and problem-solving skills in their major field to prepare for real-life roles in their future careers. They also write reflection essays on their projects

and incorporate these experiences into their professional resume.

INFO-I 399 Current Topics in Informatics (1-3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated twice with different topic.

INFO-I 400 Topics in Informatics (1-3 cr.) P: At least junior standing, or permission of instructor. Variable topic. Emphasis is on new developments and research in informatics. Can be repeated twice for credit when topics vary, subject to approval of the dean.

INFO-I 402 Informatics Project Management (3 cr.) P: Junior/Senior/Graduate This course will focus on project management in an Informatics setting. Students will become conversant in the tools and techniques of project management, such as project selection methods, work breakdown structures, network diagrams, critical path analysis, critical chain scheduling, cost estimates, earned value management, motivation theory and team building.

INFO-I 410 Electronic Discovery (3 cr.) This course will cover the legal, ethical, financial, logistical, procedural and technological considerations of electronic discovery and its implications for lawyers and their clients. It will highlight recently revised federal and state rules, new state and federal legislation and recent court cases that impact electronic discovery policies and processes. We will also consider electronic discovery from the point of view of a corporation that has to prepare for--and then respond to--requests for the production of digital evidence.

INFO-I 415 Introduction to Statistical Learning (3 cr.) This course applies statistical learning methods for data mining and inferential and predictive analytics to informatics-related fields. The course also covers techniques for exploring and visualizing data, assessing model accuracy, and weighing the merits of different methods for a given real-world application. This course is an essential toolset for transforming large, complex informatics datasets into actionable knowledge.

INFO-I 416 Cloud Computing for Data Science (3 cr.) P: INFO-B 211 OR CSCI-A 205 OR CSCI-C 200 OR CSCI 23000; Recommended: INFO-I 308 This course covers data science concepts, techniques, and tools to support big data analytics, including cloud computing, parallel algorithms, nonrelational databases, and high-level language support. The course applies the MapReduce programming model and virtual-machine utility computing environments to data-driven discovery and scalable data processing for scientific applications.

INFO-I 418 Deep Learning Neural Networks (3 cr.) P: INFO-B 210 OR CSCI-A 204 OR CSCI-C 200 OR CSCI 23000; Recommended: Statistics (ECON-E 270 or PBHL-B 280 or PBHL-B 300 or PBHL-B 301 or PBHL-B 302 or PSY-B 305 or SPEA-K 300 or STAT-I301 or STAT-I350) OR INFO-I 415
Deep learning has resurged with the availability of massive datasets and affordable computing, enabling new applications in computer vision and natural language processing. This course introduces convolutional, recurrent, and other neural network architectures for deep learning. Students design, implement, and train these models to solve real-world problems.

INFO-I 419 Enterprise Cognitive Automation (3 cr.) P: INFO-I220 This course covers the integration of cognitive automation in business process management systems. Students model organizational processes and integrate artificial intelligence (AI) to increase and monitor their efficiency and effectiveness.They also learn from cognitive automation use cases how enterprises manage processes across systems, applications, and data repositories.

INFO-I 421 Applications of Data Mining (3 cr.) P: INFO-I 223 and PBHL-B 302 (or other approved statistics) This course explores the use of data mining techniques in different settings, including business and scientific domains. The emphasis will be on using techniques, instead of developing new techniques or algorithms. Students will select, prepare, visualize, analyze, and present data that leads to the discovery of novel and usable information.

INFO-I 425 Applying Web Services in Information Systems (3 cr.) P: INFO-I211 or CSCI 24000 This course examines how cloud computing and service-oriented architecture contribute to solutions for Informatics problems in areas such as business, health care, and life sciences. Students will develop an understanding of why, when, and how organizations utilize Web services to manage data, as well as the skills to design, implement, and deploy Web services applications.

INFO-I 428 Web Mining (3 cr.) P: INFO-B 210 or CSCI-A 204 or CSCI 23000 or CSCI-C 200 This course covers concepts and methods used to search the web and other sources of unstructured text from a human-centered standpoint. These include document indexing, crawling, classification, and clustering; distance metrics; analyzing streaming data, such as social media; link analysis; and system evaluation.

INFO-I 433 Protocol Design and Analysis (3 cr.) Covers the fundamentals of computer security by looking at how things can go wrong, how people can abuse the system, and ways to make the system secure. Students will gain a basic overview of existing security problems and be introduced to methods for addressing such problems. Should be taken by anyone designing, selecting, or using applications in which security or privacy plays a role.

INFO-I 445 Competitive Intelligence for Informatics I (3 cr.) This course will focus on the basic principles, techniques and methods of competitive analysis, the types of competitive analysis systems and their applications, traditional and new sources of information about competitors and industries, the nature of business information and its lifecycle, the ethical issues of competitive analysis and the application of competitive intelligence to real-world scenarios.

INFO-I 453 Computer and Information Ethics (3 cr.) Ethical and professionalization issues that arise in the context of designing and using networked information technologies and information resources. Examines frameworks for making ethical decisions, emergent technologies and their ethical implications, information/computer professionalism. Topics include privacy,

intellectual property, cybercrime, games, social justice, and codes of professional ethics.

INFO-I 459 Media and Technology Entrepreneurship (3 cr.) Course covers legal and business aspects of starting a media or technology company, including selecting the business structure, financing and credit, drafting business plans, articles of incorporation, and bylaws, tax implications, marketing and public relations, shareholders and governance, bankruptcy, insurance, contracts, property, and working with attorneys, accountants, and insurance agents.

INFO-I 465 Informatics for Social Change (3 cr.) This course focuses on the theory and practice of service learning at IUPUI. Students will apply the knowledge of their expertise area in a service project for the local or global community. Projects will be completed through students' current and developing new media production, information technology, and client-based research skills.

INFO-I 467 Internet-of-Things Interface Design for Business Innovation (3 cr.) P: INFO-I270 or I275 or I300 Students employ human-machine interface design principles and practices as an innovation engine for Internet-of-things (IoT) ecosystems. Through design challenges, they develop and refine IoT interfaces and their business models, drawing on case studies and a review of the literature. Students acquire design-as-strategy skills through team-based, industry specific design projects.

INFO-I 470 Litigation Support Systems and Courtroom Presentations (3 cr.) Provide students with an opportunity to use specialized software that is available for organizing, managing, retrieving, and presenting documents and evidence in a legal matter. Students will gain hands-on experience with software tools and learn what is effective and allowable from a technical, legal and ethical standpoint.

INFO-I 480 Experience Design and Evaluation of Ubiquitous Computing (3 cr.) The course focuses on ubiquitous computing and related interface/system design, and user-experience issues. Applications include interactive systems which support natural/gesture/touch-based interactions on devices such as mobile, extra-small-and-large displays, and other non-traditional pervasive technologies. Projects include interaction and evaluative techniques: field observation, contextual inquiry, ethnography, survey/interviews, and cognitive walkthrough.

INFO-I 481 Experience Design and Evaluation of Access Technologies (3 cr.) This course is focused on access technologies and user experience design for users with disabilities. Through the course, students understand and apply accessible design techniques to create and evaluate assistive technologies and inclusive products.

INFO-I 481 Experience Design and Evaluation of Access Technologies (3 cr.) This course is focused on access technologies and user experience design for users with disabilities. Through the course, students understand and apply accessible design techniques to create and evaluate assistive technologies and inclusive products.

INFO-I 483 Conversational User Interfaces: Experience Design and Applications (3 cr.) This course introduces the fundamentals of user experience design for conversational computing. Students explore the cognitive, experiential, and social aspects of conversational user interaction through applied projects, labs, and discussions. Students also learn tools and methods for designing, prototyping, and testing conversational user experiences.

INFO-I 484 Professional Certification (1-6 cr.) This course prepares students to take a certification exam, earn an industry-specific credential, and enhance their career readiness. Faculty provide instruction, support, and practice while encouraging student learning and execution of critical-thinking skills and problem-solving needed in the rapidly evolving technology landscape.

INFO-I 490 Internship in Informatics Professional Practice (3-6 cr.) P: Approval of dean and completion of 100- and 200- level requirements in informatics. Students gain professional work experience in an industry or research organization setting, using skills and knowledge acquired in informatics course work.

INFO-I 491 Capstone Project Internship (3-6 cr.) P: Consent of instructor. Students culminate their course studies through practical application of concepts and practices working in industry. Course requires prior authorization and approval of internship through the Career Services Office. Required coursework is completed via Oncourse.

INFO-I 492 Senior Thesis (3 cr.) P: Consent of instructor. The senior student prepares and presents a thesis: a substantial, typically multi-chapter, paper based on a well-planned research or scholarly project, as determined by the student and a sponsoring faculty member.

INFO-I 493 Senior Thesis (3 cr.) P: Consent of instructor. The senior student prepares and presents a thesis: a substantial, typically multichapter paper based on a well-planned research or scholarly project, as determined by the student and a sponsoring faculty member.

INFO-I 494 Design and Development of an Information System (3 cr.) P: Consent of instructor. System design and development present both technical and managerial problems with which students will be familiar from their undergraduate course work. This course puts these lessons into practice as students work in teams to develop an information system. Examples of course projects include design and development of a database for a business or academic application, preparation and presentation of an interactive media performance or exhibit, or design and implementation of a simulated environment (virtual reality).

INFO-I 495 Design and Development of an Information System (3 cr.) P: Consent of instructor. System design and development present both technical and managerial problems with which students will be familiar from their undergraduate course work. This course puts these lessons into practice as students work in teams to develop an information system. Examples of course projects include design and development of a database for a business or academic application, preparation and presentation of an interactive media performance or exhibit, or design and implementation of a simulated environment (virtual reality).

INFO-I 496 Artificial Intelligence Professional Practice 1 (3 cr.) This course covers the development of a project proposal in artificial intelligence to meet business requirements using system analysis and design methods. Students identify a business problem that can be solved with AI, either independently or with an industrial partner; research the solution; and develop a plan for solving it.

INFO-I 497 Artificial Intelligence Professional Practice 2 (3 cr.) This course covers the implementation of a project in artificial intelligence to meet business requirements using system analysis and design methods. Students develop and deploy an AI solution to a business problem based on the plans and designs in their project proposal.

INFO-I 499 Readings and Research in Informatics (1-3 cr.) P: Consent of instructor and completion of 100- and 200- level requirements in informatics. Independent readings and research related to a topic of special interest to the student. Written report required.

NEWM-N 220 Media Applications I (3 cr.) P: NEWM-N 101 or INFO-I 101. Introduces concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use markup tags and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

NEWM-N 299 Directed Study (2 cr.) This course applies design and visualization information towards the development of a comprehensive portfolio and resume. The development of the portfolio and resume will provide students with a framework for display of personal growth and achievement. Students will develop a portfolio and resume to be used for future career opportunities.

NEWM-N 320 Media Applications II (3 cr.) P: NEWM-N 221. Introduces intermediate concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use information modeling, markup tags, and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

Library and Information Science
Masters Level Courses

LIS-S 501 Information Sources and Services (3 cr.) P: LIS-S 500, LIS-S 507
Course enables students to identify and evaluate a wide variety of information sources and services. It examines the nature of reference work, human information needs, and information literacy. It includes search principles and techniques in major information retrieval systems as well as web search engines. Provides practice experience in evaluation and use of bibliographic materials, reference interviewing, and search techniques, in finding answers to real-world questions reflecting the multidisciplinary and multicultural interests and characteristics of library users.

LIS-S 502 Acquisitions and Management of Knowledge and Information (3 cr.) P: LIS-S 500, LIS-S 507 Acquisitions and Management of Knowledge and Information, formerly known as Collection Development and Management, examines the principles and techniques that guide the development, management, and evaluation of library collections, and the selection of materials in various types of libraries. The course provides students with experience in the major phases involved in starting and developing collections of print and non-print materials: the formulation of collection development plans, the selection of materials in accordance with an institution's plan, and the evaluation of library collections. It enables students to recognize and respond to challenges and opportunities of special interest to collection developers: intellectual freedom, new information formats, copyright, and resource sharing.

LIS-S 503 Organization and Representation of Knowledge and Information (3 cr.) P: LIS-S 500, LIS-S 507 The representation and organization of information resources is a primary focus of the information profession. Organizational and representational structures such as classification schemes, indexes, and catalogs have been devised to provide access to information. The recent explosive growth in both the number and variety of information resources underscores the continuing need for application of effective methods of representation and organization. This course introduces students to various approaches to the understanding, organization, representation, and use of information. The goal is to identify criteria for evaluation and improvement of ways to organize and represent information for future retrieval in theory and in practice.

LIS-S 504 Cataloging (3 cr.) P: LIS-S 500, LIS-S503, LIS-S 507 This course will introduce the student to the practice of cataloging in any type of library. Students will learn how to create a bibliographic record and to edit and enhance existing records, primarily for print monographs. The course covers the basic functions of cataloging: resource descriptive, MARC tagging, subject analysis, authority work, and classification. Students begin by learning the International Cataloging Principles and LRM (Library Reference Model), which is what RDA is based on. RDA or Resource Description and Access is the international cataloging code that we follow to describe resources. Students will have extensive practice on recording and transcribing core RDA elements, and how they relate to LRM's user tasks. Then students will learn how those elements are encoded into MARC. Once we have the basics of resource description covered, we add the art of subject analysis and creating access points. Finally, students will learn about classification through the two most common schemes, DDC (Dewey Decimal System) and LCC (Library of Congress Classification). There will be a brief introduction to BIBFRAME, which utilizes Linked Data structure in bibliographic statements. Throughout the course, the student will learn the importance of developing good cataloger's judgment in bibliographic control.

LIS-S 505 Evaluation of Library Sources and Services (3 cr.) P: LIS-S 500, LIS-S 507 This course is designed to explore evaluation as a tool for the improvement of programs, services, and initiatives in information organizations. Evaluation is a process to explore the needs of users (and non-users) and examine how well information organizations support those needs. We evaluate information sources to help us make evidence-based decisions and take strategic approaches to program and service evaluation design, and we take a human-centered approach to service and program evaluation.

LIS-S 506 Introduction to Research (3 cr.) P: LIS-S 500, LIS-S 507 This course is to introduce you to the ways in which librarians use research methods and practices in their work. Librarians conduct their own research for publication and grant proposals but in equal measures, they support library users in pursuit of their own research as well as teach students how to conduct research, especially with regard to literature searching and scholarly communication. This course is intended to explore the many ways in which research influences the work of librarians and information professionals and hopefully inspire you to engage in research throughout your professional lives.

LIS-S 511 Database Design (3 cr.) P: LIS-S 500, LIS-S 507 Concerned with a comprehensive view of the processes involved in developing formal access to information from a user-centered point of view. Considers various database models (such as flat file, hierarchical, and relational), and hypertext (in terms of text, sound, numeric, image, and geographic data). Students will design and implement databases using several commercial database management systems.

LIS-S 517 Web Programming (3 cr.) P: LIS-S 500, LIS-S 507 Course covers the development of interactive web applications, focusing on server-side programming, including the implementation of web–database connections. Students build web interfaces that can retrieve and display data dynamically from a data source. You start with a simple review of HTML5 and CSS so that you are able to create responsive web design (RWD) for all work posted online. Special emphasis is given to accessible markup, especially in forms. Basic PHP is next introduced (variables, control structures, arrays, functions) to enable you to become acclimated to coding and programming. You finally learn to create a simple MySQL database that you can then access with a PHP script in order to output secure results online to a browser, either as a dynamic web page or as the result of a user search or interaction with your forms.

LIS-S 519 Evaluation of Information Systems (3 cr.) P: S401. Theoretical and practical exploration of the issues surrounding contemporary information systems. A specific focus will be on evaluating information systems from the user perspective. This evaluation approach will cut across disciplinary frameworks: behavioral, cognitive, and social sciences. The approach will also touch on multiple research methods: online surveys, sense-making, critical incident, and network analysis.

LIS-S 521 Humanities Information (3 cr.) P: LIS-S 500, LIS-S 507 Course provides an in-depth examination of information sources and services related to the humanities including performing arts, music, Line arts, literature, linguistics, philosophy, and religion. The course addresses information needs and behavior patterns of users seeking humanities information. Students will analyze and evaluate research dealing with information channels, research methods, and library service in their areas of professional interest (i.e., academic, public, school, or special library settings). Increasingly, library users expect instant, virtual access to materials. While this course includes both print sources such as reference and trade books and electronic sources including bibliographic databases, government and organization websites, audio and video materials, and eBooks; emphasis is placed on how technology and specifically social media can be used to connect with users with information and provide high-quality service.

LIS-S 522 Social Sciences Information (3 cr.) P: LIS-S 500, LIS-S 507 Course provides an in-depth examination of information sources and services related to the social sciences including anthropology, archaeology, cultural studies, economics, geography, history, political science, psychology and sociology. The course addresses information needs and behavior patterns of users seeking social science information. Students will analyze and evaluate research dealing with information channels, research methods, and library service in their areas of professional interest (i.e., academic, public, school, or special library settings). Increasingly, library users expect instant, virtual access to materials. While this course includes both print sources such as reference and trade books and electronic sources including bibliographic databases, government and organization websites, audio and video materials, and ebooks; emphasis is placed on how technology and specifically social media can be used to connect with users with information and provide high-quality service.

LIS-S 523 Science and Technology Information (3 cr.) P: LIS-S 500, LIS-S 507 course addresses information needs and behavior patterns of users seeking science and technology information. Students will analyze and evaluate research dealing with information channels, research methods, and library service in their areas of professional interest (i.e., academic, public, school, or special library settings). Increasingly, library users expect instant, virtual access to materials. While this course includes both print sources such as reference and trade books and electronic sources including bibliographic databases, government and organization websites, audio and video materials, and eBooks; emphasis is placed on how technology can be used to connect with users with information and provide high-quality service.

LIS-S 524 Adult Readers Advisory (3 cr.) P: LIS-S 500, LIS-S 507 Course is designed to teach students how to meet the popular reading needs of adult public library users. Genre fiction, literary fiction, and non-fiction titles along with readers' advisory resources and tools are explored. Readers' advisory services including the interview, book lists, and book discussion groups are examined. Relevant research, trends and issues related to readers' advisory are discussed.

LIS-S 525 Government Information (3 cr.) P: LIS-S 500, LIS-S 507 Survey of government information dissemination in all formats and at all levels of government. Consideration of government information policy. Primary emphasis given to U.S. government information but some consideration given to state and local publications in the United States, and those of international organizations.

LIS-S 526 Business Information (3 cr.) P: LIS-S 500, LIS-S 507 Course provides an in-depth examination of information sources and services related to business including accounting, administration, consumer needs, economics, entrepreneurship, ethics, and law, finance, labor relations, human resources, international trade, marketing, purchasing, and risk management. The course addresses information needs and behavior patterns of users seeking business information.

LIS-S 532 Information Architecture for the Web (3 cr.) P: LIS-S500, LIS-S507 Information architecture is focused on the practice of maximizing “findability,” or the ease with which users can find information on websites and in other digital interfaces (e.g., apps) according to their needs and expectations. While related to user experience and interface design, information architecture is distinct in that it focuses on the curation, organization, and placement of information; it also concerns the strategic deployment of waypoints, maps, and other tools to aid information seeking. Successful information architecture is supported by using quantitative and qualitative user research methods to better understand user-information interactions and expectations.

LIS-S 533 Online Searching (3 cr.) P: LIS-S 500, LIS-S 507 Principles, methods, and techniques of advanced online information retrieval (IR). Characteristics of and search strategies for the use of bibliographic, referral, citation, fact, numeric, and full text databases and search systems. Considers standards, use of communications software, front-ends and micro-based IR systems, and creation of in-house databases.

LIS-S 541 Information Policy (3 cr.) P: LIS-S 500, LIS-S 507 Information policy concerns the governance of contextual information flows and the systems on which they rely to effect specific ends in support of particular values. Given the power and privilege that can come from having access to information and the role information plays in shaping individual lives, it is necessary to justify information practices according to ethical frameworks.

LIS-S 550 Perspectives on Librarianship (3 cr.) Overview of the library as a social institution-historically, currently, and for the future-within social, economic, political, and cultural contexts. Focuses on the institution, the collections and formats, and the users to create an understanding of the role and importance of libraries. S550 provides excellent opportunities to help students explore the library profession.

LIS-S 551 Library Management (3 cr.) Management and administration of all types of libraries. Covers basics of organizational structure, planning, budget management, human resources issues and skills, and an understanding of the manager in the context of the organization.

LIS-S 552 Academic Library Management (3 cr.) P: LIS-S 500, LIS-S 507 Background and current trends in the management of academic libraries. Students will learn the academic context, organizational theory, management techniques, and information issues that concern academic librarians in collegial, supervisory, management, and leadership roles.

LIS-S 553 Public Library Management (3 cr.) P: LIS-S 500, LIS-S 507 Management and administration of public libraries, including specific material related to organization structure, planning, budget management, human resources issues and skills, and an understanding of the manager in the context of a community environment.

LIS-S 554 Library Systems (3 cr.) P: LIS-S 500, LIS-S 507 Explore the mechanics of the traditional ILS and become familiar with its modules through a series of hands-on exercises in global system configurations, circulation, cataloging, OPAC, serials, and acquisitions. You learn how to categorize your library’s collection and its users in order to create circulation rules that you will use to conduct library business.

LIS-S 557 Marketing for Libraries (3 cr.) P: LIS-S 500, LIS-S 507 Marketing is much more than creating attractive displays and updating your Facebook page, it’s about meeting the needs of individuals and groups. If library users aren’t aware of your resources and services they’re unlikely to visit your physical or virtual library. If they’ve had a bad experience in the past, they may be sharing this negativity with their friends and colleagues. Marketing is about understanding the needs and interests of current and potential users, reaching those individuals with quality resources and services, and evaluating the experience so adjustments can be made to increase effectiveness, efficiency, and appeal.

LIS-S 571 Materials for Youth (3 cr.) P: LIS-S 500, LIS-S 507 Course focuses on the evaluation and use of materials for youth including books, magazines, and media. It will expand your thinking about the role of materials in shaping today’s youth. Although the course is on-line with web-based readings, resources, and discussions, you must also have access to picture books and novels for youth.

LIS-S 572 Youth Services (3 cr.) P: LIS-S 500, LIS-S 507 The history, philosophies and descriptions of children’s and young adult library services and programs are presented, examined, and discussed. The class will provide a holistic look at the role of the youth services including (but not limited to): assessing needs based on developmental characteristics and societal trends, evaluation, planning specific service and programs and examining both the current status and future of youth services. The focus will be on children (from birth through age eight), tween (age eight to fourteen) and young adults (from ages fourteen to eighteen), as well adults who are caretakers (parents, teachers, social workers, daycare and Early Childhood Centers. etc.) Services include programming, reference/information services, readers’ advisory and educational services. The use and availability of computers, devices, and technological access (reference, educational games, and literacy) will be included. Though emphasis is on the public library, collaboration with school library media centers and other appropriate agencies (social services, health care, formal and informal educational agencies) through advocacy, networking and providing services are included.

LIS-S 573 Education of Information Users (3 cr.) P: LIS-S 500, LIS-S 507
Introduces students to the roles of librarians in adult education in university and college libraries and in public libraries. The course explores information literacy, library instructional models, education and training theories, and practical approaches for optimizing learning opportunities in library-based settings. Information literacy standards from the Association of College and Research Libraries (ACRL) and others are explored and applied to instructional design and practice. S573 also introduces students to outcomes-based planning and evaluation, a process for planning library-based educational programs with outcomes, or specific learning objectives in-mind.

LIS-S 574 Information Instruction (3 cr.) P: LIS-S 500, LIS-S 507 Provides a comprehensive examination of the systematic design of instruction including the

design, development, dissemination, and evaluation of instructional programs in library and information settings. The course places emphasis on information instruction; focuses on theory and practice related to teaching and learning; and stresses the use of technology in materials development and dissemination across all library and information settings.

LIS-S 575 Public Library Services (3 cr.) P: LIS-S 500, LIS-S 501, LIS-S 507 Course will cover the broad range of cultural, educational, and social library services and programming initiatives available for children, adolescents, and adults in public libraries, it will also provide a realistic look at the role of the public services librarian including (but not limited to): assessing needs based on community trends, evaluation of services and programs, planning and implementing specific services and programs, and examining both the current status and future of public libraries. It will also include information on programming, reference/information services, safety, readers' advisory, advocacy, customer service, and educational services such as outreach and community services.

LIS-S 580 History of Libraries (3 cr.) P: LIS-S 500, LIS-S 507 Course traces the development and evolution of libraries from the ancient world to the modern, with an emphasis on the macrocultural forces shaping libraries within each specific tradition. Library traditions in both Eastern and Western cultures are explored.

LIS-S 581 Archives and Records Management (3 cr.) P: LIS-S 500, LIS-S 507 Introduces basic theories, methods, and significant problems in archives and records management. The course also discusses how archivists are responding to the challenge of managing and preserving electronic records.

LIS-S 582 Digital Preservation (3 cr.) P: LIS-S 500, LIS-S 507 and LIS-S 503 or LIS-S 581 Course introduces approaches for preserving and ensuring long-term access to and reuse of digitized and born-digital information (text, images, data, and audiovisual information). Topics include the promise and challenges of long-term digital preservation and curation; longevity of digital media; integrity and authenticity of digital materials; selection for preservation; formats and strategies for preservation; preservation metadata; risk management; information technologies that are relevant to the digital curation lifecycle; and establishment of trustworthy digital repositories.

LIS-S 591 Grant Writing (3 cr.) P: LIS-S 500, LIS-S 507 Note: School Library Certification students may bypass S500 and S507. Students will work independently and in collaboration with course peers to prepare a grant funding proposal for a library/school library media center or non-profit organization, including organizational fact sheet, needs assessment, demographics, and problem statement; project design and development; logic model; budget; staffing; timeline; and evaluation plan. S591 is an introduction to the craft of writing a successful grant application developed via a real-world grant template and outcomes-based planning. Through a combination of individual exercises and peer review in groups, you will discover the importance of grant writing to the success of a library, school media center, or other. You will learn how skills in grant writing may be valuable to your own professional success.

LIS-S 601 Directed Readings (1-4 cr.) P: Consent of instructor. Readings and study in any area of library or information science having an extensive literature. A student may enroll for this course twice in the same semester under different instructors. Normally S601 is completed under the direction of a full-time faculty member. Readings done under S601 shall not duplicate the content of any course now in the curriculum of the School of Library and Information Science. Proposal Form due by March 15th.

LIS-S 602 Directed Research (1-3 cr.) P: Proposal form and consent of instructor and 15 SLIS graduate credit hours completed including S505 or S506. Individual research in a problem in the field of library and information science.

LIS-S 603 Workshop in Library and Information Science (1-3 cr.) P: LIS-S 500, LIS-S 507 (Note: School Library Certification students may bypass S500 and S507) Group study of specific problems in the library and information field. Generally includes a hands-on element. No more than 6 hours of S603 credit may be used toward the requirements for any LIS degree.

LIS-S 604 Topics in Library and Information Science (1-4 cr.) P: LIS-S 500, LIS-S 507 Study of specific topics in librarianship and preservation. May be repeated for credit when topic varies. Same course number used for different courses.

LIS-S 605 Internship in Library and Information Science (2-6 cr.) P: LIS-S 500, LIS-S 507 Graded S/F. Supervised internship in an information management environment. Professionals in library and information management mentor each graduate student. Sixty on-site hours must be completed for each credit earned. Students document their experiences through journals, abstracts of related publications, and a final presentation. Normally, at least 18 credits must be completed before enrollment.

LIS-S 606 Project in Library and Information Science (3 cr.) P: LIS-S 500, LIS-S 507 An independent project for a community client enables the student to apply at a professional level skills and knowledge garnered from the MLS program. Projects are situated in the community and benefit a particular organization and population. Students independently design a project and complete a literature review, executing the project in collaboration with a community partner (client) and under the supervision of a faculty advisor. Variable credit from 1–3: Approximately 30–45 hours of effort per credit over a term or semester.

LIS-S 621 Audio and Video Sources (3 cr.) P: LIS-S 500, LIS-S 507 Course provides a user-focused approach to decision making in the digital audio and video information environment. It emphasizes collection development in support of user services, including access to remote collections and evaluation of multimedia materials and delivery mechanisms as well as issues related to emerging technologies. The scope includes adult and young adult audiences. S621 will expand your thinking about the integral role of audio and video resources in a comprehensive school, academic, public library and/or special library setting. The course will include a combination of web-based readings and resources, threaded discussions, plus online presentations containing text, audio, and video. Choices allow graduate

students with varied backgrounds and interests to select activities that meet their unique professional needs.

LIS-S 622 Resources and Services for People with Disabilities (3 cr.) P: LIS-S 500, LIS-S 507 Access to information is essential for sustained independence of people with disabilities. This course studies materials, services, and assistive technologies to support this access. National and state initiatives related to people with disabilities increasingly stress maximization of their independence, whether in school, employment, or daily living environments. This course will focus on access to information as a critical element to sustained independence. Topics covered will include specific materials, services, and assistive technologies available to meet the needs of various types of disabilities.

LIS-S 623 Genealogy and Local History (3 cr.) P: LIS-S 500, LIS-S 507 This course is designed to focus on genealogy and local history resources, including print, non-print, visual, electronic, archival, newsprint and digital media and issues related to maintaining genealogy and local history collections.

LIS-S 631 Advanced Cataloging (3 cr.) P: LIS-S 500, LIS-S 503, LIS-S 504, LIS-S 507 Course will take the principles of bibliographic description, subject analysis, and classification learned in S504 and apply them to the cataloging of a wide variety of materials and resources found in libraries. You will apply RDA instructions to the description of serials, audiovisual materials (video, sound, maps), three-dimensional artifacts and realia. We will explore how online resources, including media, can be represented in library bibliographic records for patron access. You will investigate how library data might be utilized soon as Linked Data, accessible through the Semantic Web. BIBFRAME, as the successor to MARC encoding, will studied as well.

LIS-S 632 Advanced Resource Management (3 cr.) P: LIS-S 500, LIS-S 502, LIS-S 507 C: S553, S551, S552 or consent of instructor Course provides a practical foundation in the essential concepts, processes, and technologies driving electronic resource management in libraries. Electronic resources management encompasses the selection, acquisition, licensing, accessibility, linking, branding, evaluation, cost control, and preservation of licensed electronic resource. Topics covered include scholarly publishing, open access, library# vendor relations, information standards, contract law, copyright, linking and aggregation technologies, and the management systems used to control the administrative metadata for electronic resources. Course content will be of interest to all technical services staff who collect, manage, maintain, or make accessible electronic resources in any information environment.

LIS-S 634 Metadata (3 cr.) P: LIS-S 500, LIS-S S503, LIS-S 507 Metadata is essential in designing and developing effective knowledge systems; it facilitates resource discovery, database documentation, and recording digital documents' textual and conceptual histories. This course introduces principles supporting the development and implementation of metadata schemes, focusing on issues of interoperability, internal and external standardization, and evaluation.

LIS-S 640 Seminar in Intellectual Freedom (3 cr.) P: LIS-S 500, LIS-S 507. Note: School Library Certificate students may bypass all prerequisites. Intellectual freedom concerns information philosophy, ethics, and discussion of timely sociotechnical issues associated with freedom. Your primary concern is the ability of humans to participate in intellectual activities to seek and use information. From some angles, your concern will be information seeking and use without intrusion and influence. From other angles, you will examine justifiable reasons where such actions should be limited. While not always the case, intellectual freedom naturally concerns end products from intellectual activities, such as speech acts (e.g., literal speech, writing, art, other creative endeavors). You will as a result examine social, technological, and political structures that interact with one's intellectual freedom. Topics addressed will reflect timely issues and, therefore, change from semester to semester. Topics may not center directly on issues of librarianship, but students have significant flexibility to address intellectual freedom concerns that are of professional interest to them.

LIS-S 641 Computer-Mediated Discourse Analysis (3 cr.) P: or Concurrent S401. Computer-mediated discourse analysis (CMDA), applies theories from linguistic discourse analysis, pragmatics, ethnomethodology, and semiotics in the analysis of discourse -language and language use – in computer-mediated communication. This course provides hands-on experience in applying empirical analytical methods, and in interpreting the results. (This is offered in Bloomington only.)

LIS-S 642 Content Analysis for the Web (3 cr.) P: or Concurrent S401. Application of Content Analysis methods to web documents, interactivity features, and links.

LIS-S 650 Library Philanthropy (3 cr.) Introduces the role of private giving in support of libraries. Examines personal and corporate philanthropy and their applicability in libraries and information centers.

LIS-S 653 Health Science Librarianship (3 cr.) P: S501or consent of instructor;
Explores the roles of health sciences libraries, librarianship and informationists in academia and hospital libraries, health information technology and information services environments, and in research and administrative teams. This course provides an introduction to the healthcare industry, health sciences schools and education (medicine, nursing, dentistry, public health, pharmacy, allied health and others), and the culture of healthcare in the United States. Student gain extensive experience with popular reference resources, and searching MEDLINE, PubMed, and speciality bibliographic databases in the health sciences. Students will increase their understanding of librarian and informationist roles in information literacy education, evidence based practice, health literacy, and other issues

LIS-S 654 Law Librarianship (3 cr.) P: LIS-S 500, LIS-S 507 Course provides an introduction to major categories of legal materials: secondary sources, cases, statutes, regulations and administrative materials, and international treaties. Students will learn to analyze research problems to identify appropriate materials, find those materials, and evaluate them for relevance, authority, and currency. Students will also develop a collection development

recommendation and produce a legal research guide for a self-selected targeted patron group. Students will also learn about how to apply legal skills to all forms of librarianship, with a focus on law librarianship in law schools, law firms, and court/public law libraries

LIS-S 656 Scholarly Communication (3 cr.) P: LIS-S 500, LIS-S 507 Course examines scholarly communication systems for the creation, dissemination, and evaluation of scholarly information. It introduces the role of digital technology in the transformation of information, especially from the view of librarianship. Topics include scholarly publishing, peer review, and the open access movement, including achievements, challenges, and current trends.

LIS-S 671 School Library Management (3 cr.) P: LIS-S 500, LIS-S 502, LIS-S 507 (Note: School Library Certificate students may bypass all prerequisites.) Establishes the professional teaching and administrative role of the certified school library media specialist in K-12 settings. Situations are examined that pertain specifically to policy development, budgeting, collection development, instructional design, support staff training, facility design, district supervision, and information networking within the modern school corporation. Students make site visits to leading school information centers, conferences, and media fairs.

LIS-S 672 Seminar on Literature for Youth (3 cr.) P: LIS-S 500, LIS-S 501, LIS-S 507, and LIS-S 571 These advanced topical seminars address a variety of topics related to youth literature. View individual course descriptions below for specific course focus. Students may take S672 twice during their program as long as they take two different seminar topics.

LIS-S 681 The Book 1450 to the Present (3 cr.) P: LIS-S 500, LIS-S 507 A survey of the book from 1450 to the present, with emphasis on the development of the book in the West. Focuses on the physical aspects of the book from the mid-fifteenth through the twentieth centuries, and on some of the many roles of the book in society during this period; also increases awareness of current scholarly trends in the history of the book.

LIS-S 683 Reference Sources for Rare Books (3 cr.) P: or Concurrent S401. Introduces and evaluates reference sources that are useful in working with rare books an many fields.

LIS-S 685 Electronic Records Management (3 cr.) P: LIS-S 500, LIS-S 507 Addresses the major issues and challenges facing the archival/records management professions in their quest to manage electronic records. Students will study and evaluate the impact automation has had on archival theory and practice, analyzing various models and strategies archivists have developed to manage electronic records.

LIS-S 500 Methods and Tools for the Information Profession (3 cr.) Course covers tools for office productivity, presentation, analysis, database administration, and website creation and systems for collaboration and cloud computing. Students learn principles and concepts for organization and classification; develop information retrieval strategies; determine resources for information professionals; identify accessibility needs; evaluate collections, facilities, and services; and conduct preparatory work for research.

LIS-S 651 Digital Collections (3 cr.) P: LIS-S 500, LIS-S 507. Also, either S584 or S634 is required as a prerequisite. Course engages advanced students in designing and developing digital collections in real-world library and information settings. Students create digital objects and use industry-standard digital content management systems to build and test their collections for usability, findability, and accessibility. Library and information science professionals design and develop digital collections to meet the varied needs of their stakeholders and users. Along the way, collection managers must collaborate with individuals, communities, government agencies, corporations and other entities to ensure these collections meet the needs of users by being easy to access and use. This course explores both the theory and practice of digital collections in academic/research, government, public, and community settings. The course will include both born digital and digitized objects and topics will include planning and funding, the digitization process, digital archiving, digital preservation, curation, and sustainability.

LIS-S 555 Digital Services Management (3 cr.) P: LIS-S500 and LIS-S501 This course explores the theory and practice of digital services management including collaboration, financial and human resources management, leadership, organizational and change theories, project and time management, strategic planning, and values and ethics. Students synthesize principles related to collection development, communications, intellectual property, security, space, technology, data, and digital services, and user services.

LIS-S 583 Data Curation and Management (3 cr.) P: LIS-S 500, LIS-S 507; one of any S503, S584, or S634 This course introduces the active curation and management of data throughout its lifecycle to enhance its value for scholarship, science, education, industry, and other stakeholders. Students explore data activities, such as access policies and implementation, data reuse, data design through content-creator management, data entry into databases or repositories, and metadata creation.

LIS-S 585 Archival Appraisal and Management (3 cr.) P: LIS-S 500, LIS-S 507, LIS-S S581 This course explores the archivist's first and arguably most important responsibility: appraisal. Students explore the theories, techniques, and methods that archivists use to identify documents and other materials of enduring value for long-term preservation, access, and use.

LIS-S 507 Tools and Technologies for the Information Professions (3 cr.) P: S500 This course examines tools used in the information professions. Students engage with productivity, presentation, and technology-based information analysis; principles of data storage and manipulation; basics of data visualization; metadata standards; information organization concepts; web-design strategies for findability and accessibility; and processes for managing digital assets in a myriad of environments.

LIS-S 530 Makerspaces as Learning Environments (3 cr.) P: LIS-S500, LIS-S507 The Maker Movement is increasingly drawing excitement from libraries as it provides resources (i.e., making toolkits, fabrication tools) and facilitation (i.e., mentors, peers, experts) that promote

inquiry-driven learning and community engagement. This course surveys the historical roots of makerspace and the current landscape of digital and physical making toolkits with hands-on experience to consider how the practices of the maker movement can be implemented in your personal or professional information institution. This class is designed to serve as an introduction to the ethos and the culture of the maker movement with the hope that you may be motivated to continue the design and development of maker programming in your own field.

LIS-S 531 Information Structures for the Web (3 cr.) P: LIS-S 500, LIS-S 507 his course covers HTML5, CSS3, and responsive web design to meet the needs of any viewport. This course emphasizes the development of basic skills that will allow you to create webpages and to combine these pages into functional websites. After several weeks of working on your technical skills, you will be making valid, accessible, and usable websites that are viewable on all devices. This course requires that you develop a proficiency in both technical skills as well as conceptual skills. The future of information delivery is through a screen of some sort, whether it be a desktop monitor, a tablet, a smartphone, or any other device. You need to know how the users receive that information and what must be done to accommodate them. You may never enter a career where you actually create websites, but if you plan to be an information professional of any type you will certainly assist in developing, judging, acquiring, accepting, promoting, and rejecting information delivered by a web-enabled device of some sort. Learning and employing this technology will be situated in group work done collaboratively at a distance across time zones and cultures.

LIS-S 577 Designing for Informal Learning Environments (3 cr.) P: LIS-S500, LIS-S507 Students conceptualize what learning is, analyze how learning happens outside of school, and prepare students to intentionally design and facilitate different types of learning within information institution settings. In this course, students extend beyond what they know about outcome-based learning frameworks that are often used in formal learning settings (i.e., schools) to apply diverse theories and methods of learning used in informal learning settings. As a culminating project, this course requires students to design informal learning experience (i.e., library programming, field trip, in-class activity) and facilitate them with real human subjects and analyze their own facilitation through interaction analysis.

LIS-S 577 Facilitating Learning with Technology (3 cr.) P: LIS S-500 and LIS-S 507, or instructor's approval Course provides a series of opportunities for students to evaluate how emerging technologies support or hinder learning for different learner groups through readings, case studies, and hands-on experience with emerging technologies. In this process, students gather design principles based on best practices and research-informed findings that they have explored. As a culminating project, students apply the design principles to design their technology-infused learning environments for a target learner group which will be analyzed and revised.

LIS-S 584 Archival Arrangement and Description (3 cr.) P: LIS-S 500, LIS-S 507, and LIS-S 581 Course explores the theories, terms, concepts, principles and methods of arrangement and description of documents and materials in archives. Students will be introduced to the principles of archival description as expressed in Describing Archives: A Content Standard (DACS) and implementation of those principles through Encoded Archival Description (EAD) and MARC structures. Other topics will include the nature of archival aggregations; the principles of provenance, respect des fonds and original order; the history and development of archival description; issues and technologies related to current archival descriptive standards; authority and subject analysis work in archival description; and an introduction to Encoded Archival ContextCorporate Bodies, Persons, and Families (EAC-CPF).

LIS-S 584 Archival Arrangement and Description (3 cr.) P: LIS-S 500, LIS-S 507 and LIS-S 503 or LIS-S 581
This course explores the concepts, theories, and methods of arrangement and description of documents and materials in archives. Students are introduced to the principles of archival description and their implementation through encoded archival description (EAD) and machine-readable cataloging (MARC) structures.

LIS-S 586 Archival Intelligence (3 cr.) P: LIS-S 500, LIS-S 507, LIS-S 581 Course examines various aspects of archival intelligence including understanding types of archives and the collections found in them, understanding how archives are organized and accessed, and developing a research question and implementing original primary source research. In order to conduct research with primary sources users need a set of skills including subject knowledge, artifactual literacy, and archival intelligence.

LIS-S 586 Thesis/Project in Library and Information Science (1-6 cr.) Students prepare and present a master’s thesis or project in library and information science. The product is substantial, typically a multichapter paper, or a carefully designed and evaluated application, based on well-planned research or a scholarly project. The design and execution are worked out between the student and faculty advisor.

LIS-S 686 Electronic Records Management (3 cr.) P: LIS-S 500, LIS-S 507 Course addresses major challenges facing the archival and records management professions in their quest to manage electronic records. Students study and evaluate the impact of automation on archival theory and practice, analyzing various models and strategies archivists have developed to manage electronic records. Topics include general examination of the document life cycle of organizational records: generation and control; information storage and retrieval systems; protection and disposition; retention regulations and practices.

LIS-S 576 Multicultural Services (3 cr.) P: LIS-S 500, LIS-S 507 Course provides a framework for developing responsive and relevant library services for diverse populations. Students examine community data, explore organizational and professional values, and learn the theory and practice of developing culturally aware and community-centered policies, collections and programs in different library and information environments.

Undergraduate Courses

LIS-S 201 Foundations of Data Studies (3 cr.) This class introduces digital literacies, focusing on data and information literacy in the media, civic engagement, business, informatics, and data science. Students explore the production of data, their roles as data creators and consumers, and the effects of data practices on society. Students apply their acquired skills in real-world situations.This course emphasizes the value of data in society and provides students the opportunity to learn basic data concepts and skills. Students will gain an understanding of key factors for data studies including data sources, data ethics, data policy, data evaluation, data manipulation, and data visualization. Additionally, students will gain valuable hands-on experience working with data.

LIS-S 202 Data Organization and Representation (3 cr.) Course introduces approaches for organizing and representing data and information resources. Students learn the principles of data organization, documentation, description, and classification devised to provide access to these resources and methods to evaluate and improve them for future retrieval and reuse.

LIS-S 222 Social Science Information (3 cr.) An introduction to information sources and services for the social sciences including anthropology, archaeology, cultural studies, economics, geography, history, political science, psychology, and sociology.

LIS-S 223 Genealogy and Local History Resources (3 cr.) Course introduces information tools for family and community history with an emphasis on U.S. genealogical tools, including census and military records. It covers city, county, and state historical resources.

LIS-S 281 Introduction to Archives (3 cr.) Course introduces and compares the various types of archival repositories. The concepts and techniques used to organize, preserve, and make accessible historical materials in various formats are also covered. Students learn technologies to preserve, interconnect, and analyze archival material.

LIS-S 282 Digital Preservation (3 cr.) Course introduces approaches for preserving digitized and born-digital information (text, images, and audiovisual information) for access andreuse. Topics include curation lifecycle for long-term preservation; longevity of digital media; integrity and authenticity of digital materials;formats and technologies for preservation; and establishment of trustworthydigital repositories.

LIS-S 303 Information Organization (3 cr.) Introduction to general and disciplinary approaches to the organization and representation (summarizing) of information, including information science, cognitive psychology, semiotics, and artificial intelligence perspectives. Information systems currently used in digital and physical libraries, databases, and repositories will be studied as examples. Students will identify criteria for improving future retrieval methods.

LIS-S 321 Humanities Information (3 cr.) An introduction to information sources and services in the humanities with emphasis on the disciplines of performing arts, music, fine arts, literature, linguistics, philosophy, and religion. In addition, the course addresses information needs and behavior patterns of users seeking these types of information.

LIS-S 352 Digital Libraries (3 cr.) Course covers the theory and practice of networked information repositories that provide users access to multimedia data in academic and community settings. Topics include collection definition; digitization processes, archiving, and preservation; metadata, ontologies, classification, and description; accessibility, user behavior, and interaction; management and evaluation; and legal and social issues.

LIS-S 402 Data Preservation (3 cr.) P: Recommended to take LIS-S 305 as prerequisites Course surveys the fundamental principles of data preservation. Students will explore newly developed tools and techniques for long-term data preservation strategies. Topics include selecting file formats and storage media, technical obsolescence, digital forensics, acceptable risk/loss, preservation metadata, data repositories, and preservation policy for long-term access and reuse.

LIS-S 302 Data and Society (3 cr.) Course reviews big and small data practices in research, education, business, government, and nonprofits, while critically examining the role of data in society. Using case studies, students will address ethical questions related to fairness, discrimination, power, and privilege. Topics include machine learning, black-box algorithms, wearable technology, data justice, and data activism, among others.

LIS-S 304 Social Media Data (3 cr.) Social media creates enormous troves of user data capturing behaviors, interests, and relationships. Social media thus holds significant value for research, business, and politics. This course examines the production of social media data, how industry and academics use this data, and the tools and techniques for analyzing it.

LIS-S 305 Data Curation and Management (3 cr.) Course introduces concepts of data curation and management with applications. This course understands data curation as an active and ongoing management of data through its lifecycle, and adding values to the data in a way to be useful to scholarship, science, education, and any other relevant stakeholders (e.g., business, industry). Students explore the characteristics of data and data-curation lifecycle activities, such as the design of data through content-creator management; metadata creation; entry into a database system or a repository; access policies and implementation; and data reuse.

LIS-S 404 Surveillance Studies (3 cr.) Data-driven surveillance can breach values, target individuals and disenfranchised groups, and infringe expected rights. This course critically analyzes surveillance practices, their benefits and harms, and considers contextual norms, policies, and laws. Topics include user monitoring on social networking sites, healthcare and personalized medicine, and mass surveillance for national security.

LIS-S 405 Data Archives (3 cr.) This course surveys the fundamental principles and practices of archival and record management within the context of data archives. Students explore newly developed tools and techniques specific to data archives. Topics include archive sources, archivaldescription, archival management software,

digitization and born-digital archives, and standards and policies.

LIS-S 406 Scientific Data (3 cr.) This course reviews data practices in the sciences from the perspectives of multiple scientific domains. Topics include data sources, management, lifecycles, description, organization, workflows, repositories, and analytical tools for the sciences. Additionally, students explore newly developing technologies and analytical practices including data visualization and big data methods.

LIS-S 408 Business Data (3 cr.) This course reviews data practices in business environments. Students examine business data resources including company, financial, and marketing research data. Students explore data management, analytical practices, and newly developed technologies. Topics include business data and metadata, data governance and policy, data-driven marketing, visualization, and analytics.

LIS-S 408 Business Data (3 cr.) Course reviews data practices in business environments. Students examine business data resources including company, financial, and marketing research data. Students explore data management, analytical practices, and newly developed technologies. Topics include business data and metadata, data governance and policy, data-driven marketing, visualization, and analytics.

LIS-S 301 Data Policy and Governance (3 cr.) This course surveys data and information ethics and policy, justifying data practices per ethical frameworks. Students examine data-policy concerns governing contextual data flows and the systems on which they rely. Students distinguish the results of data policies and the manner they are used to support particular values.

LIS-S 400 Topics in Applied Data and Information Science (3 cr.) This course covers specific topics in applied data and information science. It may be repeated for credit when the topic varies. The same course number is used for different courses.

LIS-S 407 Social Science Data (3 cr.) This course reviews data practices in the social sciences. Students examine data sources, management, and analytical tools for the social sciences. Additionally, students explore newly developing technologies and analytical practices, including data visualization and big data methods for the social sciences, and ethical and policy considerations.

LIS-S 408 Business Data (3 cr.) This course reviews data practices in business environments. Students examine business data resources including company, financial, and marketing research data. Students explore data management, analytical practices, and newly developed technologies. Topics include business data and metadata, data governance and policy, data-driven marketing, visualization, and analytics.

Media Arts and Science

Media Arts and Science

NEWM-N 500 Principles of Multimedia Technology (3 cr.) This course examines issues related to digital media communication in the context of e-commerce and the information industry, especially its impact on the cultural, economic, social, and ethical dimensions of local and global communities. Topics also include: usability, intellectual property, and a diversity of user markets for new media products.

NEWM-N 501 Foundations of Digital Arts Production (3 cr.) This course examines the production process and management of digital multimedia. Students investigate and produce projects by researching foundations in the use of digital video with special emphasis on production process of storytelling. Skills learned will include: project development and video production. Students will develop presentation skills through research papers.

NEWM-N 502 Digital Media Motion and Simulation Methods (3 cr.) Applications in animation/ simulation design and creation using computer desktop tools. Examines the fundamentals of three-dimensional animation through storyboards and planning, modeling, texturing, lighting, rendering, and composite techniques. Topics will include nurbs design development, texture mapping for realism and stylistic output, keyframe and path animation, and cinematography lighting techniques. Skills will be developed through design and modeling of individual or team multidisciplinary projects.

NEWM-N 503 Digital Media Application Design Processes (3 cr.) Presents the principles and fundamentals of design techniques using authoring tools on PC, Macintosh, and emerging computer platforms. Included are storyboarding, planning and organization of scripts, use of current technology, computers, video and digital arts equipment; computer-assisted design and project planner software tools and management of design team concepts.

NEWM-N 504 Advanced Interactive Design Applications (3 cr.) Incorporates extensive analysis and use of computer and multimedia authoring tools intended for character simulation design. The course will study the concepts of physics-based bipedal movement in relation to gravity, balance, anticipation, potential energy, personality constructs, and locomotion. Assessment modeling for character depiction and animation will be planned and storyboarded. Other topics include more advanced facets of computer animation including paint tube modeling, layered texture mapping, and track and block animation for cyclical actions.

NEWM-N 506 Media Arts Project or Thesis (1-6 cr.) Students prepare a thesis or project that includes supporting documentation, as well as a final public defense. In either case, students are required to prepare a proposal that is approved by their advisor or committee chair before beginning their research.

NEWM-N 507 Digital Media for Healthcare (3 cr.) Course examines how healthcare systems employ digital media for marketing, education, communication, and ecommerce. Students research digital media usage in the healthcare industry and work in teams to design and execute an empirical research project culminating in a publication or online interface with digital media elements.

NEWM-N 510 Web Database Concepts (3 cr.) Addresses diverse issues arising when designing World Wide Web interface. Basic database concepts will be presented but the course will focus on discussion of interface issues specific to Web databases, technologies for linking databases to Web servers for delivery,

discussion of various Web-database applications, case studies, and industry trends.

NEWM-N 512 Trends in Media, Informatics and Communications (3 cr.) This seminar course challenges students to define their career paths through the ever-evolving world of media, information and communication technologies. Through class dialogue and independent research, students define and answer in writing their own fundamental questions about how their chosen career path will fulfill personal and societal goals.

NEWM-N 515 Documenting Cultural Heritage: Artifacts and Traditions (3 cr.) This service-learning course engages students in projects on the research and digital documentation of cultural heritage sites and traditions. Students develop content and produce digital media including 3D models and animations, videos, and photographs. Students gain a better understanding of other societies and cultures through this international experience.

NEWM-N 516 Online Video Presentation (3 cr.) Course explores multiple aspects of online video presentation. Students learn how to encode, web-author, and deliver on-demand videos to computers and hand-held devices. Topics include the video delivery process, theories, database support, technologies, technological development, and business models.

NEWM-N 534 Serious Games and Simulations (3 cr.) This course examines the use of serious games, simulations, and virtual worlds in education, healthcare, health education, and the military. Students research and deconstruct successful serious games and simulations and design, implement, and evaluate their own serious game or simulation, devising its learning outcomes and evaluation metrics.

NEWM-N 537 Virtual Worlds Design and Development (3 cr.) Students research factors influencing the design and implementation of online virtual worlds. They use their design knowledge and technical skills to create several small virtual world prototypes to explore potential uses of virtual worlds and effects of networked interaction on their inhabitants.

NEWM-N 540 3D Compositing and Visual Effects (3 cr.) Course covers Hollywood 3D compositing and visual effects production, integrating film footage, 3D modeling, texturing, lighting, camera techniques and matchmoving, compositing, filter layering, color correction, projection mapping, video effects, and green screen. Students research, design, and build environments and create believable, cohesive production shots.

NEWM-N 542 Advanced 3D Character Animation (3 cr.) Course covers the theory and practice of 3D character animation, including development, reference, and acting. It applies advanced rigging principles to animations in industry pipelines for film and computer games. Topics include story development, facial and body dynamics, and motion capture. Students create animations and perform a literature review and peer critique.

NEWM-N 548 3D Prototyping for Medical and Dental Applications (3 cr.) This course covers advanced modeling, sculpting, articulation, and printing of 3D objects for applications in medicine and dentistry. It includes strategies for the collection, evaluation, and editing of data from medicine and dentistry and the creation of prototypes for complete medical and dental applications.

NEWM-N 549 3D Prototyping and Articulation (3 cr.) Course covers advanced 3D organic modeling, sculpting, articulation rigging, animation, rendering, and printing of objects, characters, creatures, and plants. Students create and 3D print fully articulated models while researching and experimenting with strategies for collecting, wrangling, and analyzing datasets and visualizing them both on screen and in physical prototypes.

NEWM-N 590 Independent Study (1-3 cr.) Research and/or production related to a particular theme or topic in media arts. Course topic, learning outcomes, and a plan of study must be developed by the student, with guidance from the instructor, prior to registration. Course can be repeated multiple times. Approval by the program advisor is required for registration.

NEWM-N 560 Advanced Scriptwriting for New Media (3 cr.) Course evaluates the concepts, theories, techniques, and practices of scriptwriting for 3D animation, computer games, interactive stories, and film, including genre, theme, development, character, dialogue, structure, research, formatting, style, and revision. Students research, create, and develop effective, original scripts for digital media.

NEWM-N 585 Seminars in Media Arts and Science (3 cr.) Current trends, problems, best practices and developments in new media. Students pursue a special interest and share information and experience with the group. This course is an in-depth exploration of topics and issues at the forefront of new media. Seminar format with research papers and class discussion/presentations.

NEWM-N 595 Internship in Media Arts and Technology (3 cr.)
An internship program for students to work with and learn from experts in media (digital arts) technology fields who are developing and using new applications in commercial and educational settings. Requirements for interns include the development of a technology project proposal; interview, resume, and project presentation; on-site intern residency; project report; oral and media presentation of project outcomes.

NEWM-N 545 3D Character Development (3 cr.)
Course covers character development, creation, and implementation for game and film pipelines. It applies advanced principles of 3D sculpting anatomy, texturing, rigging, and human kinesiology. Other topics include research and planning, preproduction, production, and postproduction, and marketing. Students perform a peer critique, annotated bibliography, and literature review.

NEWM-N 505 Advanced Issues in Emerging Media Environments (3 cr.) This course covers theoretical and exploratory investigations of creative activities in emerging media environments, enabling students to enhance their knowledge, experience, and problem-solving skills. Students establish a research framework and discover new knowledge about media design, human factors, and technological issues by designing, conducting, and evaluating empirical studies.

NEWM-N 539 Augmented Reality Design and Development (3 cr.) P: NEWM-N504 This course covers the design and development of computer games and simulations for augmented and virtual reality. To supplement and simulate the physical world, students research methods for integrating 3D objects and animations into interactive mobile applications. They also propose new, disruptive applications in entertainment, education, and other industries.

New Media

NEWM-N 100 Foundations of New Media (3 cr.) An exploration of the characteristics of digital media, including interactivity, hypermedia, immersion, and storytelling. Includes an introduction to the practice, theory, and history of new media, from the viewpoint of technology, communication, and culture. There are readings, demonstrations, examples, hands-on projects, and written assignments.

NEWM-N 102 Digital Media Imagery (3 cr.) A hands-on introduction to the basic tools used in industry for the creation, editing, manipulation, and uses of 2D raster and vector graphics. Other topics include the integration of imagery into a personal Web site.

NEWM-N 115 Introduction to Multi-Device Web Development (3 cr.) A hands-on introduction to some of the fundamental tools used in industry to produce interactive media-rich Web pages. Case studies of sites that incorporate text, sounds, graphics, animations, and interactivity. Other topics include the design, development, and deployment of a personal Web site.

NEWM-N 131 Game On! A History of Video Games (3 cr.) Course examines ancient and traditional games to inform a history of video games from their humble birth in the 1940's to the present. Students design and evaluate aspects of games to understand the historical development of game designs.

NEWM-N 140 History of Animation (3 cr.) This course introduces the history and development of the field of animation. Students view some of the most important animations created and discuss the technical and narrative developments in animation from the early 20th century to the present.

NEWM-N 132 Game Design Psychology: Theory and Prototyping (3 cr.) Course explores the application of cognitive psychology and theories of learning and motivation to the design and prototyping of games. Students learn how to create games that are fun to play, and evaluate and improve games that may not be, based on psychological concepts, theories, and findings.

NEWM-N 201 Design Issues in Digital Media (3 cr.) Exploration of the traditional principles of visual design, as expressed in digital design tools and applied to digital media. Topics include visual literacy, fundamental design elements and design principles, and their expression in various tools for digital design. Hands-on practice with applying design principles in several projects.

NEWM-N 202 Digital Storytelling (3 cr.) P: N100 Examination of the principles of storytelling across a range of digital media formats, with attention to techniques for creating story-rich projects. Explores the role of agency, interactivity, story structure, and narrative, as well as the opportunities and challenges raised by emerging interactive and transmedia approaches to story-rich projects.

NEWM-N 203 Digital Painting (3 cr.) Course introduces digital painting and 2D design in media arts. Students develop a basic understanding of digital software and hardware, conceptual design standards and practices, techniques used in industry, and visual development for films, games, animation, and comic books.

NEWM-N 215 Intermediate Multi-Device Web Development (3 cr.) P: N101, N102 Study of the creation, publication, and management of documents, images, and other media types on the Web. Topics include Web publishing, asset preparation, document types, contemporary content management systems and their use in the organization. Hands-on experience with contemporary systems for content management.

NEWM-N 220 Introduction to Media Application Development (3 cr.) Introduces concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use markup tags and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

NEWM-N 221 Mobile and Game Nonrelational Database Development (3 cr.) This course covers the design and implementation of databases for mobile and game applications. Students learn to develop frontend and backend nonrelational databases, methods of data modeling, best practices for maintaining data integrity, and techniques for using data in mobile and game projects to be completed within the course.

NEWM-N 458 Beyond the Frame: New Forms of Video Production (3 cr.) P: NEWM-N 353, NEWM-N 356, or NEWM-N 357 This course explores various emerging video forms. Students draw on their foundational knowledge and skills of conventional production and post-production to create videos using emerging technologies. These technologies include 360° stereoscopic video, branching video, database cinema, projection mapping, and immersive filmmaking.

NEWM-N 241 Stop Motion Animation (3 cr.) Through lecture and hands-on practice, this class studies the production techniques of stop action animation. Topics include the study of pioneers in the field, evolution from analog to digital techniques, and the building of sets and characters. Students will produce a series of short frame-by-frame digital animations.

NEWM-N 243 Introduction to 3D (3 cr.) An introduction to the concepts and production process of 3D graphics and animation. Students learn basic techniques and theories related to modeling, texturing, lighting, animation, and rendering. Students produce animated graphics and text within the context of various projects.

NEWM-N 230 Introduction to Game Design and Development (3 cr.) P: CIT 21500, CSCI 23000, INFO-I210, NEWM-N220 or NEWM-N243 Introduction to designing and developing games, examining the role that games play in daily life, and analyzing the impact of games in popular culture. Additional topics include world

creation, game space design, programming 2D games, character and creature design, animation, and playability testing.

NEWM-N 253 Introduction to Digital Video (3 cr.) Introduction to video production techniques for digital media. Hardware, software, and technique are explored through lecture and projects. All phases of video production are addressed, from pre-production through production to post-production with a focus on the digital media aspects.

NEWM-N 255 Introduction to Digital Sound (3 cr.) Introduction to role and function of sound in interactive media. Concepts, theory, and practice related to audio, including voice, music, and sound effects. Effective listening skills, and understanding how people listen and comprehend sound. Experience with tools and techniques for recording, editing, and reproduction.

NEWM-N 256 Digital Composition (3 cr.) P: N102 An introduction to digital cameras and the principles of photographic composition for multimedia. Topics include shot selection, framing, camera movements, and time-based effects, as well as the use of photographs in storytelling.

NEWM-N 260 Scriptwriting (3 cr.) An introduction to writing for new media. Concentrating on developing ideas, concepts, plans and stories, students will generate scripts and analysis for numerous new media projects. Other topics covered include writing for scripts, grants, storyboards, and advertising and marketing plans.

NEWM-N 261 Storyboarding for Multimedia (3 cr.) P: N101, N102 Introduction to story and production planning through traditional and digital techniques. Topics include the development of roughs, storyboards, and animatics as planning devices for digital storytelling and other new media products.

NEWM-N 262 Introduction to Comics and Sequential Narratives (3 cr.) An introduction to the use of panel-to-panel and frame-to-frame sequential storytelling as foundational elements of animation and storytelling. Other topics covered include pre-visualization, storyboards, and character design. Students will become familiar and comfortable with 2D visual storytelling, illustration, design, integrated text, media integration of their creations, and final production techniques. Additionally, students will develop a series of storyboards, visuals, and comic books utilizing existing new media knowledge and applications.

NEWM-N 265 Sound Composition (3 cr.) An introduction to digital sound creation and editing. Concentrating on sound effects, voiceover, and composition, students will generate sound for various new media projects. Other topics covered include recording, formatting, effects, editing, and conversion.

NEWM-N 290 Creative Concept Development (3 cr.) Exploration of creativity, ideation, and concept development. Students learn the processes of creative thinking, idea generation and development, and creative problem solving through specific theories, methodologies, and application in multimedia projects.

NEWM-N 295 Career Enrichment Cooperative (3 cr.) A semester of external career experiences designed to enrich the student's preparedness for entering the workforce. Periodic meetings with faculty advisors and a comprehensive written report on the experience detailing the intern's activities and reactions are required.

NEWM-N 299 Career Planning (2 cr.) P: INFO-I101 or NEWM-N100 or HIM-M108 This course applies design and visualization information towards the development of a comprehensive portfolio and resume. The development of the portfolio and resume will provide students with a framework for display of personal growth and achievement. Students will develop a portfolio and resume to be used for future career opportunities.

NEWM-N 300 Digital Media Production (3 cr.) Hands-on experience in taking a project through the typical product life-cycle, from initial contact to final acceptance. Topics include communicating with a client, cost estimation, product design, implementation, handling change requests, product documentation, acceptance testing, and post-process review.

NEWM-N 245 Introduction to 3D Preproduction (3 cr.) This course covers the preproduction process for digitized models. Specifically, students learn how to create, sculpt, and scan characters into a computer and then revise them using digital sculpting software. As students hone their modeling technique, they also discuss and apply aesthetics to character development and engage in peer critique.

NEWM-N 315 Advanced Multi-Device Web Development (3 cr.) P: N215 Advanced creation, publication, and manage-ment of interactive publications for online distribution with the inclusion of emerging technologies for a media-rich experience. Topics include interactive Web site development, animations for the Web, online interactive design, document conversion, file exchanges, and digital media development for online usage.

NEWM-N 320 Intermediate Media Application Development (3 cr.) P: NEWM-N220 and NEWM-N221 Introduces intermediate concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use information modeling, markup tags, and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

NEWM-N 322 Dynamic Data Applications (3 cr.) P: N222 Examines the techniques used in multimedia applications to communicate with back-end data and information services, and to create applications with run-time access to data, information, and media assets.

NEWM-N 330 Intermediate Game Design and Development (3 cr.) P: N230 Design and development of 3D games in the context of a 3D game engine. Topics include world creation, game space design, programming, design and modeling of characters and creatures, environmental animation, and playability testing.

NEWM-N 331 Game Testing and Evaluation (3 cr.) Course focuses on the evaluation of the quality of a game in both early and later states. Students will learn usability evaluation techniques and apply them to the evaluation of their own and others games. Recruitment and sampling of the correct, real-world individuals will be required.

Additional work will be done to understand the factors that go into making a game playable and enjoyable and how to identify those factors and tweak them to produce better gameplay outcomes.

NEWM-N 333 Introduction to Creature and Character Design (3 cr.) Course will give students a fundamental grasp of creature creation and their underlying narratives, world creation/development, basic design solutions, character, creature, and environmental design choices, an understanding of creature design, and a comprehensive working knowledge of the history, development, and evolution of the creature creation from the dawn of our civilization to the present day.

NEWM-N 335 Character Modeling and Animation (3 cr.) P: N230 Intermediate course in designing characters, for a variety of applications. Topics include character modeling, locomotion, facial animation, and lip movement.

NEWM-N 337 Virtual World Design and Development (3 cr.) P: NEWM-N220 Course explores the state of the art of virtual worlds, social constructions formed within them, and technical details of building the worlds. Topics include procedural world generation, avatar creation, real-time interaction, and client data storage. Students construct a virtual world, either individually or in a group.

NEWM-N 339 Augmented Reality Design and Development (3 cr.) P: NEWM-N220 and NEWM-N243 Course covers the design and development of computer games and simulations for augmented and virtual reality. To supplement and simulate the physical world, students learn methods for integrating 3D objects and animations into interactive mobile applications. They also propose new, disruptive applications in entertainment, education, and other industries.

NEWM-N 340 Motion Graphics (3 cr.) P: NEWM-N243 or NEWM-N357 or NEWM-N502 or instructor approval Course covers commerical, broadcast and other forms of motion graphics. Projects introduce motion graphics principles, design and composition, timing and drama, storyboarding and planning, sound and music development, synchronization. Students master the preproduction, production, and postproduction pipeline, including brainstorming, pitches, style frames, logo/identity animation, commericals, and banners.

NEWM-N 341 Lighting and Materials (3 cr.) Course focuses on texturing and lighting in creating 3D objects and environments. Topics include an examination of state-of-the-art examples, reproduction of results, and production of individual portfolio-quality projects. Possible software includes use of Autodesk Maya, Mental Ray, Adobe Photoshop, and Adobe AfterEffects.

NEWM-N 342 3D Animation (3 cr.) P: N243 Introduction to 3D computer graphic animation for students interested in producing animations for product design, gaming, entertainment, marketing, training, and simulation. Topics include environment design, modeling, motion studies, camera movement, and composition.

NEWM-N 343 Hard Surface 3D Modeling (3 cr.) P: NEWM-N243 Intermediate modeling course, aimed at achieving high-detail, professional quality 3D models for games, film, architecture, science, and other application areas. In-depth use of professional software packages. Possible topics include modeling high-resolution organic characters, modeling foliage and ornate structures, displacement mapping techniques.

NEWM-N 345 Organic Modeling and Texturing (3 cr.) P: NEWM-N243 Intermediate organic modeling course, aimed at achieving high-detail, professional quality 3D models for games, film, architecture, science, and other application areas. This course will explore using the foundations 3D modeling, Sculpture, and Texture painting to output believable creations.

NEWM-N 353 Intermediate Digital Sound Design (3 cr.) P: NEWM-N253
Video production techniques for digital media. Preproduction, production, and postproduction of digital video will be addressed and utilized for the completion of a short video project. Other topics covered include directing, editing, media optimization, and assembling assets.

NEWM-N 354 Directorial Analysis, Production and RAW Workflow (3 cr.) P: NEWM-N253 Students screen and analyze the unique visual styles of different directors. They complete preproduction, filming, and postproduction on a scene inspired by a selected film using industry standard software and best practices for RAW workflow and color grading.

NEWM-N 355 Intermediate Sound (3 cr.) P: N255 Intermediate course in designing soundtracks and sound effects for various media applications. Topics include digital signal processing, digital sound techniques, sound recording using a variety of synthesizers and samplers, editing techniques, file formats and conversion techniques.

NEWM-N 356 LIghting and Field Production (3 cr.) P: N253 Theoretical and practical application of lighting, filming, and audio recording. Students will work in a variety of locations to encompass as many different environments as possible. Other topics covered include daytime shooting, nighttime shooting, studio shooting, and storytelling.

NEWM-N 357 Digital Effects (3 cr.) P: N253 Integration of computer-generated imagery and digital effects technique for video production. Students learn techniques for creating digital effects, shooting video for effects, and the use of effects to aid in storytelling. Other topics covered include programming/scripting, shooting raw footage, effects, and media integration.

NEWM-N 364 Directing Visual Narratives (3 cr.) P: NEWM-N253 Course introduces principles of animation, derived from acting techniques, to arouse empathy and appeal for characters. Students experiment with how a character should react to objects, environments, and other characters to convey its thoughts, emotions, personality, and aspirations. Students create expressive poses to visualize an effective performance.

NEWM-N 385 Seeing Sideways: Experimental Approaches to New Media (3 cr.) In this non-traditional open format course students will explore a variety of methods for fostering creative exploration in new media. Discussion, readings, blogging, and directed exercises lead the student to find individual ways of exploring

different areas of new media through a variety of output options.

NEWM-N 399 Portfolio Development (1 cr.) This course applies design and visualization information towards the development of a comprehensive portfolio. The development of the portfolio will provide students with a framework for display of personal growth and achievement. Students will develop a portfolio to be used for future career opportunities.

NEWM-N 407 Digital Media for Healthcare (3 cr.) Course examines how healthcare systems employ digital media for marketing, education, communication, and ecommerce. Students work together in teams on the design and execution of a digital media project for healthcare.

NEWM-N 413 Advanced Web Application Development (3 cr.) P: NEWM-N315 A survey of advanced issues in Web site design, maintenance, and enhancement. Possible topics include Web analytics, clickstream analysis, ads and other revenue opportunities, payment systems, attracting visitors, and search engine optimization.

NEWM-N 415 Documenting Cultural Heritage: Artifacts and Traditions (3 cr.) This service-learning course engages students in projects on the digital documentation of cultural heritage sites and traditions. Students develop content and produce digital media including 3D models and animations, videos, and photographs. Students gain a better understanding of other societies and cultures through this international experience.

NEWM-N 416 Online Video Presentation (3 cr.) Course explores multiple aspects of online video presentation. Students learn how to encode, web-author, and deliver on-demand videos to computers and hand-held devices. Topics include the video delivery process, theories, database support, technologies, technological development, and business models.

NEWM-N 420 Multimedia Project Development (3 cr.) P: Junior Standing and NEWM-N399 Project design in new media. Topics include product planning and design, hardware and software selection, cost estimation, timelines, project management tools, feasibility studies, prototyping, and product presentation. Students work individually or in small groups to develop a project plan suitable for a capstone experience.

NEWM-N 422 Advanced Interactive Production (3 cr.) P: N322 A project-based course emphasizing the design, implementation, and evaluation of interactive new media applications. Working individually and in teams, students create multiple products, evaluate the products, and evaluate their own production process.

NEWM-N 423 Database Development for Mobile Applications (3 cr.) P: NEWM-N320 Course applies the representational state transfer software architecture to the development of mobile applications using a nonrelational database. Students learn how to implement a RESTFUL backend API for securely storing and retrieving data in a NoSQL database via AJAX calls.

NEWM-N 430 Advanced Game Design and Development (3 cr.) P: NEWM-N330 Students learn techniques and strategies to develop portfolio-ready 3D games, levels, and environments, from initial concept to full production. This course covers professional game engines and game development software, graphics and sound editors, and 3D animation software, enabling integration of graphics, textures, objects, and audio for effective communication and engagement.

NEWM-N 434 Serious Games and Simulations (3 cr.) Course examines the use of serious games, simulations, and virtual worlds in education, healthcare, health education, and the military. It explores the work of notable game authors and developers. Students design, implement, and evaluate a small-scale serious game or simulation.

NEWM-N 436 Game Production (3 cr.) Course engages students in the design, development, and implementation of a multifaceted, large-scale game, played by the wider community. Students form cross- functional teams, leveraging on their diverse backgrounds and expertise, to employ of variety of technologies in implementing the massively multiplayer game. Topics include alternate reality and augmented reality.

NEWM-N 306 Social Media Content, Analytics, and Management (3 cr.) This course introduces social media as a tool for digital storytellers. From activating high-awareness influencers to finely tuning media content and targeting campaigns, students learn how to develop a comprehensive social media strategy and manage a personal brand.

NEWM-N 438 Advanced 2D Animation (3 cr.) P: N238 The creation, development, and production of animation utilizing advanced methods of performance and movement. Possible topics include character and environment design, soundtrack, syncing, backgrounds and animation, and motion principles.

NEWM-N 440 3D Compositing and Visual Effects (3 cr.) P: NEWM-N243 An advanced course covering the integration of CGI (computer-generated imagery) and digital effect techniques for video production, as used in industry. Students learn the techniques for creating digital effects, shooting video for effects, and the use of effects to aid in the telling of a story.

NEWM-N 441 3D Production (3 cr.) P: N243, N342 and N343
Team-based course focusing on the creation of high-end, broadcast-quality animations. Team members demonstrate mastery of narrative, modeling, lighting, effects, rendering, and animation skills culminating in a final team project. Other topics include planning, preproduction, production, and postproduction.

NEWM-N 442 Advanced 3D Animation Techniques (3 cr.) P: N342 Advanced techniques in computer animation, including character development and dynamics. Possible topics include story development, character facial animation and locomotion, dynamics, special effects, composites, fluid effects and particle systems.

NEWM-N 443 Advanced Lighting and Texturing (3 cr.) P: N243 Advanced course in creating 3D objects and environments with specialized texturing and lighting. Possible topics include an examination of state-of-the-

art examples, reproduction of results, and production of individual portfolio-quality projects. Possible software includes use of Autodesk Maya, mental ray, Adobe Photoshop and Adobe AfterEffects.

NEWM-N 444 Stereoscopic Production and Display (3 cr.) P: NEWM-N243 and NEWM-N341 The production and display of stereoscopic imagery for various applications, including games, education, science, virtual reality, and marketing. Topics include human stereoscopic perception, types of stereoscopic displays, evolution of techniques, production issues for various types of stereoscopic media.

NEWM-N 445 3D Character Development (3 cr.) P: NEWM-N343 and NEWM-N345 An advanced class in working with character development, creation, and implementation for game and film pipelines. This class takes the basics of 3D organic modeling to an advanced level by including character development, modeling, texturing, rigging and basic animation. This course covers advanced modeling techniques used for building three-dimensional character and creatures. Students will explore techniques of character modeling to include the various approaches of figure construction. Other topics covered include research/planning, marketing, preproduction, production and postproduction.

NEWM-N 456 Digital Cinema (3 cr.) P: NEWM-N253, NEWM-N353 and NEWM-N354 Students work with the latest digital cinema technologies and workflows to create short narrative films. Students develop, script, and storyboard films and then plan and execute shoots. During post-production students employ the latest professional practices to edit, color grade, mix, finish, and author their films for final presentation.

NEWM-N 447 3D Prototyping for Applications in Dentistry (3 cr.) Course covers advanced modeling, sculpting, articulation, and printing of 3D objects from computer-generated images for dental industry applications. It also includes strategies for the collection, evaluation, and editing of dental data and the creation of prototypes for full dental and surgical applications.

NEWM-N 448 3D Prototyping for Application in Medicine (3 cr.) P: NEWM-N243 Course covers advanced modeling, sculpting, articulation, and printing of 3D objects from computer-generated images for applications in the medical industry. It also includes strategies for the collection, evaluation, and editing of medical data and the creation of prototypes for complete medical and surgical applications.

NEWM-N 449 3D Prototyping for Visualization and Abstraction (3 cr.) Course incorporates advanced modeling, sculpting, articulation, and printing of 3D printed objects from computer-generated images for both visualization and abstraction. It also includes strategies for the collection, evaluation, and editing of various datasets, and the creation of manipulatives that represent both the abstract and the informative.

NEWM-N 450 Usability Principles for New Media Interfaces (3 cr.) P: N285 Examination of principles of human-computer interaction (HCI) and user experience modeling. Study of user-centered design, usability, and usability testing in the context of new media (hypermedia and multimedia). Topics include aesthetics, human factors, and cognitive psychology as related to user interfaces, navigation, and interactivity.

NEWM-N 453 Advanced Digital Video (3 cr.) P: N353 Application of technical and critical-thinking skills towards understanding the genre of documentary films. Students review, discuss, and analyze several exemplar films, as well as do the research, planning, production, editing, post-production, and evaluation of a short high-quality documentary.

NEWM-N 455 Advanced Digital Sound Design (3 cr.) P: NEWM-N355 Students design, record, and edit sound files, apply effects, and mix several audio projects using state of the art technology. Topics include acoustics, circuits, waveforms, digital signal processing (DSP), and studio design and equipment. Emphasis is on practical techniques for integrating sound with other media.

NEWM-N 456 Digital Cinema (3 cr.) Students work with the latest digital cinema technologies and workflows to create short narrative films. Students develop, script, and storyboard films and then plan and execute shoots. During post-production students employ the latest professional practices to edit, color grade, mix, finish, and author their films for final presentation.

NEWM-N 437 Science Fiction in Virtual Reality (3 cr.) P: NEWM-N243 This course covers advanced techniques in research, concept design, modeling, unwrapping, and texturing using the physically based rendering (PBR) pipeline to place science fiction characters, vehicles, and environments into virtual reality. Pre-production and production pipeline theories and practices are implemented to allow students to gain experience creating assets and animation for virtual reality using a game engine.

NEWM-N 460 Advanced Scriptwriting for New Media (3 cr.) Course provides a deeper examination of scriptwriting for 3D animation, computer games, and film, building on previously introduced theories and practices. It focuses on an in-depth analysis of the techniques and processes of scriptwriting, including genre, theme, development, character, dialogue, story structure, formatting, style, and revision.

NEWM-N 462 Advanced Comics and Sequential Narratives (3 cr.) P: NEWM-N262 and NEWM-N332 Advanced topics in the creation of sequential narrative using 2D animation. Topics include ideas of pacing, tempo, sequence, and synchronization of graphic and audio elements.

NEWM-N 465 Informatics for Social Change (3 cr.) This course focuses on the theory and practice of service learning at IUPUI. Students will apply the knowledge of their technology expertise area in a service project for the local, state or global community. Projects will be completed through students' current and developing new media production, information technology, and client-based research skills.

NEWM-N 468 Video for Social Change (3 cr.) P: NEWM-N253 NEWM-N353 recommended Students explore theories of documentary filmmaking by screening and writing analyses of seminal documentaries. They also create a documentary about a cause or controversy,

or work with a nonprofit client to develop material and produce a finished video.

NEWM-N 475 Research in Design Methods (3 cr.) This course is designed to give students an understanding of the advanced concepts of theoretical topics, simulation modeling, and analysis concepts. Investigate applications of simulation in systems characterized by probabilistic behavior.

NEWM-N 480 Technology and the Law (3 cr.) Provides students with a solid foundation on legal matters that impact new media and informatics, including intellectual property (copyright, patents, trademark, trade secrets), contracts, licensing, privacy, publicity, global legal issues, and professional ethics.

NEWM-N 485 Seminar in New Media (3 cr.)
P: Prerequisite varies by topic. Current trends, problems, best practices, and developments in new media. Students pursue a special interest and share information and experiences with the group. This course is an in-depth exploration of topics and issues at the forefront of new media. Seminar format with research papers and class discussion/presentations.

NEWM-N 490 Independent Study (1-6 cr.) Departmental consent required. Research and practical experience in various areas of new media as selected by the student prior to registration, outlined in consultation with the instructor and approved by the program advisor. Total credit of internship/independent study shall not exceed nine hours.

NEWM-N 491 Capstone Project Internship (3 cr.) The capstone project represents the culmination of a student's studies. This experiential learning course supports the development of the capstone project in a professional setting. Students apply the knowledge and skills acquired in the media arts and science major to an industrial or research internship and present their final work at an exhibition.

NEWM-N 495 Enrichment Internship (3 cr.) P: Junior standing. Completion of 9 credit hours of new media electives at the 300-400 level is required. Industry, corporate, or similar experience in new media-oriented employment. Projects jointly arranged, coordinated, and evaluated by faculty and industrial supervisors. Apply during the semester prior to desired internship. Total credit of internship/independent study shall not exceed nine hours.

NEWM-N 499 Capstone Experience (3 cr.) To be taken during the students' senior year. Departmental consent required. The capstone experience is the culmination of the student's major in both knowledge and abilities of a particular area of interest in new media. The successful execution, individually or as a team, integrates student's learning across the field.

Undergraduate Course Descriptions
Informatics

INFO-I 100 First Year Experience (1 cr.)
This course introduces specific survival skills for success in college and beyond, while reconciling personal learning skills with instructor-based teaching styles. Master the art of inquiry and elevate your sense of integrity while sharpening your personal edge by exploring critical thinking, project management and current/future job market trends. Required by all informatics and media arts and science majors.

INFO-I 101 Introduction to Informatics (4 cr.)
Problem solving with information technology; introductions to information representation, relational databases, system design, propositional logic, cutting-edge technologies: CPU, operation systems, networks, laboratory emphasizing information technology including web page design, word processing, databases, using tools available on campus.

This course is approved for the Analytical Reasoning component of the General Education core.

INFO-I 112 Basic Tools of Informatics - Programming and Database Concepts (3 cr.) Introduction to programming and database design concepts. Emphasis on problem-solving and information gathering techniques. The lecture will discuss general concepts and syntax. The lab will focus on the use of software, including a programming language, modifying and accessing data using visual tools, and building database applications using forms and development tools.

INFO-I 130 Introduction to Cybersecurity (1 cr.) P: I101 C: I101 This course introduces students to Cybersecurity. The course will primarily focus on introduction to three core areas (technical aspects of security, organizational aspects of security, and legal aspects of security). Through examples of security problems in real life, this course will illuminate fundamental ideas and concepts of information security.

INFO-I 201 Mathematical Foundations of Informatics (4 cr.) An introduction to the suite of mathematical and logical tools used in information sciences, including finite mathematics, automata and computability theory, elementary probability and statistics, and basics of classical information theory. Cross listed with COGS Q250. Credit given for either INFO I201 or COGS Q250.

INFO-I 202 Social Informatics (3 cr.)
Introduction to key social research perspectives and literatures on the use of information and communication technologies. Discusses current topics such as information ethics, relevant legal frameworks, popular and controversial uses of technology (e.g. peer-to-peer file sharing), digital divides, etc. Outlines research methodologies for social informatics.

This course is approved for the Social Sciences component of the General Education core.

INFO-I 210 Information Infrastructure I (4 cr.) The software architecture of information systems. Basic concepts of systems and applications programming.

INFO-I 483 Conversational User Interfaces: Experience Design and Applications (3 cr.) This course introduces the fundamentals of user experience design for conversational computing. Students explore the cognitive, experiential, and social aspects of conversational user interaction through applied projects, labs, and discussions. Students also learn tools and methods for designing, prototyping, and testing conversational user experiences.

INFO-I 230 Analytical Foundations of Security (3 cr.) P: I130 This course will allow students to re-evaluate and conceptualize material learned in discrete courses to consider the topics from the perspective of security. For example, computer system basics such as hardware (CPU, memory, ...) and software are reconsidered from the perspective of how their interactions create vulnerabilities. Vulnerabilities that combine standard hardware and software configurations will be examined, as these illuminate both security and computer networks. Operating systems and file systems are examined from the perspective of access control, permissions and availability of system services, etc.

INFO-I 231 Introduction to the Mathematics of Cybersecurity (3 cr.) P: I130 C: I130 Introduces the basic mathematical tools used in modern cybersecurity. Covers mathematical material from a number of disparate fields, including probability theory, analysis of algorithms, complexity theory, number theory, and group theory.

INFO-I 270 Introduction to Human-Computer Interaction Principles and Practices (3 cr.) Students learn the fundamental principles and practices of human-computer interaction (HCI) and evaluation. Specific focus is given to the introductory knowledge of HCI methods, tools, and techniques for designing and evaluating user interfaces through the use of low and high fidelity prototypes for the Web and software.

This course is approved for the Social Sciences component of the General Education core.

INFO-I 275 Introduction to Human-Computer Interaction Theory (3 cr.) Students will learn the fundamental theories of human-computer interaction (HCI) and user-centered design. This course is both a survey of HCI research and an introduction to the psychological, behavioral, and other social science knowledge and techniques relevant to the design of interactive and ubiquitous computing systems.

This course is approved for the Social Sciences component of the General Education core.

INFO-I 300 Human-Computer Interaction (3 cr.) P: INFO I270 An intermediate course that teaches students how to assess the usability of software through quantitative and qualitative methods, including conducting task analyses, usability studies, heuristic inspections, interviews, surveys, and focus groups. The course also introduces students to the tool and techniques for designing and testing user interfaces based on a human-centered methodology.

INFO-I 303 Organizational Informatics (3 cr.) Examines the various needs, uses, and consequences of information in organizational contexts. Topics include organizational types and characteristics, functional areas and business processes, information-based products and services, the use of and redefining role of information technology, the changing character of work life and organizational practices, sociotechnical structures, and the rise and transformation of information-based industries. Credit given for either INFO I303 or SPEA V369.

INFO-I 305 Introduction to Research in Informatics (3 cr.) P: Sophomore standing This course presents a broad overview of research philosophy, designs and methods. Its focus is on social science research methods and the content is specifically tailored to reflect the rapidly emerging field of informatics. The course will include major methods that are the core of contemporary approaches to research in informatics.

INFO-I 308 Information Representation (3 cr.) The basic structure of information representation in digital information systems. It covers three modules: web development, relational databases, and XML technologies. Through this course, students are able to develop web pages that are able to interact with the backend servers; represent relational databases in the ER model, query the data using the formal query language SQL; and use XML technologies to store and display data.

INFO-I 310 Multimedia Arts and Technology (3 cr.) This course studies how the paradigm shift to a digital world will affect humanity. The course will consider the evolution of media arts and its underlying principles of communications. Students will study application development paradigms in current practice. Readings, lectures, class discussions, and research papers.

INFO-I 320 Distributed Systems and Collaborative Computing (3 cr.) P: INFO I211 An introductory treatment of distributed systems and programming. Topics range from the distributed and object models of computation to advanced concepts, such as remote method invocations, object brokers, object services, open systems, and future trends for distributed information systems.

INFO-I 330 Legal and Social Informatics of Security (3 cr.) This course will examine that set of ethical and legal problems most tightly bound to the issues of information control. The interaction and technology changes, but the core issues have remained: privacy; intellectual property; Internet law; concepts of jurisdiction; speech anonymity versus accountability; and ethical decision-making in the network environment.

INFO-I 350 Foundations in Legal Informatics (3 cr.) This course examines the basic concepts of the design, evaluation and use of technology in the study and practice of law. The course provides an overview of the application of a variety of emerging informatics and new media technologies to the field of law. Will cover technology for law office management, legal research, litigation support, document management, imaging and animations, case management, and electronic court filing.

INFO-I 391 Internship in Informatics Professional Practice (1-3 cr.) P: Approval of the dean and completion of 100- and 200-level requirements in informatics. Students gain professional work experience in an industry or research organization setting, using skills and knowledge acquired in informatics course work. May be repeated for a maximum of three credit hours.

INFO-I 399 Current Topics in Informatics (1-3 cr.) Variable topic. Emphasis is on new developments and research in informatics. Can be repeated twice with different topic.

INFO-I 400 Topics in Informatics (1-3 cr.) P: at least junior standing, or permission of instructor. Variable topic. Emphasis is on new developments and research in informatics. Can be repeated twice for credit when topics vary, subject to approval of the dean.

INFO-I 402 Informatics Project Management (3 cr.) P: Sophomore standing This course will focus on project management in an Informatics setting. Students will become conversant in the tools and techniques of project management, such as project selection methods, work breakdown structures, network diagrams, critical path analysis, critical chain scheduling, cost estimates, earned value management, motivation theory and team building.

INFO-I 410 Electronic Discovery (3 cr.) This course will cover the legal, ethical, financial, logistical, procedural and technological considerations of electronic discovery and its implications for lawyers and their clients. It will highlight recently revised federal and state rules, new state and federal legislation and recent court cases that impact electronic discovery policies and processes. We will also consider electronic discovery from the point of view of a corporation that has to prepare for – and then respond to – requests for the production of digital evidence.

INFO-I 421 Applications of Data Mining (3 cr.) P: INFO-I 211 This course explores the use of data mining techniques in different settings, including business and scientific domains. The emphasis will be on using techniques, instead of developing new techniques or algorithms. Students will select, prepare, visualize, analyze, and present data that leads to the discovery of novel and usable information.

INFO-I 425 Applying Web Services in Information Systems (3 cr.) P: INFO I211 and INFO I308 This course examines how cloud computing and service-oriented architecture contribute to solutions for Informatics problems in areas such as business, health care, and life sciences. Students will develop an understanding of why, when, and how organizations utilize Web services to manage data, as well as the skills to design, implement, and deploy Web services applications.

INFO-I 430 Security for Networked Systems (3 cr.) P: INFO I211 and INFO I308 An extensive survey of network security. Covers threats to information confidentiality, integrity, and availability in different Internet layers, and defense mechanisms which control these threats. Also provides a necessary foundation on network security, such as cryptographic primitives/ protocols, authentication, authorization, and access control technologies. Hands-on experiences through programming assignments and course projects.

INFO-I 433 Protocol Design and Analysis (3 cr.) Covers the fundamentals of computer security by looking at how things can go wrong, how people can abuse the system, and ways to make the system secure. Students will gain a basic overview of existing security problems and be introduced to methods for addressing such problems. Should be taken by anyone designing, selecting, or using applications in which security or privacy plays a role.

INFO-I 441 Interaction Design Practice (3 cr.) Human-computer interaction design (HCID) describes the way a person or group accomplishes tasks with a computer - what the individual or group does and how the computer responds; what the computer does and how the individual or group responds. This course will be organized a collection of readings and three design projects applying human-computer interaction principles to the design, selection, and evaluation of interactive systems.

INFO-I 445 Competitive Intelligence for Informatics I (3 cr.) This course will focus on the basic principles, techniques and methods of competitive analysis, the types of competitive analysis systems and their applications, traditional and new sources of information about competitors and industries, the nature of business information and its lifecycle, the ethical issues of competitive analysis and the application of competitive intelligence to real-world scenarios.

INFO-I 453 Computer and Information Ethics (3 cr.) P: Sophomore standing Ethical and professionalization issues that arise in the context of designing and using networked information technologies and information resources. Examines frameworks for making ethical decisions, emergent technologies and their ethical implications, information/computer professionalism. Topics include privacy, intellectual property, cybercrime, games, social justice, and codes of professional ethics.

INFO-I 465 Informatics for Social Change (3 cr.) This course focuses on the theory and practice of service learning at IUPUI. Students will apply the knowledge of their expertise area in a service project for the local or global community. Projects will be completed through students' current and developing new media production, information technology, and client-based research skills.

INFO-I 470 Litigation Support Systems and Courtroom Presentations (3 cr.) Provide students with an opportunity to use specialized software that is available for organizing, managing, retrieving, and presenting documents and evidence in a legal matter. Students will gain hands-on experience with software tools and learn what is effective and allowable from a technical, legal and ethical standpoint.

INFO-I 475 Informatics in Sports (3 cr.) Technology applications are changing the sports world in biomechanics, sports advancement and injury prevention, equipment, entertainment, gaming, and journalism. The approach of this course is to delineate what digital technologies are progressing the sporting field most and changing the way we view athletics.

INFO-I 480 Experience Design and Evaluation of Ubiquitous Computing (3 cr.) The course focuses on ubiquitous computing and related interface/system design, and user-experience issues. Applications include interactive systems which support natural/gesture/touch-based interactions on devices such as mobile, extra-small-and-large displays, and other non-traditional pervasive technologies. Projects include interaction and evaluative techniques: field observation, contextual inquiry, ethnography, survey/interviews, and cognitive walkthrough.

INFO-I 490 Internship in Informatics Professional Practice (3-6 cr.) P: approval of dean and completion of 100- and 200- level requirements in informatics Students gain professional work experience in an industry or research organization setting, using skills and knowledge acquired in informatics course work.

INFO-I 491 Capstone Project Internship (1-6 cr.) P: Consent of instructor Students culminate their course studies through practical application of concepts and practices working in industry. Course requires prior authorization and approval of internship through the

Career Services Office. Required coursework is completed via Oncourse.

INFO-I 492 Senior Thesis (3 cr.) P: Consent of instructor The senior student prepares and presents a thesis: a substantial, typically multi-chapter, paper based on a well-planned research or scholarly project, as determined by the student and a sponsoring faculty member.

INFO-I 493 Senior Thesis (3 cr.) P: Consent of instructor The senior student prepares and presents a thesis: a substantial, typically multichapter paper based on a well-planned research or scholarly project, as determined by the student and a sponsoring faculty member.

INFO-I 494 Design and Development of an Information System (3 cr.) P: Consent of instructor System design and development present both technical and managerial problems with which students will be familiar from their undergraduate course work. This course puts these lessons into practice as students work in teams to develop an information system. Examples of course projects include design and development of a database for a business or academic application, preparation and presentation of an interactive media performance or exhibit, or design and implementation of a simulated environment (virtual reality).

INFO-I 495 Design and Development of an Information System (3 cr.) P: Consent of instructor System design and development present both technical and managerial problems with which students will be familiar from their undergraduate course work. This course puts these lessons into practice as students work in teams to develop an information system. Examples of course projects include design and development of a database for a business or academic application, preparation and presentation of an interactive media performance or exhibit, or design and implementation of a simulated environment (virtual reality).

INFO-I 499 Readings and Research in Informatics (1-3 cr.) P: consent of instructor and completion of 100- and 200- level requirements in informatics Independent readings and research related to a topic of special interest to the student. Written report required.

NEWM-N 220 Media Applications I (3 cr.) P: NEWM N101 or INFO I101 Introduces concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use markup tags and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

NEWM-N 299 Directed Study (2 cr.) This course applies design and visualization information towards the development of a comprehensive portfolio and resume. The development of the portfolio and resume will provide students with a framework for display of personal growth and achievement. Students will develop a portfolio and resume to be used for future career opportunities.

NEWM-N 320 Media Applications II (3 cr.) P: NEWM N221 Introduces intermediate concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use information modeling, markup tags, and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

INFO-Y 395 Career Development for Informatics Majors (1 cr.) Develops skills and knowledge that enable the student to successfully pursue the career search both at the time of graduation and later as the student progresses through their career. The course covers techniques and strategies which make the job search more efficient and effective.

INFO-I 211 Information Infrastructure II (4 cr.) P: INFO I210 The systems architecture of distributed applications. Advanced programming, including an introduction to the programming of graphical systems.

INFO-I 219 Software Bots for Cognitive Automation (3 cr.) This course introduces the development of software bots for process and cognitive automation. Students learn how organizations adopt artificial intelligence and related technologies to process unstructured and uncurated data in various industries. The course also examines the disruptive effects of process and cognitive automation on social, economic, and global environments.

INFO-I 220 The Social Impact of Bots and Automation (3 cr.) This course examines the disruptive effects of process automation on social, economic, and global environments and how organizations adopt artificial intelligence and other technologies to process unstructured and uncurated data. The course also introduces applications of cognitive automation with bots in various industries and their implications.

INFO-I 319 Cognitive Automation and Bots Development (3 cr.) P: INFO-I220 This course covers how to develop robotic process automation and cognitive automation for various kinds of organizations. Students apply artificial intelligence and bot platforms and frameworks to automate organizational processes from end to end.

INFO-I 340 Collaborative Human–AI Systems (3 cr.) This course introduces human–AI interaction design for systems that solve problems neither humans nor artificial intelligence could solve separately.Topics include interpretability, transparency, trust, and AI ethics. Student projects focus on developing applications where AI provides cognitive and perceptual augmentation to humans.

INFO-I 340 Collaborative Human–AI Systems (3 cr.) This course introduces human–AI interaction design for systems that solve problems neither humans nor artificial intelligence could solve separately. Topics include interpretability, transparency, trust, and AI ethics. Student projects focus on developing applications where AI provides cognitive and perceptual augmentation to humans.

INFO-I 415 Introduction to Statistical Learning (3 cr.) This course applies statistical learning methods for data mining and inferential and predictive analytics to informatics-related fields. The course also covers techniques for exploring and visualizing data, assessing model accuracy, and weighing the merits of different methods for a given real-world application. This course is an essential toolset for transforming large, complex informatics datasets into actionable knowledge.

INFO-I 416 Cloud Computing for Data Science (3 cr.) P: Programming (INFO-B 211 or CSCI-A 205, or CSCI 23000), and Database (CSCI-N 211 or INFO-I 308, or CSCI 44300) This course covers data science concepts, techniques, and tools to support big data analytics, including cloud computing, parallel algorithms, nonrelational databases, and high-level language support. The course applies the MapReduce programming model and virtual-machine utility computing environments to data-driven discovery and scalable data processing for scientific applications.

INFO-I 419 Enterprise Cognitive Automation (3 cr.) This course covers the integration of cognitive automation in business process management systems. Students model organizational processes and integrate artificial intelligence (AI) to increase and monitor their efficiency and effectiveness.They also learn from cognitive automation use cases how enterprises manage processes across systems, applications, and data repositories.

INFO-I 419 Enterprise Cognitive Automation (3 cr.) This course covers the integration of cognitive automation in business process management systems. Students model organizational processes and integrate artificial intelligence (AI) to increase and monitor their efficiency and effectiveness. They also learn from cognitive automation use cases how enterprises manage processes across systems, applications, and data repositories.

INFO-I 428 Web Mining (3 cr.) P: INFO-B 210 or CSCI-A 204 or CSCI 23000 This course covers concepts and methods used to search the web and other sources of unstructured text from a human-centered standpoint. These include document indexing, crawling, classification, and clustering; distance metrics; analyzing streaming data, such as social media; link analysis; and system evaluation.

INFO-I 459 Media and Technology Entrepreneurship (3 cr.) This course covers legal and business aspects of starting a media or technology company, including selecting the business structure, financing and credit, drafting business plans, articles of incorporation, and bylaws, tax implications, marketing and public relations, shareholders and governance, bankruptcy, insurance, contracts, property, and working with attorneys, accountants, and insurance agents.

INFO-I 467 Internet-of-Things Interface Design for Business Innovation (3 cr.) P: INFO-I 270, INFO-I 275, or INFO-I 300 and instructor permission Students employ human-machine interface design principles and practices as an innovation engine for Internet-of-things (IoT) ecosystems. Through design challenges, they develop and refine IoT interfaces and their business models, drawing on case studies and a review of the literature. Students acquire design-as-strategy skills through team-based, industry specific design projects.

INFO-I 478 Information Governance (3 cr.) This course covers the structures, policies, procedures, processes, technology tools and controls that encompass the emerging discipline of information governance (IG) which are implemented to manage information at an enterprise level to support an organization's immediate and future regulatory, legal, risk, environmental and operational requirements.

INFO-I 481 Experience Design and Evaluation of Access Technologies (3 cr.) This course is focused on access technologies and user experience design for users with disabilities. Through the course, students understand and apply accessible design techniques to create and evaluate assistive technologies and inclusive products.

INFO-I 483 Conversational User Interfaces: Experience Design and Applications (3 cr.) This course introduces the fundamentals of user experience design for conversational computing. Students explore the cognitive, experiential, and social aspects of conversational user interaction through applied projects, labs, and discussions. Students also learn tools and methods for designing, prototyping, and testing conversational user experiences.

New Media

NEWM-N 100 Foundations of New Media (3 cr.) An exploration of the characteristics of digital media, including interactivity, hypermedia, immersion, and storytelling. Includes an introduction to the practice, theory, and history of new media, from the viewpoint of technology, communication, and culture. There are readings, demonstrations, examples, hands-on projects, and written assignments. This course is approved for the Arts and Humanities component of the General Education core.

NEWM-N 102 Digital Media Imagery (3 cr.) A hands-on introduction to the basic tools used in industry for the creation, editing, manipulation, and uses of 2D raster and vector graphics. Other topics include the integration of imagery into a personal Web site.

NEWM-N 115 Multimedia Authoring Tools (3 cr.) A hands-on introduction to some of the fundamental tools used in industry to produce interactive media-rich Web pages. Case studies of sites that incorporate text, sounds, graphics, animations, and interactivity. Other topics include the design, development, and deployment of a personal Web site.

NEWM-N 190 Topics in Interactive Media (1-3 cr.) Special topics in interactive media, with a focus on exploring concepts at the forefront of media arts.

NEWM-N 199 Directed Study I (1 cr.) This course introduces the new media student to the current job market and will provide instruction on the development of job promotional material. Students will explore various new media careers in business, education, entertainment, science, and other related fields.

NEWM-N 200 Desktop Tools for Digital Media (3 cr.) A hands-on survey of the wide variety of tools used in creating multimedia animation, video, sound, and digital effects.

NEWM-N 201 Design Issues in Digital Media (3 cr.) Exploration of the traditional principles of visual design, as expressed in digital design tools and applied to digital media. Topics include visual literacy, fundamental design elements and design principles, and their expression in various tools for digital design. Hands-on practice with applying design principles in several projects. This course is approved for the Arts and Humanities component of the General Education core.

NEWM-N 202 Digital Storytelling (3 cr.) P: NEWM-N 100. Examination of the principles of storytelling across a

range of digital media formats, with attention to techniques for creating story-rich projects. Explores the role of agency, interactivity, story structure, and narrative, as well as the opportunities and challenges raised by emerging interactive and transmedia approaches to story-rich projects.

NEWM-N 204 Introduction to Interactive Media (3 cr.) The creation of interactive multimedia products for multi-platform delivery. Topics include the multimedia production process, audience analysis, hardware and software requirements, authoring tools, scripting, content development, interface design, distribution, and development strategies. Concentration will be on real-world applications for interactive multimedia.

NEWM-N 215 Online Document Development (3 cr.) P: N101, N102 Study of the creation, publication, and management of documents, images, and other media types on the Web. Topics include Web publishing, asset preparation, document types, contemporary content management systems and their use in the organization. Hands-on experience with contemporary systems for content management.

NEWM-N 220 INTRODUCTION TO MEDIA APPLICATION DEVELOPMENT (3 cr.) P: NEWM N101 or INFO I101 Introduces concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use markup tags and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

NEWM-N 230 Introduction to Game Design and Development (3 cr.) P: N221 Introduction to designing and developing games, examining the role that games play in daily life, and analyzing the impact of games in popular culture. Additional topics include world creation, game space design, programming 2D games, character and creature design, animation, and playability testing.

NEWM-N 238 2D Animation (3 cr.) P: N101 Introduction to traditional techniques for 2D animation, and their application in digital media. An exploration of the 12 principles of animation and how to use them to create effective animations.

NEWM-N 241 Stop Motion Animation (3 cr.) Through lecture and hands-on practice, this class studies the production techniques of stop action animation. Topics include the study of pioneers in the field, evolution from analog to digital techniques, and the building of sets and characters. Students will produce a series of short frame-by-frame digital animations.

NEWM-N 243 Introduction to 3D (3 cr.) An introduction to the concepts and production process of 3D graphics and animation. Students learn basic techniques and theories related to modeling, texturing, lighting, animation, and rendering. Students produce animated graphics and text within the context of various projects.

NEWM-N 250 Team Building in Technology (3 cr.) P: N202. Practical introduction to working in groups of three or more people. Topics include the interpersonal process, decision-making styles, the creative effort, problem-solving, conflict resolution, leadership, and assessment techniques.

NEWM-N 253 Introduction to Digital Video (3 cr.) Introduction to video production techniques for digital media. Hardware, software, and technique are explored through lecture and projects. All phases of video production are addressed, from pre-production through production to post-production with a focus on the digital media aspects.

NEWM-N 255 Introduction to Digital Sound (3 cr.) Introduction to role and function of sound in interactive media. Concepts, theory, and practice related to audio, including voice, music, and sound effects. Effective listening skills, and understanding how people listen and comprehend sound. Experience with tools and techniques for recording, editing, and reproduction.

NEWM-N 256 Digital Composition (3 cr.) P: N102 An introduction to digital cameras and the principles of photographic composition for multimedia. Topics include shot selection, framing, camera movements, and time-based effects, as well as the use of photographs in storytelling.

NEWM-N 260 Scriptwriting (3 cr.) P: N202 An introduction to writing for new media. Concentrating on developing ideas, concepts, plans and stories, students will generate scripts and analysis for numerous new media projects. Other topics covered include writing for scripts, grants, storyboards, and advertising and marketing plans.

NEWM-N 261 Storyboarding for Multimedia (3 cr.) P: N101, N102 Introduction to story and production planning through traditional and digital techniques. Topics include the development of roughs, storyboards, and animatics as planning devices for digital storytelling and other new media products.

NEWM-N 262 Sequential Narrative (3 cr.) P: N202 An introduction to the use of panel-to-panel and frame-to-frame sequential storytelling as foundational elements of animation and storytelling. Other topics covered include pre-visualization, storyboards, and character design.

NEWM-N 265 Sound Composition (3 cr.) An introduction to digital sound creation and editing. Concentrating on sound effects, voiceover, and composition, students will generate sound for various new media projects. Other topics covered include recording, formatting, effects, editing, and conversion.

NEWM-N 270 Visual Composition (3 cr.) An introduction to the composition of visual information in regards to new media. Students will develop a visual style through digital and traditional methods to tell stories. Other topics covered include digital photography, framing, shot selection, camera movements, and time-based programs.

NEWM-N 284 Building Physical Prototypes (3 cr.) An examination of concept formation for multimedia technology, including current, emerging, and future devices and displays. Learn to build physical and digital prototypes to facilitate idea development and presentation. Students research ideas, develop prototypes, evaluate, and present results.

NEWM-N 285 Interactive Design (3 cr.) P: N101 Examination of issues related to interactivity, including the frameworks, models, and theories related to user interaction with new media products. Topics include

user modeling, types of user interfaces, and interaction paradigms.

NEWM-N 288 New Media Marketplace Innovation (3 cr.) Through discussion, reading and writing, this course introduces students to the strategies needed to think outside the box and generate innovation in digital products and services, with an emphasis on existing or potential businesses and markets.

NEWM-N 290 Creative Concept Development (3 cr.) Exploration of creativity, ideation, and concept development. Students learn the processes of creative thinking, idea generation and development, and creative problem solving through specific theories, methodologies, and application in multimedia projects.

NEWM-N 295 Career Enrichment Cooperative (3 cr.) P: N175 and N180; sophomore standing and approval of the dean. A semester of external career experiences designed to enrich the student's preparedness for entering the workforce. Periodic meetings with faculty advisors and a comprehensive written report on the experience detailing the intern's activities and reactions are required.

NEWM-N 299 Directed Study (2 cr.) This course applies design and visualization information towards the development of a comprehensive portfolio and resume. The development of the portfolio and resume will provide students with a framework for display of personal growth and achievement. Students will develop a portfolio and resume to be used for future career opportunities.

NEWM-N 300 Digital Media Production (3 cr.) P: N101, N102 Hands-on experience in taking a project through the typical product life-cycle, from initial contact to final acceptance. Topics include communicating with a client, cost estimation, product design, implementation, handling change requests, product documentation, acceptance testing, and post-process review.

NEWM-N 311 The Digital Paradigm Shift: Effects in International Cultures and Society (3 cr.) Examination of the digital paradigm shift and its global impact on cultures and societies. A study of major paradigm shifts in reference to culture and society as well as the implications for the future. Readings, lectures, class discussions.

NEWM-N 315 Online Document Development II (3 cr.) P: N215 Advanced creation, publication, and management of interactive publications for online distribution with the inclusion of emerging technologies for a media-rich experience. Topics include interactive Web site development, animations for the Web, online interactive design, document conversion, file exchanges, and digital media development for online usage.

NEWM-N 320 Media Applications II (3 cr.) P: N221 Introduces intermediate concepts and skills related to the design of interactive multimedia applications for the Web, the desktop, and mobile devices. Within the context of industry-standard application design tools, students use information modeling, markup tags, and scripting to create applications that emphasize graphics, animation, sounds, and interactivity.

NEWM-N 322 Dynamic Data Applications (3 cr.) P: N222 Examines the techniques used in multimedia applications to communicate with back-end data and information services, and to create applications with run-time access to data, information, and media assets.

NEWM-N 328 Visualizing Information (3 cr.) P: N222 Exploration of techniques for using graphics and sound to present data and information. Topics include data types (including data that is geographical and/or time-varying), presentation techniques, effective use of design elements, and effective use of interactive media.

NEWM-N 330 Intermediate Game Design and Development (3 cr.) P: N230 Design and development of 3D games in the context of a 3D game engine. Topics include world creation, game space design, programming, design and modeling of characters and creatures, environmental animation, and playability testing.

NEWM-N 335 Character Modeling and Animation (3 cr.) P: N230 Intermediate course in designing characters, for a variety of applications. Topics include character modeling, locomotion, facial animation, and lip movement.

NEWM-N 340 Digital Video Production (3 cr.) P: N253 Video production techniques for digital media. Preproduction, production, and postproduction of digital video will be addressed and utilized for the completion of a short video project. Other topics covered include directing, editing, media optimization, and assembling assets.

NEWM-N 341 LIGHTING AND MATERIALS (3 cr.) P: N243 This course focuses on texturing and lighting in creating 3D objects and environments. Topics include an examination of state-of-the-art examples, reproduction of results, and production of individual portfolio-quality projects. Possible software includes use of Autodesk Maya, Mental Ray, Adobe Photoshop, and Adobe AfterEffects.

NEWM-N 342 3D Animation (3 cr.) P: N243 Introduction to 3D computer graphic animation for students interested in producing animations for product design, gaming, entertainment, marketing, training, and simulation. Topics include environment design, modeling, motion studies, camera movement, and composition.

NEWM-N 343 3D Modeling (3 cr.) P: N243 Intermediate modeling course, aimed at achieving high-detail, professional quality 3D models for games, film, architecture, science, and other application areas. In-depth use of professional software packages. Possible topics include modeling high-resolution organic characters, modeling foliage and ornate structures, displacement mapping techniques.

NEWM-N 353 Intermediate Video (3 cr.) P: N253 Video production techniques for digital media. Preproduction, production, and postproduction of digital video will be addressed and utilized for the completion of a short video project. Other topics covered include directing, editing, media optimization, and assembling assets.

NEWM-N 355 Intermediate Sound (3 cr.) P: N255 Intermediate course in designing soundtracks and sound effects for various media applications. Topics include digital signal processing, digital sound techniques, sound recording using a variety of synthesizers and samplers, editing techniques, file formats and conversion techniques.

NEWM-N 356 LIghting and Field Production (3 cr.) P: N253 Theoretical and practical application of lighting, filming, and audio recording. Students will work in a variety of locations to encompass as many different environments as possible. Other topics covered include daytime shooting, nighttime shooting, studio shooting, and storytelling.

NEWM-N 357 Digital Effects (3 cr.) P: N253 Integration of computer-generated imagery and digital effects technique for video production. Students learn techniques for creating digital effects, shooting video for effects, and the use of effects to aid in storytelling. Other topics covered include programming/scripting, shooting raw footage, effects, and media integration.

NEWM-N 385 Seeing Sideways: Experimental Approaches to New Media (3 cr.) In this non-traditional open format course students will explore a variety of methods for fostering creative exploration in new media. Discussion, readings, blogging, and directed exercises lead the student to find individual ways of exploring different areas of new media through a variety of output options.

NEWM-N 399 Directed Study III (1 cr.) P: Junior standing or N299 This course applies design and visualization information towards the development of a comprehensive portfolio. The development of the portfolio will provide students with a framework for display of personal growth and achievement. Students will develop a portfolio to be used for future career opportunities.

NEWM-N 400 Imaging and Digital Media Seminar (3 cr.) Variable titled course designed to bring guest speakers from the industry and other disciplines on campus to expose students to the wide realm of new media and how it can be utilized in each discipline. Class discussions, assigned readings, and research papers.

NEWM-N 410 History and Theory of Digital Media (3 cr.) Examines the history of computer-based media, technologies, and the digital information age. Topics include studying the historical components and developments, as well as present digital media and research speculation towards the future of digital media and technologies.

NEWM-N 413 Advanced Web (3 cr.) P: N315 A survey of advanced issues in Web site design, maintenance, and enhancement. Possible topics include Web analytics, clickstream analysis, ads and other revenue opportunities, payment systems, attracting visitors, and search engine optimization.

NEWM-N 420 Multimedia Project Development (3 cr.) P: (COMM-R 110 and ENG-W 131 and JOUR-J 200) or ENG-132 or TCM 220 and Senior standing. THIS IS A PRE-CAPSTONE COURSE. Project design in new media. Topics include product planning and design, hardware and software selection, cost estimation, timelines, project management tools, feasibility studies, prototyping, and product presentation. Students work individually or in small groups to develop a project plan suitable for a capstone experience.

NEWM-N 421 Physical Object Interfaces (3 cr.) P: N222 Exploration of the possibilities for interacting with computer applications through physical objects and other tangible media. Introduces the use of several sensor technologies to support interactivity, including cameras, proximity, contact, and RFID. Students design, build, and evaluate applications that address various scenarios.

NEWM-N 422 Advanced Interactive Production (3 cr.) P: N322 A project-based course emphasizing the design, implementation, and evaluation of interactive new media applications. Working individually and in teams, students create multiple products, evaluate the products, and evaluate their own production process.

NEWM-N 423 DATABASE DEVELOPMENT FOR MOBILE APPLICATIONS (3 cr.) P: N222 This course applies the representational state transfer software architecture to the development of mobile applications using a nonrelational database. Students learn how to implement a RESTFUL backend API for securely storing and retrieving data in a NoSQL database via AJAX calls.

NEWM-N 431 Game On! (3 cr.) An exploration of the evolution, concepts, and impact of video games. Examines the role of games in popular culture, as well as the impact on contemporary notions of interactivity, learning, and storytelling. Includes discussion of console and online games, casual games, Alternate Reality Games, serious games, and others.

NEWM-N 438 Advanced 2D Animation (3 cr.) P: N238 The creation, development, and production of animation utilizing advanced methods of performance and movement. Possible topics include character and environment design, soundtrack, syncing, backgrounds and animation, and motion principles.

NEWM-N 440 DV and CGI Digital Effects (3 cr.) P: N 342 and N 343 Covering the integration of CGI and digital effects technique for video production. Students learn the techniques for creating digital effects, shooting video for effects, and the use of effects to aid in storytelling. Other topics covered include programming/scripting, shooting raw footage, effects and integrating all new media.

NEWM-N 441 3D Production (3 cr.) P: N243, N342 and N343
Team-based course focusing on the creation of high-end, broadcast-quality animations. Team members demonstrate mastery of narrative, modeling, lighting, effects, rendering, and animation skills culminating in a final team project. Other topics include planning, preproduction, production, and postproduction.

NEWM-N 442 Advanced 3D Animation Techniques (3 cr.) P: N342 Advanced techniques in computer animation, including character development and dynamics. Possible topics include story development, character facial animation and locomotion, dynamics, special effects, composites, fluid effects and particle systems.

NEWM-N 444 Stereoscopic Production and Display (3 cr.) P: N243 The production and display of stereoscopic imagery for various applications, including games, education, science, virtual reality, and marketing. Topics include human stereoscopic perception, types of stereoscopic displays, evolution of techniques, production issues for various types of stereoscopic media.

NEWM-N 450 Usability Principles for New Media Interfaces (3 cr.) P: N285 Examination of principles of human-computer interaction (HCI) and user experience modeling. Study of user-centered design, usability, and usability testing in the context of new media (hypermedia and multimedia). Topics include aesthetics, human factors, and cognitive psychology as related to user interfaces, navigation, and interactivity.

NEWM-N 453 Advanced Video (3 cr.) P: N353 Application of technical and critical-thinking skills towards understanding the genre of documentary films. Students review, discuss, and analyze several exemplar films, as well as do the research, planning, production, editing, post-production, and evaluation of a short high-quality documentary.

NEWM-N 455 Advanced Sound Design (3 cr.) Students design, record, and edit sound files, apply effects, and mix several audio projects using state of the art technology. Topics include acoustics, circuits, waveforms, digital signal processing (DSP), and studio design and equipment. Emphasis is on practical techniques for integrating sound with other media.

NEWM-N 462 Advanced Sequential Narrative (3 cr.) P: N332 Advanced topics in the creation of sequential narrative using 2D animation. Topics include ideas of pacing, tempo, sequence, and synchronization of graphic and audio elements.

NEWM-N 465 Informatics for Social Change (3 cr.) This course focuses on the theory and practice of service learning at IUPUI. Students will apply the knowledge of their technology expertise area in a service project for the local, state or global community. Projects will be completed through students' current and developing new media production, information technology, and client-based research skills.

NEWM-N 475 Research in Design Methods (3 cr.) This course is designed to give students an understanding of the advanced concepts of theoretical topics, simulation modeling, and analysis concepts. Investigate applications of simulation in systems characterized by probabilistic behavior.

NEWM-N 480 Technology and the Law (3 cr.) Provides students with a solid foundation on legal matters that impact new media and informatics, including intellectual property (copyright, patents, trademark, trade secrets), contracts, licensing, privacy, publicity, global legal issues, and professional ethics.

NEWM-N 485 Seminar in New Media (3 cr.) P: Prerequisite varies by topic. Current trends, problems, best practices, and developments in new media. Students pursue a special interest and share information and experiences with the group. This course is an in-depth exploration of topics and issues at the forefront of new media. Seminar format with research papers and class discussion/presentations.

NEWM-N 490 Independent Study (1-6 cr.) Departmental consent required. Research and practical experience in various areas of new media as selected by the student prior to registration, outlined in consultation with the instructor and approved by the program advisor. Total credit of internship/independent study shall not exceed nine hours.

NEWM-N 495 Enrichment Internship (3 cr.) P: Junior standing. Completion of 9 credit hours of new media electives at the 300-400 level is required. Industry, corporate, or similar experience in new media-oriented employment. Projects jointly arranged, coordinated, and evaluated by faculty and industrial supervisors. Apply during the semester prior to desired internship. Total credit of internship/independent study shall not exceed nine hours.

NEWM-N 499 Capstone Experience (3 cr.) To be taken during the students' senior year. Departmental consent required. The capstone experience is the culmination of the student's major in both knowledge and abilities of a particular area of interest in new media. The successful execution, individually or as a team, integrates student's learning across the field.

Health Information Management

HIM-M 108 Introduction to Health Information Management (3 cr.)
Course introduces the health information management profession and healthcare delivery systems. Topics include healthcare settings, the patient record, electronic health records (EHRs), data collection standards, legal aspects of health information, coding, and reimbursement. Students gain hands-on experience with a virtual EHR and examine the impact of EHRs on healthcare.

HIM-M 110 Computer Concepts for Health Information (3 cr.) Course provides an overview of applications for the health and medical professionals. Topics include: audit trails, generating, quantifying and analyzing medical reports, word processing, computer hardware, medical software, copyright and fair usage. Students retrieve and present medical data.

HIM-M 120 Data Organization and Presentation in the Healthcare Environment (3 cr.) Students will study and apply problem solving, decision analysis and data presentation techniques used in healthcare data representation for both internal and external users. ICD and CPT classification systems will be modeled and analyzed utilizing spreadsheets.

HIM-M 200 Database Design for Health Information Administration (3 cr.) Introduction to database design with an emphasis on managing data in the health information environment. Topics and concepts include creating data table relationships and normalization. Utilizing Microsoft Access to create user forms and reports. Students will be required to create a large group project.

HIM-M 220 Healthcare Decision Support (3 cr.) This course provides an overview of essential information technology tools necessary for quantitative and qualitative decision making in a healthcare environment. Students will learn effective methods to analyze patient data including ICD and CPT classification systems as they relate to decision processes in a healthcare environment.

HIM-M 270 Foundations and Principles of Health Information Management (2 cr.) Course focuses on the administration of foundational principles of management within a health information department. Students will

gain an understanding of the language of quantitative methods as well as the processes that are required for health information managers to function in a healthcare environment which demands competency in the areas of profit margins, management of financial resources and complex reimbursement processes.

HIM-M 275 Effective Communication for the Healthcare Environment (3 cr.) Course is designed to develop effective interaction among internal and external customers in a healthcare environment. Emphasis is placed on professional communications with superiors, peers and subordinates in all areas of healthcare. Topics include: policy creation, HIM job descriptions, information technology proposal requests, e-mail etiquette and presentation skills.

HIM-M 322 Hospital Organization and Management (3 cr.) Orientation to hospital departments hospital organization; inter- and intra-relationships of hospital and community agencies.

HIM-M 325 Health Care Information Requirements and Standards I (3 cr.) Course outlines the essential documents/data content required for maintaining legal health records using paper and electronic media. Federal, state and local law, accreditation standards and regulatory requirements for maintaining patient data examined. Documentation in acute care, psychiatric and other healthcare settings. Students begin to explore the health information management professions.

HIM-M 326 Laboratory Enrichment for Healthcare Information Requirements and Standards I (1 cr.) This course consists of exercises that reinforce the lectures in HIA-M 325. Students explore up-to-date Web resources used in the healthcare field as well as perform database searches. Students engage in laboratory exercises that consist of evaluating health records for completeness, regulatory compliance and documentation.

HIM-M 327 Healthcare Information Requirements and Standards II (3 cr.) This course is a continuation of HIA-M 325 and includes the ongoing review of health record documentation, in particular secondary data bases such as cancer registry, long term care and other healthcare settings. Healthcare information resources, both in print and on the World Wide Web are researched and examined extensively.

HIM-M 328 Laboratory Enrichment for Healthcare Information Requirements and Standards II (1 cr.) P: M325 This course consists of exercises that reinforce the lectures in HIA-M 327. Students explore Web resources used in the healthcare field and perform extensive database searches.

HIM-M 330 Medical Terminology (3 cr.) The purpose of this course is to further develop a student's understanding and use of medical terminology. There is a focus on spelling and pronunciation, abbreviations, analyzing words based on their root, prefix or suffix as well as identifying common mistakes within medical terminology.

HIM-M 345 Medicine and the Law (1-2 cr.) Presentation of concepts of law in medical, and/or health related areas as applied to the physician, hospital, health institutions, health information and individual health workers.

HIM-M 350 Medical Science for Health Information I (3 cr.) This course will cover pathophysiology and pharmacology associated with the body systems.

HIM-M 351 Medical Science for Health Information II (3 cr.) P: M350. This course is a continuation of M350. Course will cover pathophysiology and pharmacology associated with the body systems.

HIM-M 355 ICD-9-CM Coding (3 cr.) This course will focus on International Classification of Diseases (ICD) and coding. Students will learn how to code, index, and sequence diagnoses and procedures. Ethical coding guidelines will be taught.

HIM-M 356 Laboratory Enrichment for ICD-9-CM Coding (1 cr.) This course is a laboratory for HIA-M 355 that provides hands-on experience in assigning ICD-9-CM codes. Actual patient records are used for coding practice which focuses on correct code assignment and sequencing of codes to follow ethical coding guidelines. Students will also gain hands-on experience with electronic health records and coding software used in the HIM industry.

HIM-M 358 CPT Coding (3 cr.) P: M355. Focus on Current Procedural Terminology coding. Sequence of procedures as they relate to correct coding guidelines. Study of Health Care Common Procedure Coding System (HCPCS) will also be included.

HIM-M 359 Clinical in Health Information Administration (1 cr.) P: M355 This course is a laboratory for HIA-M 455 that provides hands-on experience in assigning CPT codes. Actual patient records are used for coding practice which focuses on correct code assignment and sequencing of codes to follow ethical coding guidelines. Students will also gain hands-on experience with electronic health records and coding software used in the HIM industry.

HIM-M 361 Release of Health Care Information (1 cr.) This course will outline the requirements associated with confidentiality and privacy of health information. This course will focus on Health Insurance Portability and Accountability Act (HIPAA) code sets and transactions privacy.

HIM-M 370 Health information Management (3 cr.) This course will focus on human resources management in a Health information Department. Work scheduling, work flow and work design will be discussed. Other issues in managing an HIM department will be addressed such as education and training, establishing productivity standards, developing a budget and managing contracts.

HIM-M 400 Health Information Storage and Retrieval (3 cr.) This course will focus on the creation of forms design, including the retrieval, filing, and storage of health care information according to the guidelines established by federal and state regulations. Registries will be discussed with specific focus on the cancer registry and master patient index (MPI).

HIM-M 420 Health Care Planning and Information Systems (3 cr.) Understanding the design of systems, research various vendors, present information so that a selection of information system can be recommended. This course will also address systems planning; systems selection process; clinical and business applications

of computing in healthcare; resolving organization information issues.

HIM-M 425 Quantitative Methods and Research (2 cr.) This course will outline the procedures associated with vital statistics in health care (birth/death certificates). The student will learn about the statistics associated with health care. The research portion will focus on data search and access techniques, national research policy making, biomedical and health research investigation, and research protocol data management.

HIM-M 443 Professional Practicum in Health Information Management I (1-8 cr.) This course is designed to provide professional practice experience in an approved clinical site under the direction of an HIA faculty member and an onsite clinical instructor. Students also receive didactic and practicum experience in the classroom. Emphasis on clinical science, health information management, business administration and information systems.

HIM-M 444 Professional Practicum in Health Information Management II (1-8 cr.) P: M443 This course is a continuation of HIA-M 443 and includes professionally supervised experience in an approved clinical site as well as practicum experience in the classroom.

HIM-M 457 Practicum in Medical Coding (4 cr.) Course is designed for students completing the Certificate in Medical Coding. Students will participate in a supervised laboratory practicum focusing on the coding of complex medical records using both the ICD and CPT coding systems. Onsite observations related to coding function in approved clinical settings are included in the course content.

HIM-M 462 Health Care Quality Improvement (2 cr.) This course will identify quality/performance improvement methods and techniques for health care professionals. Interpretation of data appropriate to user needs and presentation of information will also be covered.

HIM-M 470 Health Care Reimbursement Systems (3 cr.) P: M355,M455 This course will present data elements that apply to prospective payment systems. It will allow the student to gain the knowledge of correct reimbursement systems and to identify issues and patient types in meeting medical necessity guidelines.

HIM-M 475 Health information Technology (3 cr.) Introduction to health information standards that have been developed for the electronic health record and information interoperability and standards in development. Emphasis on understanding healthcare organization networks, intranets, the role of the Internet in patient data access, differences between clinical and administrative information systems used in healthcare organizations and the management and maintenance of those systems.

HIM-M 490 Directed Study (1 cr.) This course will reinforce the concepts taught throughout the semester in an independent study approach in order to review for the certification examination.

HIM-M 499 Capstone Experience (3 cr.) This final project will allow the student to synthesize all of the information learned throughout the professional program. Written research projects and oral presentations will test the student's integrated knowledge and abilities across the field.

HIM-M 430 Health Care Planning and Information Systems (3 cr.) Understand the design of systems, research various vendors, present information so that a selection of information system can be recommended. This course also will address systems planning; systems selection process; clinical and business applications of computing in health care; resolving organization and information issues.

General Education Courses

INFO-I 101 Introduction to Informatics (4 cr.) Problem solving with information technology; introductions to information representation, relational databases, system design, propositional logic, cutting-edge technologies: CPU, operation systems, networks, laboratory emphasizing information technology including web page design, word processing, databases, using tools available on campus.

This course is approved for the Analytical Reasoning component of the General Education core.

INFO-I 201 Mathematical Foundations of Informatics (3 cr.) An introduction to the suite of mathematical and logical tools used in information sciences, including finite mathematics, automata and computability theory, elementary probability and statistics, and basics of classical information theory. Cross listed with COGS Q250. Credit given for either INFO I201 or COGS Q250.

This course is approved for the Analytical Reasoning, List B, component of the General Education core.

INFO-I 202 Social Informatics (3 cr.) Introduction to key social research perspectives and literatures on the use of information and communication technologies. Discusses current topics such as information ethics, relevant legal frameworks, popular and controversial uses of technology (e.g. peer-to-peer file sharing), digital divides, etc. Outlines research methodologies for social informatics.

This course is approved for the Social Sciences component of the General Education core.

INFO-I 210 Information Infrastructure I (3 cr.) The software architecture of information systems. Basic concepts of systems and applications programming.

This course is approved for the Analytical Reasoning, List B, component of the General Education core.

INFO-I 223 Data Fluency (3 cr.) Pervasive, vast, and growing describe data in today’s environment. This course introduces fundamental skills for extracting from data actionable knowledge. Students create, access, munge, analyze, and visualize data to draw inferences and make predictions. The course uses real datasets from a variety of disciplines including healthcare, business, and the humanities.

This course is approved for the Analytical Reasoning, List B, component of the General Education core.

INFO-I 270 Introduction to Human-Computer Interaction Principles and Practices (3 cr.)
Students learn the fundamental principles and practices of human-computer interaction (HCI) and evaluation. Specific focus is given to the introductory knowledge of HCI methods, tools, and techniques for designing and evaluating user interfaces through the use of low and high fidelity prototypes for the Web and software.

This course is approved for the Social Sciences component of the General Education core.

INFO-I 275 Introduction to Human-Computer Interaction Theory (3 cr.)
Students will learn the fundamental theories of human-computer interaction (HCI) and user-centered design. This course is both a survey of HCI research and an introduction to the psychological, behavioral, and other social science knowledge and techniques relevant to the design of interactive and ubiquitous computing systems.

This course is approved for the Social Sciences component of the General Education core.

HIM-M 200 Database Design for Health Information Management (3 cr.)
An introduction to database design with an emphasis on managing data in the health information environment. Topics include using a relational database system to create tables and relationships, perform normalization, and generate user forms and reports. Students conduct a large group project.

This course is approved for the Analytical Reasoning component of the General Education core.

NEWM-N 100 Foundations of New Media (3 cr.)
An exploration of the characteristics of digital media, including interactivity, hypermedia, immersion, and storytelling. Includes an introduction to the practice, theory, and history of new media, from the viewpoint of technology, communication, and culture. There are readings, demonstrations, examples, hands-on projects, and written assignments.

This course is approved for the Arts and Humanities component of the General Education core.

NEWM-N 102 Digital Media Imagery (3 cr.)
A hands-on introduction to the basic tools used in industry for the creation, editing, manipulation, and uses of 2D raster and vector graphics. Other topics include the integration of imagery into a personal Web site.

This course is approved for the Arts and Humanities component of the General Education core.

NEWM-N 131 Game On! A History of Video Games (3 cr.)
Course examines ancient and traditional games to inform a history of video games from their humble birth in the 1940's to the present. Students design and evaluate aspects of games to understand the historical development of game designs.

This course is approved for the Arts and Humanities component of the General Education core.

NEWM-N 132 Game Design Psychology: Theory and Prototyping (3 cr.)
Course explores the application of cognitive psychology and theories of learning and motivation to the design and prototyping of games. Students learn how to create games that are fun to play, and evaluate and improve games that may not be, based on psychological concepts, theories, and findings.

This course is approved for the Social Sciences component of the General Education core.

NEWM-N 201 Design Issues in Digital Media (3 cr.)
Exploration of the traditional principles of visual design, as expressed in digital design tools and applied to digital media. Topics include visual literacy, fundamental design elements and design principles, and their expression in various tools for digital design. Hands-on practice with applying design principles in several projects.

This course is approved for the Arts and Humanities component of the General Education core.

NEWM-N 260 Scriptwriting (3 cr.)
An introduction to writing for new media. Concentrating on developing ideas, concepts, plans and stories, students will generate scripts and analysis for numerous new media projects. Other topics covered include writing for scripts, grants, storyboards, and advertising and marketing plans.

This course is approved for the Arts and Humanities component of the General Education core.

Library and Information Science

INFO-C 100 Informatics Foundations (3 cr.) This course introduces informatics, basic problem-solving, and elementaryprogramming. It also provides a survey of computing tools in the context ofselected disciplines. Online delivery.

INFO-C 112 Tools for Informatics: Programming and Databases (3 cr.) This course is an introduction to programming and databases, two basic means of creating, changing, and storing information on a computer. Computational thinking, programming, and debugging methods will be covered in a high-level language. Topics also include data modeling, schemas, SQL queries, and data-entry forms. Online delivery.

INFO-C 201 Mathematical Foundations of Informatics (3 cr.) P: MATH-M118 or higher An introduction to methods of analytical, abstract, and critical thinking; deductive reasoning; and logical and mathematical tools used in information sciences. Topics include propositional and predicate logic, natural deduction proof system, sets, functions and relations, elementary statistics, proof methods in mathematics, and mathematical induction. Online delivery.

INFO-C 203 Social Informatics (3 cr.) This course introduces ethical, privacy, and legal issues in informatics as well as social research perspectives and literature on

the use of information and communication technologies. Topics include intellectual property, legal issues, societal laws, ethical use of information, information privacy laws, personal codes of ethics, principles for resolving ethical conflicts, and popular and controversial uses of technology. This course also outlines research methodologies for social informatics. Online delivery.

INFO-C 210 Problem Solving and Programming I (3 cr.) P: INFO-C112 First in a two-course sequence of intensive computer programming. In this course, students will design, develop, test, and debug software solutions. Online delivery.

INFO-C 211 Problem Solving and Programming 2 (3 cr.) P: INFO-C210 Second course in the two-course sequence of intensive computer programming. In this course, students will learn and apply object-oriented computer programming concepts and techniques. The course also will provide a brief introduction to data structures and files. Online delivery.

INFO-C 300 Human-Computer Interaction (3 cr.) This course provides an introduction to the core topics, approaches, and developments in the field of human-computer interaction (HCI). The course introduces the process involved in designing and evaluating interactive technologies. Topics include interaction design, evaluation, usability, user psychology, web design, prototyping, requirements and analysis, and other related issues. Online delivery.

INFO-C 307 Data Representation and Organization (3 cr.) P: INFO-C211 This course provides an introduction to ways in which data can be organized, represented, and processed from low level to high level. Topics include construction of memory based structures and algorithms using arrays (single, multidimensional), lists (single, double, circular), stacks, queues, binary trees, and hash tables, and basic file manipulation. Online delivery.

INFO-C 413 Web Design and Development (3 cr.) P: INFO-C211 and INFO-C300 This courses introduces Website design and development, topics include client-side technologies such as Hypertext Markup Language (HTML, XML), the document object model (DOM), Cascading Style Sheet (CSS), JavaScript and jQuery, AJAX, front-end framework, and server-side technologies. Online delivery.

INFO-C 450 System Design (3 cr.) P: INFO-C300 This course introduces the concepts of large-scale system design and development. Topics include the software development life cycle, specification, analysis, design, modeling, use cases, user interface design, planning, estimating, reusability, portability, working in teams, introductory project management, and CASE tools. Student teams will present their final project design. Online delivery.

INFO-C 451 System Implementation (3 cr.) P: INFO-C450 This course introduces the concepts of large-scale system implementation. Topics include implementation of data models, user interfaces, and software systems, working in teams, software testing, planning, estimating, and post-delivery maintenance. The students work in teams and use project management tools and revision control and source code management systems. Student teams present their final project design. Online delivery.

INFO-C 452 Project Management (3 cr.) P: INFO-C450 This course provides an in-depth discussion of project management in an informatics setting. Students become conversant in the tools and techniques of project management, such as project selection methods, work breakdown structures, network diagrams, critical path analysis, critical chain scheduling, cost estimates, earned value management, motivation theory, and team building. Online delivery.

INFO-C 399 Database Systems (3 cr.) P: INFO-C201 and INFO-C211 This course will provide an in-depth discussion of database systems fundamentals. The course emphasizes the concepts underlying various functionalities provided by a database management system, and its usage from an end-user perspective. Topics include overview and architecture of database systems, relational database modeling and querying, and basic XML database modeling and querying.

INFO-C 453 Computer and Information Ethics (3 cr.) This course covers ethical and professional issues that arise in designing and using networked information technologies and information resources. It examines frameworks for making ethical decisions, emergent technologies and their ethical implications, and information and computer professionalism. Topics include privacy, intellectual property, cybercrime, games, social justice, and codes of professional ethics.

Informatics

INFO-B 101 Introduction to Biomedical Informatics (3 cr.) This course introduces principles underpinning biomedical informatics, including concepts from anatomy and physiology, cellular and molecular biology, clinical decision support, comparative -omics, computer programming, database concepts, DNA, RNA, and protein data and their applications, electronic health records, healthcare delivery, machine learning, and natural language processing.

INFO-B 205 Topics in Biomedical Informatics (1-6 cr.) This course covers special topics in biomedical informatics, including recent trends in the field.

INFO-B 211 Information Infrastructure II (4 cr.) P: INFO-B210 This course focuses on more advanced web application development than those in INFO-B 210 using the Python language and environment. It uses methodologies such as object-oriented programming and pattern based design to discuss how to develop relatively advanced, reliable, and reusable web applications.Note: This course involves programming in Python using biomedical data. It is especially suitable for life and health science majors, such as students in the Bachelor of Science in Biomedical Informatics.

INFO-B 405 Social Foundations of Biomedical Informatics (3 cr.) This course introduces the economics of information businesses and societies. It examines how the use of information and information technology is influenced by laws and regulations, the ownership of intellectual property, and organizational culture.

INFO-B 406 Biomedical Informatics (3 cr.) Course covers the latest biomedical informatics concepts,

technologies, policies, and skills, including infrastructure and data management, imageanalytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer outcomes from data processing and analysis, and master the tools required for biomedical data analytics.

INFO-B 406 Biomedical Informatics (3 cr.) Course covers the latest biomedical informatics concepts, technologies, policies, and skills, including infrastructure and data management, imageanalytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer outcomes from data processing and analysis, and master the tools required for biomedical data analytics.

INFO-B 406 Biomedical Informatics (3 cr.) Course covers the latest biomedical informatics concepts, technologies, policies, and skills, including infrastructure and data management, imageanalytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer outcomes from data processing and analysis, and master the tools required for biomedical data analytics.

INFO-B 413 The Design, Implementation, and Evaluation of Electronic Health Record Systems (3 cr.) Students learn how to design, implement, and evaluate electronic health record (EHR) system and how to use technology to support their data acquisition, storage, reuse, interoperability, exchange, and analysis. They also evaluate their legal, ethical, and regulatory implications and learn how to build teams to manage their implementation in healthcare organizations.

INFO-B 406 Biomedical Informatics (3 cr.) Course covers the latest biomedical informatics concepts, technologies, policies, and skills, including infrastructure and data management, imageanalytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer outcomes from data processing and analysis, and master the tools required for biomedical data analytics.

INFO-B 429 Machine Learning for Bioinformatics (3 cr.) Course covers machine learning theories and methods and their application to biological sequence analysis, gene expression data analysis, genomics and proteomics data analysis, and other problems in bioinformatics.

INFO-B 430 Introduction to Health Informatics (3 cr.) This course introduces the foundations of health informatics. It reviews how information science and computer technology can be applied to enhance research and practice in healthcare. The basic principles of informatics that govern communication systems, clinical decisions, information retrieval, telemedicine, bioinformatics and evidence-based medicine will be explored.

INFO-B 435 Clinical Information Systems (3 cr.) This course covers human-computer interface and systems design, healthcare decision support and clinical guidelines, system selection, organizational issues in system integration, project management for information technology change, system evaluation, regulatory policies, impact of the Internet, economic impacts of e-health, distributed healthcare information technologies, and future trends.

INFO-B 436 Computational Methods for Biomedical Informatics (3 cr.) Course covers algorithm design, algorithm analysis, and complexity analysis and their applications in biomedical informatics.

INFO-B 441 Business of Health Informatics (3 cr.) Course examines the economic impact of the adoption of healthcare information technology. Students explore its role as a strategic asset and analyze its return on investment to make a case for investment. Topics include decision support system, barcode tracking, electronic health records, and pay-for-performance incentives.

INFO-B 442 Clinical Decision Supports Systems (3 cr.) Course examines clinical decision support systems (CDSS), both the current state of the art and their historical development. Topics include the application of CDSS to clinical practice, patient-centered CDSS, clinical vocabularies, legal and ethical issues, and mathematical foundations of the knowledge-based and pattern recognition systems.

INFO-B 443 Natural Language Processing (3 cr.) P: INFO-B 210 OR CSCI-A 204 OR CSCI-C 200 OR CSCI 23000; Recommended: Statistics (ECON-E 270 or PBHL-B 280 or PBHL-B 300 or PBHL-B 301 or PBHL-B 302 or PSY-B 305 or SPEA-K 300 or STAT-I301 or STAT-I350) OR INFO-I 415 This course introduces the theory and methodology of natural language understanding and generation. Topics include stemming, lemmatization, parts of speech tagging, parsing, and machine translation. Employing specialized libraries, students develop applications for topic modeling, sentiment analysis, and text summarization.

INFO-B 444 Consumer Health Informatics (3 cr.) Course explores how technologies are used to deliver healthcare to the public. Topics include access to patient data and privacy issues, consumer access to clinical information and current research, the design and development of consumer health information resources, health literacy and health information literacy, information quality, and models for information delivery, including the Internet.

INFO-B 406 Biomedical Informatics (3 cr.) Course covers the latest biomedical informatics concepts, technologies, policies, and skills, including infrastructure and data management, imageanalytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer outcomes from data processing and analysis, and master the tools required for biomedical data analytics.

INFO-B 473 Application Programming for Biomedical Data Analysis (3 cr.) Course covers Perl, R, and SQL programming for analyzing biomedical datasets. It includes Unix system administration, MySQL database management, and the R statistical package. Students learn which computational approach to take in developing translational applications to solve biomedical problems.

INFO-B 474 Next Generation Sequencing Data Analysis (3 cr.) Course covers basic concepts of genomic sequencing datasets from several sequencing platforms, including how the data motivates computational

needs and methods for analysis. Students learn how to devise approaches for analyzing massive clinical and biomedical sequencing datasets and for developing sound hypotheses and predictions from them.

INFO-B 481 Health Information Standards and Terminologies (3 cr.) Health information standards specify representation of health information for communication between information systems. Standards not only standardize data formats, but also the conceptualizations underlying the data structures. The design process of data standards, domain analysis, conceptualization, modeling, and the methods and tools commonly used are explored.

INFO-B 482 Health Information Exchange (3 cr.) Course introduces health information exchange (HIE), the electronic transfer of administrative and clinical information among healthcare organizations. Students examine strategic, organizational, legal, technical, and sociopolitical aspects of HIE initiatives in the U.S. and abroad, including their impact on healthcare quality, safety, efficiency, and cost.

INFO-B 483 Security and Privacy Policies and Regulations for Healthcare (3 cr.) Course discusses privacy and security regulations for healthcare information transactions including policy, procedures, guidelines, security architectures, risk assessments, disaster recovery, and business continuity. Particular attention is given to the Health Insurance Portability and Accountability Act (HIPAA) and the Health Information Technology for Economic and Clinical Health (HITECH) Act.

INFO-B 406 Biomedical Informatics (3 cr.) Course covers the latest biomedical informatics concepts, technologies, policies, and skills, including infrastructure and data management, imageanalytics, visualization, and API design and implementation for healthcare. Students analyze healthcare and biomedical information, infer outcomes from data processing and analysis, and master the tools required for biomedical data analytics.

Computer and Information Science Undergraduate

CSCI-A 205 Computer Programming (4 cr.) P: CSCI-A 201 or CSCI-A 204 or CSCI 23000 or INFO-B 210 Computer programming, algorithms, program structure, arrays, stacks-procedures, functions, modularization parameter-passing-mechanisms, recursion vs. iteration, and issues of programming style. Computer solutions of problems in diverse fields.

CSCI-B 355 Autonomous Robotics (3 cr.) P: CSCI-C 335 or CSCI 40300 Introduction to the design, construction, and control of autonomous mobile robots. This course covers the basic mechanics, electronics, and programming for robotics, and the applications of robots in cognitive science.

CSCI-B 365 Introduction to Data Analysis and Mining (3 cr.) P: CSCI-C 310 or CSCI-C 343 The course objective is to study computational aspects of discovering patterns and relationships in large data. This course is designed to introduce fundamental concepts of data mining and provide hands-on experience in data collection, preprocessing, analysis, clustering and prediction.

CSCI-B 392 Competitive Programming (3 cr.) P: CSCI-C 310 or CSCI-C 343 This course prepares students for programming contests (such as the ACM International Collegiate Programming Contest). The students will learn to design time and space-efficient algorithms to solve challenging contest problems and produce bug-free code under the time pressure in the contest.

CSCI-B 401 Fundamentals of Computer Theory (3 cr.) P: CSCI-C 310, CSCI-C 343, or CSCI 36200 Fundamentals of formal language theory, computation models and computability, the limits of computability and feasibility, and program verification.

CSCI-B 404 Introduction to Cryptography (3 cr.) P: CSCI-C 310 or CSCI-C 343 or CSCI 36200 The course provides students with a foundational introduction to cryptography. Students learn the basic primitives used in cryptography, such as symmetric encryption, public-key encryption, message authentication codes, digital signatures, cryptographic hashes, and related material. Computational aspects of modern cryptography are stressed, as are appropriate security models and computational security reductions.

CSCI-B 404 Introduction to Cryptography (3 cr.) P: CSCI-C 310 or CSCI-C 343 or CSCI 36200 The course provides students with a foundational introduction to cryptography. Students learn the basic primitives used in cryptography, such as symmetric encryption, public-key encryption, message authentication codes, digital signatures, cryptographic hashes, and related material. Computational aspects of modern cryptography are stressed, as are appropriate security models and computational security reductions.

CSCI-B 424 Parallel and Distributed Programming (3 cr.) P: CSCI-C 310 or CSCI-C 343 Overview of parallel computers, shared memory, message passing, MIMD, and SIMD classifications. Understanding and use of message passing and synchronization facilities such as MPI. Study of parallel programming models such as master-slave, client-server, task-farming, divide-and-conquer, and pipeline. Performance analysis of parallel systems, execution time, time complexity, load balancing, and scalability.

CSCI-B 430 Security for Networked Systems (3 cr.) P: CSCI-C 310, CSCI-C 343, or CSCI 36200 This course is an extensive survey of network security. The course materials cover threats to information confidentiality, integrity, and availability in different internet layers, and defense mechanisms that control these threats. The course also provides a necessary foundation on network security, such as technologies for cryptography, primitives/protocols, authentication, authorization, and access control. It includes hands-on experiences through programming assignments and course projects.

CSCI-B 438 Fundamentals of Computer Networks (3 cr.) P: CSCI-C 335 or CSCI 40300 History, theory, and design of data communicating between devices. Topics include the history of computer networks, network architecture and topology, local- and wide-area networks, ISO network layers, current and future IEEE standards for networks, and network operating systems.

CSCI-B 443 Introduction to Computer Architecture (3 cr.) P: CSCI-C 310 or CSCI-C 343 Principles of

processors, control units, and storage systems. Registers, buses, microprogramming, virtual storage. Relationship between computer architecture and system software.

CSCI-B 457 Introduction to Computer Vision (3 cr.) In this course, the students will learn fundamental computer vision algorithms and basic machine learning frameworks necessary for the automated understanding of images and videos. Topics will include object recognition from images, activity/event recognition from videos, scene segmentation and clustering, motion and tracking, and deep learning for images and videos.

CSCI-B 459 Efficient Artificial Intelligence (3 cr.) P: CSCI-C 310 Data Structures – Python or CSCI-C 343 Data Structures – Java This course covers efficient artificial intelligence theories and techniques for designing advanced machine learning models. The goal is to optimize architecture, implementation, performance, power, memory, and time. Students learn efficient AI theories, patterns in AI, critical pattern determination, AI complexity, AI optimization, large deep models, real-time inference, and practical applications.

CSCI-B 457 Introduction to Computer Vision (3 cr.) In this course, the students will learn fundamental computer vision algorithms and basic machine learning frameworks necessary for the automated understanding of images and videos. Topics will include object recognition from images, activity/event recognition from videos, scene segmentation and clustering, motion and tracking, and deep learning for images and videos.

CSCI-B 475 CSCI-C 343 Data Structures (or CSCI-C 310 or CSCI 36200) (3 cr.) This course introduces quantum computing, including single and multiple-qubit systems; quantum states, superposition, measurements, and entanglement; and quantum gates and circuits. Students learn principles of quantum algorithms like Simon's, Shor's factorization, and Grover's search. Topics may include quantum information, programming, hardware, cryptography, and machine learning applications.

CSCI-B 477 Security Engineering (3 cr.) P: CSCI-C 310 or CSCI-C 343 or CSCI 36200 This course covers a broad range of topics in system security engineering, including authentication and authorization, cryptography, architectures, detection systems, quantum computing security, risk assessment, social engineering, strategic policy, and trustworthy hardware. Students conduct research activities, such as selecting research topics, writing papers, and presenting their results.

CSCI-C 155 Problem Solving and Programming I (4 cr.) This course introduces problem-solving by programming in Java. Programming concepts include data types, control structures, arrays, methods, exception handling, and input/output. Object-oriented thinking is acquired by using classes and objects. Students learn how to solve problems by designing, implementing, and testing simple Java programs.

CSCI-C 200 Introduction to Computers and Programming (4 cr.) This course is an introduction, broadly, to algorithmic thinking and, specifically, to programming. It teaches the basics of programming using real-world applications in the natural, physical, and social sciences. Students will develop the ability to program by identifying problems in the real world and then creating a program that solves the problem.

CSCI-C 212 Introduction to Software Systems (3 cr.) P: CSCI-C 200 OR INFO-B 210 OR CSCI 23000 Design of computer software systems and introduction to programming in a contemporary operating system environment. Topics include a modern object-oriented programming language, building and maintaining large projects, and understanding the operating system interface.

CSCI-C 241 Discrete Structures for Computer Science (3 cr.) Induction and recursive programs, running time, asymptotic notations, combinatorics and discrete probability, trees and lists, the relational data model, graph algorithms, and propositional and predicate logic.

CSCI-C 255 Problem Solving and Programming II (4 cr.) P: CSCI-C 155 or INFO-C 210 This course continues to explore how to solve problems by programming in Java. Topics include abstract classes and interfaces, event-driven programming, user interface controls, animation and multimedia, binary input/output, recursion, generics, lists, stacks, queues, priority queues, sets, and maps. Students learn programming techniques to solve problems for various applications.

CSCI-C 291 System Programming with C and Unix (3 cr.) This course introduces programming using the C language in a Unix (Linux) environment. The key ideas to be discussed are the Unix shell, file system, and basic shell commands, the Emacs text editor, and the C programming language.

CSCI-C 308 Placeholder (3 cr.)

CSCI-C 310 Data Structures – Python (3 cr.) P: CSCI-C 212 OR CSCI 24000 OR INFO-B 211 OR CSCI-A 205 AND CSCI-C 241 OR INFO-I 201 OR CSCI 34000 The focus of this course is on solving computational problems that involve manipulating collections of data. We will study a core set of data abstractions, data structures, and algorithms that provide a foundation for writing efficient programs.

CSCI-C 311 Programming Languages (3-4 cr.) P: CSCI-C 310, CSCI-C 343, or CSCI 36200 A systematic approach to programming languages. Relationships among languages, properties, and features of languages; and the computer environment necessary to use languages.

CSCI-C 323 Mobile Application Development (3 cr.) This course focuses on developing mobile applications for modern platforms and introduces common tools and languages used. The course will emphasize the app development cycle: application design, development, testing, publishing, and distribution; development tools and emulators/simulators; user interface layout; using sensors including touch, geo-location, and orientation; and data management.

CSCI-C 335 Placeholder (3 cr.)

CSCI-C 343 Data Structures – Java (3 cr.) P: CSCI-C 212 OR CSCI 24000 OR CSCI-A 255 AND CSCI-C 241 OR INFO-I 201 OR CSCI 34000 This course systematically studies data structures encountered in computing problems, structure and use of storage media,

methods of representing structured data, and techniques for operating on data structures.

CSCI-C 407 Introduction to Digital Forensics (4 cr.) Overview of the principles and practices of digital forensics, emphasize the different techniques and procedures to analyze physical storage media. Students will study the underpinnings of common operating systems and various formats for file storage and transmission, including secret hiding places unseen by the user or the operating system.

CSCI-C 435 Placeholder (3 cr.)

CSCI-C 437 Computer Security (4 cr.) P: CSCI-C 335 or CSCI-B 443 OR CSCI 40200 Introduction to the principles, mechanisms, policies, and implementation for computer security; learn how attacks are carried out, how to defend against attacks, and how to design systems to withstand them.

CSCI-C 442 Database Systems (3 cr.) P: CSCI-C 310 or CSCI-C 343 or CSCI 36200 Study of fundamental concepts, theory and practices in design and implementation of database management systems. Topics include data independence, data modeling, ER modeling, functional dependencies, normalization, relational, hierarchical, network and object oriented data models, relational algebra, relational calculus, data definition and manipulation languages, recovery, concurrency, security, and integrity of data.

CSCI-C 455 Analysis of Algorithms (3-4 cr.) P: CSCI-C 310, CSCI-C 343, or CSCI 36200

CSCI-C 460 Senior Project 1 (3 cr.) Students work on projects in supervised teams, from planning and design to implementing, testing, and releasing a final product. Teamwork, communication, and organizational skills are emphasized in a real-world-style environment.

CSCI-C 463 Artificial Intelligence I (3 cr.) P: CSCI-A 204 or CSCI-A 202 or CSCI-C 201 or CSCI 24000 or INFO-B 211 or CSCI-A 255 or CSCI-C 212 Goals of artificial intelligence, relations with other fields. Introduction to knowledge representation and inference: predicate calculus, frames, semantic networks, and connectionist representation schemes. Pattern recognition and pattern association. Computer vision. Natural language processing: speech recognition, syntax, and semantics. Heuristic search. Extensive laboratory exercises.

CSCI-C 470 Senior Project II (3 cr.) Students work on projects in supervised teams, from planning and design to implementation, testing and releasing of a final product. Teamwork, communication, and organizational skills are emphasized in a real-world-style environment.

CSCI-C 486 Senior Capstone Project (3 cr.) P: Instructor's approval A capstone experience based on the knowledge and skills acquired in earlier coursework. Students work on projects in supervised teams, from planning and design to implementation, testing and releasing of a final artifact. Teamwork, communication, and organizational skills are emphasized in a real-world-style environment.

CSCI-C 490 Seminar in Computer Science (1-4 cr.) This course covers special topics in computer science, including recent trends in the field.

CSCI-N 200 Principles of Computer Science (3 cr.) Explore the Big Ideas of Computer Science (CS) and Computational Thinking (CT) through hands-on explorations with social networking, gaming, big data, robots, programming and more. Learn about the creativity, usefulness and breadth of Computer Science in a fun way that can enhance any field of study.

CSCI-N 201 Programming Concepts (3 cr.) This course covers basic computing topics, problem-solving techniques, and their computing application. It introduces programming concepts, focusing on language-independent principles, including algorithm design, debugging strategies, essential control structures, and basic data structure concepts.

CSCI-N 207 Data Analysis Using Spreadsheets (3 cr.) Summary of basic computing topics. An introduction to data analysis using spreadsheets. Emphasis on the application of computational problem-solving techniques.

CSCI-N 211 Introduction to Databases (3 cr.) Summary of basic computing topics. Introduction to database design concepts, creation of user forms, development of databases, querying techniques, and building reports. Focus on relational database systems from a development and administration point of view.

CSCI-N 241 Fundamentals of Web Development (3 cr.) Introduction to writing content for the Internet and World Wide Web. Emphasis on servers, hand-coded HTML, Cascading Style Sheets, and extending HTML with other Web technologies. Lecture and laboratory.

CSCI-N 299 Survey of Computing Applications (topic varies) (1-3 cr.) An introduction to an emerging technology in the computing field. It will emphasize the various problems technology helps to solve and specific problem-solving strategies. Lecture and laboratory. May be repeated for credit.

CSCI-N 301 Fundamental Computer Science Concepts (3 cr.) P: MATH-M 118. An introduction to fundamental principles of computer science, including hardware architecture, algorithms, software engineering, and data storage. Lecture and laboratory.

CSCI-N 311 Advanced Database Programming, Oracle (3 cr.) P: Recommended CSCI-N 211 or equivalent. Focus on the concepts and skills required for database programming and client server development. Concepts will apply to any modern distributed database management system. Emphasis on developing Oracle SQLPlus scripts, PL/SQL server side programming, and Oracle database architecture. Students with programming experience in ODBC compliant languages will be able to practice connecting such languages to an Oracle database. Lecture and laboratory.

CSCI-N 317 Computation for Scientific Applications (3 cr.) A survey and illustration of popular computational software used in multiple scientific domains to support data processing and scientific research. This class focuses on teaching how to use software to efficiently process data in terms of modeling, simulating, visualizing and data-mining. Fundamental concepts related to scientific computing are introduced briefly. Lecture and Lab.

CSCI-N 341 Introduction to Client-Side Web Programming (3 cr.) P: Recommended CSCI-N 241 or equivalent. Introduction to programming with a focus on the client-side programming environment. Programming using languages commonly embedded in Web browsers. Lecture and laboratory.

CSCI-N 342 Server-Side Programming for the Web (3 cr.) P: Recommended CSCI-N 341. Designing and building applications on a Web server. Focuses on the issues of programming applied to Web servers. Emphasis on relational database concepts, data design, languages used on the server, transaction handling, and integration of data into Web applications.

CSCI-N 361 Fundamentals of Software Project Management (3 cr.) Tools and techniques used to manage software projects to successful completion. Problem-solving focus to learn specification development and management, program success metrics, UML modeling techniques, code design and review, principles, testing procedures, usability measures, release and revision processes, and project archival. Lecture and laboratory.

CSCI-N 399 Topics in Computing (topic varies) (1-3 cr.) An investigation of an emerging language or topic in computing. May be repeated for credit.

CSCI-N 410 Mobile Computing Application Development (3 cr.) Focus of this course is to give programmers information they need to develop new applications or move existing applications to handheld devices and other resource-constrained hardware. All programming is done via Visual Basic.NET or C#.

CSCI-N 431 E-Commerce with ASP.NET (3 cr.) Topics include basic Web controls, form validation, connecting to an Enterprise-level database, SSL, and sending email within an ASP.NET Web page. A significant software development final project creating a functional Web store is featured. Lecture and laboratory.

CSCI-N 499 Topics in Applied Computing (topic varies) (1-3 cr.) P: CSCI-N 300-level course or equivalent. An investigation and examination of an emerging discipline in applied computer science.

CSCI-P 434 Distributed Systems (4 cr.) Principles of distributed systems, including system design, distributed algorithms, consistency and concurrency, and reliability and availability. The role of these foundational issues in distributed file systems, distributed computing, and data-driven systems.

CSCI-P 465 Software Engineering for Information Systems I (3 cr.) Analysis, design, and implementation of information systems. Project specification. Data modeling. Software design methodologies. Software quality assurance. Supervised team development of a real system for a real client.

CSCI-P 465 Software Engineering for Information Systems I (3 cr.) Analysis, design, and implementation of information systems. Project specification. Data modeling. Software design methodologies. Software quality assurance. Supervised team development of a real system for a real client.

CSCI-Y 390 Independent Study (3 cr.) P: CSCI-C 310 Data Structures – Python or CSCI-C 343 Data Structures – Java Independent research based on existing literature or original work. A report, in the style of a departmental technical report, is required.

CSCI-Y 398 Internship in Professional Practice (1-6 cr.) Designed to provide opportunities for students to receive credit for selected, career-related, full-time or part-time work. Evaluation by employer and faculty sponsor.

CSCI-Y 399 Project in Professional Practice (3 cr.) The student designs, programs, verifies, and documents a project assignment selected in consultation with an employer and the department.

Graduate

CSCI-P 567 Software Quality Assurance (3 cr.) P: Graduate Student standing in Department of Computer Information Science. Models, algorithms, recurrences, summations, growth rates. Probabilistic tools, upper and lower bounds; worst-case and average-case analysis, amortized analysis, dynamization. Comparison-based algorithms: search, selection, sorting, hashing. Information extraction algorithms (graphs, databases). Graphs algorithms: spanning trees, shortest paths, connectivity, depth-first search, breadth-first search.

CSCI-C 591 Research Seminar (0-1 cr.) P: CS graduate standing or instructor consent required. First-year seminar in research methods and current research directions of the faculty. Repeatable.

CSCI-B 503 Algorithm Design and Analysis (3 cr.) This course covers models, algorithms, recurrences, summations, and growth rates. Topics include probabilistic tools, upper and lower bounds, worst-case and average-case analysis, amortized analysis, and dynamization. Comparison-based algorithms include search, selection, sorting, and hashing. The course also covers information extraction algorithms for graphs and databases. Graphs algorithms include spanning trees, shortest paths, connectivity, depth-first search, and breadth-first search.

CSCI-B 561 Advanced Database Concepts (3 cr.) Database models and systems, especially relational and object-oriented; relational database design theory; structures for efficient data access; query languages and processing; database applications development; views. Transaction management: concurrency and recovery.

CSCI-P 538 Computer Networks (3 cr.) This course covers the layered TCP/IP architecture, LAN technologies (e.g., ethernet, wireless), switching, Internet Protocol (IPv4, IPv6), routing protocols, transport protocols (TCP, UDP), and application protocols and models (e.g., DNS, HTTP, client-server, peer-to-peer networks). Topics also include DHCP, ICMP, VPNs, software-defined networking, and mobile networks.

CSCI-B 555 Machine Learning (3 cr.) P: Programming, calculus, linear algebra, probability, and statistics This course covers the theory and practice of constructing algorithms that learn functions and choose optimal decisions from data and knowledge. Topics include mathematical and probabilistic foundations, MAP classification/regression, linear and logistic regression, neural networks, support vector machines, Bayesian networks, tree models, committee machines, kernel

functions, EM, density estimation, accuracy estimation, normalization, and model selection.

CSCI-B 565 Data Mining (3 cr.) This course covers algorithmic and practical aspects of discovering patterns and relationships in large databases. The course also provides hands-on experience in data analysis, clustering, and prediction. Topics include data preprocessing and exploration, data warehousing, association rule mining, classification and regression, clustering, anomaly detection, human factors, and social issues in data mining.

CSCI-B 504 Introduction to Cryptography (3 cr.) The course provides students with a foundational introduction to cryptography. Students learn the basic primitives used in cryptography, such as symmetric encryption, public-key encryption, message authentication codes, digital signatures, cryptographic hashes, and related material. Computational aspects of modern cryptography are stressed, as are appropriate security models and computational security reductions.

CSCI-B 577 Security Engineering (3 cr.) This course covers a broad range of topics in system security engineering, including authentication and authorization, cryptography, architectures, detection systems, quantum computing security, risk assessment, social engineering, strategic policy, and trustworthy hardware. Students conduct research activities, such as selecting research topics, writing papers, and presenting their results.

CSCI-B 575 Quantum Computing and Applications (3 cr.) P: Programming, systems, and linear algebra This course introduces quantum computing, including single and multiple-qubit systems; quantum states, superposition, measurements, and entanglement; and quantum gates and circuits. Students learn principles of quantum algorithms like Simon's, Shor's factorization, and Grover's search. Topics may include quantum information, programming, hardware, cryptography, and machine learning applications.

CSCI-H 510 Statistics for Data Science (3 cr.) This course introduces statistical inference for big data. It covers distributions, confidence intervals, hypothesis testing, ANOVA, linear models, bias, model critique, and effective data communication. Students learn data analysis, wrangling, and visualization through hands-on programming projects.

CSCI-B 516 Engineering Cloud Computing (3 cr.) This course covers cloud system architectures, emphasizing network architectures, server and storage virtualization, data center topologies, and mobile cloud computing, building on knowledge of computer architectures, networks, and operating systems. While honing their research skills, students study cloud systems' trustworthiness, including security and privacy, and related economics, laws, and regulations.

CSCI-P 532 Object-Oriented Software Development (3 cr.) This course will help turn motivated students into superior contributors to small- to mid-sized commercial or open-source software projects. It takes a hands-on, learning-by-doing approach. Students are introduced to design patterns, tools, and teamwork strategies from the first assignment to the last project.

CSCI-P 536 Advanced Operating Systems (3 cr.) P: Graduate Student standing in Department of Computer Information Science. Advanced operating system topics include multi-tasking, synchronization mechanisms, distributed system architecture, client–server models, distributed mutual exclusion and concurrency control, agreement protocols, load balancing, failure recovery, fault tolerance, cryptography, and multiprocessor operating systems.

CSCI-P 539 Sensor Networks and the Internet of Things (3 cr.) P: CSCI-P 538 Computer Networks This course covers principles of wireless sensor networks and the Internet of Things. Students learn to design and analyze sensor networks and their applications. Topics include sensor network architectures, MAC layer, routing, data dissemination, transport protocols, operating systems, programming, querying, management, and applications.

CSCI-B 543 Computer Architecture (3 cr.) P: CSCI-C 335 and 343 or honors versions; ECE 36500 or CS 40200 Fundamentals of computer design, instruction processing, and performance analysis. Single-processor systems' architecture focuses on pipelining, memory and memory hierarchies, and interconnect technology. Exploration of architecture classes such as high-performance multiprocessors, massively parallel computers, and embedded systems.

CSCI-B 547 Systems and Protocol Security and Information Assurance (3 cr.) P: CSCI-B 504 Introduction to Cryptography This course covers the design and analysis of secure systems, including identifying security goals and risks, threat modeling and defense, integrating different technologies to achieve security goals, developing security protocols and policies, implementing security protocols, and secure coding. Real-world scenarios with many security requirements are studied.

CSCI-B 551 Elements of Artificial Intelligence (3 cr.) Introduction to major issues and approaches in artificial intelligence. Principles of reactive, goal-based, and utility-based agents. Problem-solving and search. Knowledge representation and design of representational vocabularies. Inference and theorem proving, reasoning under uncertainty, and planning. Overview of machine learning.

CSCI-B 558 Deep Learning (3 cr.) P: CSCI-B 551 Elements of Artificial Intelligence or CSCI-B 555 Machine Learning or CSCI-B 565 Data Mining or INFO-H 515 Statistical Learning This course covers deep learning neural networks. Topics include logistic regression, feedforward networks, autoencoders, convolutional neural networks, recurrent neural networks, graph neural networks, deep generative models, adversarial and reinforcement learning, and optimization and regularization techniques. Students also delve into recent research and learn through projects to develop deep learning systems.

CSCI-P 566 Software Engineering II (3 cr.) P: CSCI-P 538 Computer Networks This course covers the analysis, design, and implementation of software systems. Students learn requirements specifications through data and process modeling, software design methodologies, and software quality assurance, including testing and

verification. The course also covers software development processes.

CSCI-B 570 Wireless and Mobile Security (3 cr.) P: CSCI-P 538 Computer Networks or CSCI 53600 Data Communication and Computer Networks This course covers challenges and strategies for safeguarding wireless and mobile systems. Students learn to identify, assess, and mitigate security risks, including authentication and authorization, distributed denial of service, jamming, malware injection, and side-channel attacks. Topics include security for blockchain, machine learning, mobile crowdsourcing, Internet of Things, and voice-controlled systems.

CSCI-P 583 Data Visualization (3 cr.) This course covers the theory, design, and application of scientific and information visualization, including algorithm design and implementation. Students learn to represent multidimensional data using computer graphics and other techniques, enabling users to interact with it. Projects span biomedical data analysis, scientific and engineering simulations, and visual web data mining.

CSCI-B 649 Topics in System (3 cr.) Special topics in systems. This course covers advanced principles, algorithms, and architectures for designing and optimizing high-performance computing systems. Students analyze real-world case studies and cutting-edge research to develop expertise in scalable, reliable, and efficient computing infrastructures for diverse applications.

CSCI-B 651 Natural Language Processing (3 cr.) P: CSCI-B 551 or CSCI-B 555 or CSCI-B 565 or INFO-H 515 Theory and methods for natural language processing. Algorithms for sentence parsing and generation. Context-free and unification grammars. Question-and-answer systems. Analysis of narratives. Finite-state approaches to computational phonology and morphology. Machine translation. Machine learning of natural language. Speech recognition. Neural network and statistical alternatives to symbolic approaches.

CSCI-B 654 Explainable Artificial Intelligence (3 cr.) P: CSCI-B 503 and one of the following: CSCI-B 551, CSCI-B 555, CSCI-P 558, INFO-H 515, or INFO-H 518 This course covers explainable artificial intelligence methodologies and techniques for effective model building. The goal is to leverage explainability design principles to build powerful, complex, and transparent models. Students learn methodologies, parametric models, nonparametric models, deep learning complexity, activation and saliency maps, attention and transformer, compliance and ethics, and applications.

CSCI-B 658 Trustworthy Causal Artificial Intelligence (3 cr.) P: None This course explores how causal methods enhance AI-model trustworthiness. Students apply causal models to represent cause-effect relationships governing human understanding, improving generalization to novel data and yielding fairer, more interpretable results. Topics include AI robustness, privacy, safety, and accountability; tradeoffs among assumptions; associational, causal, and counterfactual conclusions; and trustworthiness architectures.

CSCI-Y 790 Graduate Independent Study (1-6 cr.) P: Permission from a faculty mentor and department approval. This course engages graduate students in focused, independent study and research under the supervision of a faculty mentor. The course is intended for students who wish to explore specialized topics not covered in existing courses or conduct original research. The course culminates in a written report or project demonstrating the student's understanding and contributions to the chosen topic.

CSCI-Y 791 Graduate Independent System Development (1-6 cr.) P: Permission from a faculty mentor and department approval. This course offers graduate students the opportunity to design and develop a substantial system under the guidance of a faculty mentor. During the course, students hone their skills in creativity and problem-solving. Students compose a detailed report on the system's architecture, features, and performance. The course culminates in the system's public release, showcasing their achievement and contribution to the broader community.

CSCI-Y 792 Master's Thesis (1-6 cr.) Readings and research under the supervision of the master's thesis advisor, leading to a thesis at a level admissible as a departmental technical report.

CSCI-Y 890 Thesis Readings and Research (1-12 cr.) P: Nomination to Candidacy Research under the direction of a graduate faculty member leading to a Ph.D. dissertation.

CSCI-Y 794 Master's Project (1-6 cr.) P: None This course enables students to apply advanced computer science skills to a capstone project. Students design, develop, and test solutions to real-world problems, culminating in a report and presentation. Projects may involve industry collaboration or faculty mentorship, emphasizing innovation and professional practices.

CSCI-G 901 Advanced Research (6 cr.) P: CSCI-Y 890 Thesis Readings and Research Available to graduate students who have completed all course requirements for their doctorates, have passed doctoral qualifying examinations, and have the requisite number of degree credit hours, this course provides the advanced research student with a forum for sharing ideas and problems under the supervision of a senior researcher.

CSCI-B 657 Computer Vision (3 cr.) Concepts and methods of machine vision as a branch of artificial intelligence. Basics of digital image processing. Local and global tools for deriving information from image data. Model-based object recognition and scene understanding.

CSCI-B 659 Topics in Artificial Intelligence (3 cr.) Special topics in artificial intelligence. This course covers recent advances in artificial intelligence. While engaging in research, students investigate advanced AI concepts such as autonomous systems, computer vision, deep learning, explainable AI, generative adversarial networks, human–robot interaction, natural language processing, quantum machine learning, and virtual assistants.

CSCI-Y 793 Master's Software Thesis (1-6 cr.) A major software development project, possibly performed jointly with other students, documented in the public domain, and with final approval by three graduate faculty.

Informatics

AII-I 100 Introduction to Artificial Intelligence (3 cr.) This course presents current real-world applications of

AI with multiple case studies. Students learn the history of AI and how its coming pervasiveness could impact the future. Topics include heuristic search, machine learning, automated decision-making, and interaction with the physical world. Programming-based assignments enable students to learn AI techniques.

AII-I 200 Introduction to Data Science (3 cr.) This course introduces data science and programming in the R statistical computing environment. Students learn relevant concepts from statistics, mathematics, and computer science. Topics include data manipulation, analysis, modeling, and visualization. Students gain experience analyzing real-world datasets from science, government, and industry.

AII-I 300 Collaborative Human–AI Systems (3 cr.) This course introduces human-AI interaction design for systems that solve problems neither humans nor artificial intelligence could solve alone.Topics include interpretability, transparency, trust, and AI ethics. Student projects focus on developing applications where AI provides cognitive and perceptual augmentation to humans.

INFO-B 443 Natural Language Processing (3 cr.) P: INFO-B 210 OR CSCI-A 204 OR CSCI-C 200 OR CSCI 23000; Recommended: Statistics (ECON-E 270 or PBHL-B 280 or PBHL-B 300 or PBHL-B 301 or PBHL-B 302 or PSY-B 305 or SPEA-K 300 or STAT-I301 or STAT-I350) OR INFO-I 415 This course introduces the theory and methodology of natural language understanding and generation. Topics include stemming, lemmatization, parts of speech tagging, parsing, and machine translation. Employing specialized libraries, students develop applications for topic modeling, sentiment analysis, and text summarization.

INFO-B 585 Biomedical Analytics (3 cr.) Course introduces the use of patient data, genomic databases, and electronic health records (EHR) to improve patient care and to achieve greater efficiencies in public and private healthcare systems. The course explores clinical intelligence and the role of analytics in supporting a data-driven learning healthcare system. Topics include the value-driven healthcare system, measuring health system performance, existing quality/performance measurement frameworks (NQF, HEDIS), comparing healthcare delivery, attributes of high performing healthcare systems, and the IT infrastructure and human capital needed to leverage analytics for health improvement.

INFO-B 621 Computational Techniques in Comparative Genomics (3 cr.) Course will summarize computational techniques for comparing genomes on the DNA and protein sequence levels. Topics include state-of-the-art computational techniques and their applications: understanding of hereditary diseases and cancer, genetic mobile elements, genome rearrangements, genome evolution, and the identification of potential drug targets in microbial genomes.

CSCI-B 355 Autonomous Robotics (3 cr.) Introduction to the design, construction, and control of autonomous mobile robots. This course covers the basic mechanics, electronics, and programming for robotics, and the applications of robots in cognitive science.

CSCI-B 551 Elements of Artificial Intelligence (3 cr.) Introduction to major issues and approaches in artificial intelligence. Principles of reactive, goal-based, and utility-based agents. Problem-solving and search. Knowledge representation and design of representational vocabularies. Inference and theorem proving, reasoning under uncertainty, and planning. Overview of machine learning.

CSCI-P 558 Deep Learning (3 cr.) P: CSCI-B 551 Elements of Artificial Intelligence or CSCI-B 555 Machine Learning or CSCI-B 565 Data Mining or INFO-H 515 Statistical Learning This course covers deep learning neural networks. Topics include logistic regression, feedforward networks, autoencoders, convolutional neural networks, recurrent neural networks, graph neural networks, deep generative models, adversarial and reinforcement learning, and optimization and regularization techniques. Students also delve into recent research and learn through projects to develop deep learning systems.

CSCI-B 559 Efficient Artificial Intelligence (3 cr.) P: None This course covers efficient artificial intelligence theories and techniques for designing advanced machine learning models. The goal is to optimize architecture, implementation, performance, power, memory, and time. Students learn efficient AI theories, patterns in AI, critical pattern determination, AI complexity, AI optimization, large deep models, real-time inference, and practical applications.

INFO-I 219 Software Bots for Cognitive Automation (3 cr.) This course introduces the development of software bots for process and cognitive automation. Students learn how organizations adopt artificial intelligence and related technologies to process unstructured and uncurated data in various industries. The course also examines the disruptive effects of process and cognitive automation on social, economic, and global environments.

INFO-I 220 The Social Impact of Bots and Automation (3 cr.) This course examines the disruptive effects of process automation on social, economic, and global environments and how organizations adopt artificial intelligence and other technologies to process unstructured and uncurated data. The course also introduces applications of cognitive automation with bots in various industries and their implications.

INFO-I 319 Cognitive Automation and Bots Development (3 cr.) P: INFO-I 220 This course covers how to develop robotic process automation and cognitive automation for various kinds of organizations. Students apply artificial intelligence and bot platforms and frameworks to automate organizational processes from end to end.

INFO-I 340 Collaborative Human–AI Systems (3 cr.) This course introduces human–AI interaction design for systems that solve problems neither humans nor artificial intelligence could solve separately.Topics include interpretability, transparency, trust, and AI ethics. Student projects focus on developing applications where AI provides cognitive and perceptual augmentation to humans.

INFO-I 419 Enterprise Cognitive Automation (3 cr.) P: INFO-I220 This course covers the integration of

cognitive automation in business process management systems. Students model organizational processes and integrate artificial intelligence (AI) to increase and monitor their efficiency and effectiveness.They also learn from cognitive automation use cases how enterprises manage processes across systems, applications, and data repositories.

INFO-I 428 Web Mining (1-3 cr.) P: INFO-B 210 or CSCI-A 204 or CSCI 23000 or CSCI-C 200 This course covers concepts and methods used to search the web and other sources of unstructured text from a human-centered standpoint. These include document indexing, crawling, classification, and clustering; distance metrics; analyzing streaming data, such as social media; link analysis; and system evaluation.

INFO-I 483 Conversational User Interfaces: Experience Design and Applications (3 cr.) This course introduces the fundamentals of user experience design for conversational computing. Students explore the cognitive, experiential, and social aspects of conversational user interaction through applied projects, labs, and discussions. Students also learn tools and methods for designing, prototyping, and testing conversational user experiences.

INFO-I 496 Artificial Intelligence Professional Practice 1 (3 cr.) This course covers the development of a project proposal in artificial intelligence to meet business requirements using system analysis and design methods. Students identify a business problem that can be solved with AI, either independently or with an industrial partner; research the solution; and develop a plan for solving it.

INFO-I 497 Artificial Intelligence Professional Practice 2 (3 cr.) This course covers the implementation of a project in artificial intelligence to meet business requirements using system analysis and design methods. Students develop and deploy an AI solution to a business problem based on the plans and designs in their project proposal.