

Master of Science
in



**Software
Development
&
Management**

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An apprentice carpenter may want only a hammer and saw, but a master craftsman employs many precision tools. Computer Programming likewise requires sophisticated tools to cope with the complexity of real applications, and only practice with these tools will build skill in their use.

-- Robert L. Kruse, Data Structures and Program Design

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Master of Science in Software Development and Management

Department of Information Sciences & Technologies

Program Philosophy and Objectives

Software development is a discipline that is concerned with establishing and using proven methodologies in the production of software-based solutions. The result of these methodologies should be software solutions that are reliable, robust, and effective on current computer hardware. The main distinction between this field and more traditional engineering disciplines lies in the abstract nature of software design and the concern for the human, behavioral, and organizational dimensions that impact the building and application of software technologies.

The financial risks associated with enterprise-scale software development are considerable.¹ Historically the software industry has lagged behind the demands that have been placed upon it. Computer hardware has advanced rapidly and has, in fact, created a demand that the software industry has not satisfied. So far, the need for sophisticated software systems has outpaced the capacity of this industry to respond. There is a need for software professionals who are effective in the use of methodologies, understand business and industrial environments, and are capable of participating in management planning and decision-making.

The software development professionals who work in this environment must possess a specific set of skills to be successful. Critical skills include communication, programming, knowledge of software tools and techniques, and an understanding of managerial techniques and philosophies. The central role of the software design process in the development of integrated software solutions must be understood. This includes software requirements definition, specification development, design, implementation, and verification. In addition, analysis and synthesis techniques must be applied repeatedly during the development process.

The Software Development and Management (SD&M) degree program provides the opportunity to study, develop, and become proficient in the practices, methodologies, and techniques applicable to all levels of the software development process. The program is designed for students whose undergraduate majors were in business, computer science, engineering, science, or any discipline that leads to careers involving the development of software systems. Students who do not have adequate undergraduate preparation are required to do prerequisite work prior to matriculation in the program.

The underlying principle of this curriculum is that software development is a manageable process – i.e. that the software development problems encountered now and in the future will be amenable to solutions based on sound managerial methodology and reasoned application of technology. The curricular focus is on the design, development, and deployment of IT-based software solutions for the enterprise domain. Modern programming environments are incorporated to provide a comprehensive approach to current software development issues.

¹ The Standish Group. Press release: Latest Standish Group CHAOS Reports, March 2003.

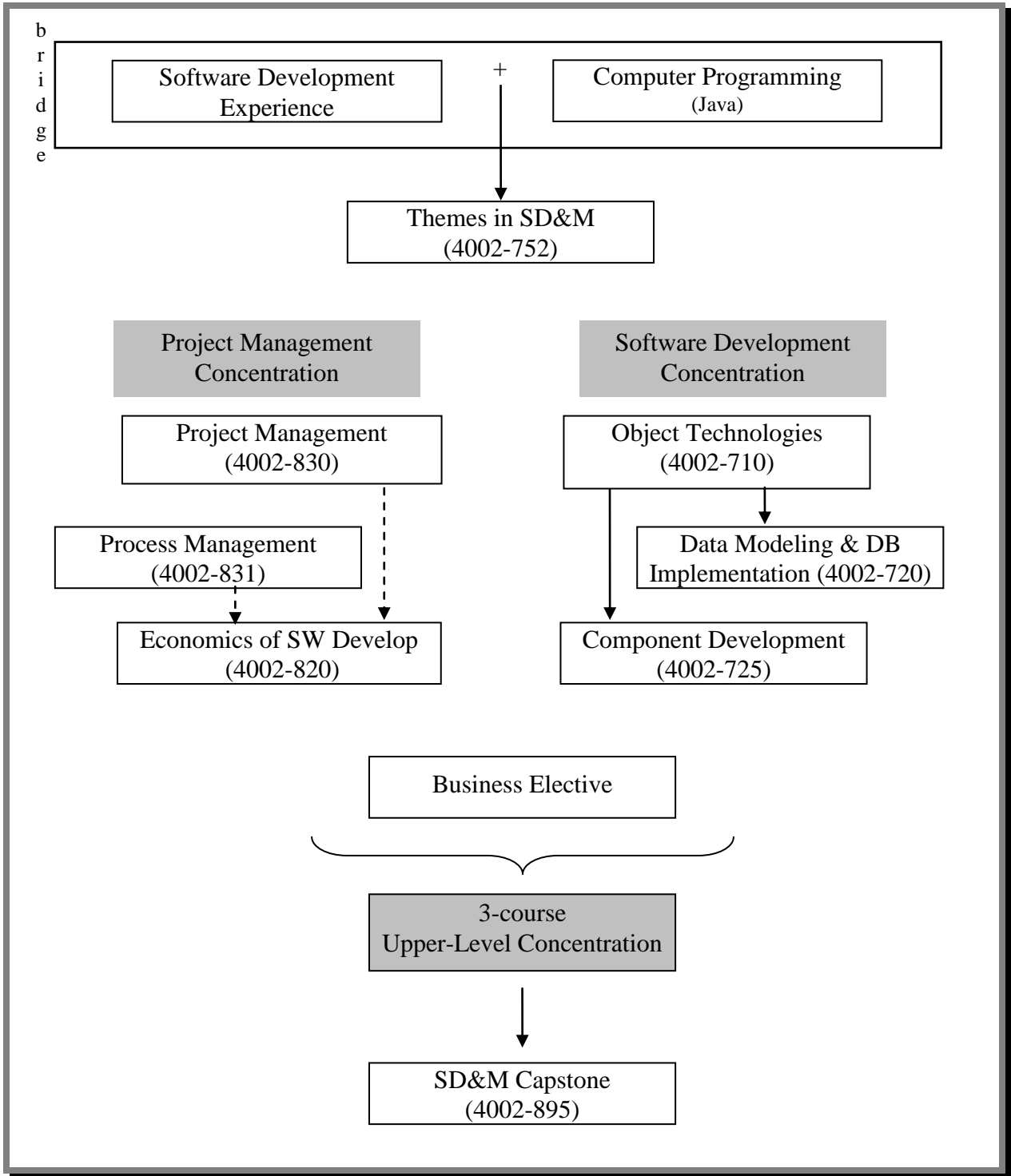


Figure 1. Course Plan for the SD&M Program

Key: \longrightarrow indicates a required prerequisite; $- - - \blacktriangleright$ indicates a recommended prerequisite

Distance Learning

This program is intended for part-time, rather than full-time study, and is available entirely online in distance-learning format. There is no on-campus residency requirement, although some of the more popular courses are also available in traditional on-campus format as well. You can enroll in the program regardless of where you live or work. Instead of going to a traditional college classroom, online courses use a variety of methods, including web-based presentations, video and audio tapes, telephone and computer conferencing, and electronic blackboards. These tested educational delivery methods give you time and place flexibility while maintaining RIT's academic standards and quality instruction.

A wide variety of support services are available remotely, including advising, on-line library catalogs and indexes (some with full text), inter-library loans, toll free (8000 telephone numbers for audio conferences, computer conferencing and other group software. Courses offered in online learning format follow the same quarterly schedule as other RIT on-campus courses; and you register for them in the same way (distance courses have a section of 9x).

To participate in this program, you will need the following:

- Access to a personal computer or workstation (with Web Browser)
- Access to the Internet via a network or broadband connection to your own Internet Service Provider.

Entrance Requirements²

Degree applicants should minimally have a baccalaureate or equivalent degree from an accredited institution of higher education and a minimum cumulative grade-point average equivalent to 3.0 out of 4.0 ('B' average) or a first class degree from an accredited foreign university.

Additionally, applicants with degrees from foreign universities must submit Graduate Record Examination (GRE) scores (standard exam). The GRE may also be required for those applicants requesting consideration whose undergraduate grade-point average is less than 3.0/4.0.

Applicants whose native language is other than English must take and submit the TOEFL examination. A minimum score of 570 (paper-based exam), 230 (computer-based exam), or 88 (internet-based) is required. Applicants with a lower TOEFL may be admitted conditionally. However, they will be required to take a prescribed program in English along with a reduced program course load until the required English level is achieved.

Information about the GRE and the TOEFL examinations is available at <http://www.ets.org>. For your convenience, RIT is currently offering the GRE examination.

Since this program is intended for part-time study, an I-20 for full-time study in the United States is not available to foreign students. However foreign students may study part-time at a distance.

² RIT's reporting number for ETS's GRE and TOEFL examinations is 2760.

Application & Deadlines

The application process typically takes four to six weeks after the Office of Graduate Enrollment Services has received a complete application. However, foreign applications may take longer due to slow physical mail. Applications are only evaluated after all of the information has been submitted and verified by a counselor in RIT's Office of Graduate Enrollment Services.

Students can be admitted at various times during the year. However, acceptance into the MS program does not guarantee availability of classes. As the start of the quarter approaches, classes tend to become full. Students, who apply just before the start of a quarter, may need to wait until the following quarter before starting their course work.

The application deadline schedule is shown below:

Quarter	Typical Starting Date of Quarter	Domestic Application Deadline (Part Time)	International Residents Application Deadline (Part Time)
Fall	~ September 3	August 10	July 1
Winter	Not Permitted	Not Permitted	Not Permitted
Spring	~ March 7	February 1	January 1
Summer	Not Permitted	Not Permitted	Not Permitted

All applicants are required to submit the following:

- An electronic (http://www.rit.edu/emcs/ptgrad/grad_admission.html) or paper application
- A well-written statement of purpose that discusses your background and the personal goals relevant to this program. Please discuss your preference for the upper-level concentration.
- Current resume.
- Valid transcripts from all universities listed on the application.
- Two current recommendations from educational and/or professional sources.

Requests for information can be sent via email to InformaticsGrad@rit.edu.

We may be able to start you in your studies while your application is being processed. Please feel free to contact the Graduate Coordinator about this option.

Prerequisites

Applicants wishing to enter this master's program are expected to have the equivalent of at least two (2) years of full-time employment experience in software development, or other related employment, and knowledge of one or more current programming languages. Knowledge of specific programming languages may be required; currently the Java language is required.

If a student does not have the necessary program language background, bridge courses are available to satisfy this prerequisite. Formal acceptance into the master's program may be possible at the discretion of the Graduate Program Coordinator even though the applicant must complete the programming language bridge requirement.

The Bridge Program

All students must have the required software development or other relevant work experience before matriculating in this program. Students, whose undergraduate preparation or industrial/work experience does not satisfy the program language prerequisite, can make up this deficiency through study, taking one or more of courses as prescribed by the Graduate Coordinator.

The courses offered by RIT that can be used to satisfy the programming prerequisite are:

Java Programming:

4002-217³, 4002-218³ and 4002-219³ Programming for Information Technology I, II & III

-or-

4002-414³ Java for Programmers (undergraduate; requires prior programming experience)

-or-

4002-714 Java for Programmers (graduate; requires prior programming experience)

-or-

a one-year sequence from another university as approved by the Program Coordinator

Students are expected to achieve a 3.0 ('B' grade) or better average in course work done as part of the bridge program. Bridge program courses are not part of the 48-quarter credit hours required for the master's degree. Grades for bridge courses are not included in a student's graduate grade-point average if taken before matriculation. However grades for bridge courses taken after matriculation will be included in student's cumulative grade-point average.

Students who have been admitted to the program before completing the programming language entrance requirement must complete bridge coursework within the first two (2) quarters of matriculation. Prior approval of the Graduate Coordinator is required before any other courses in the program may be taken.

This prerequisite may be completed at any accredited college or university that is convenient. To meet individual needs, a bridge program can be designed differently from that described above. Other courses can be substituted, or courses at other colleges can be applied. For example applicants studying at a distance may take equivalent courses from their local community colleges or universities. However such programs must be approved in advance. Contact the Graduate Coordinator for approval prior to beginning bridge work.

³ These courses are only available in traditional on-campus format, not in online-learning format.

The Curriculum

This program of study consists of twelve four-credit courses (48 quarter-credit hours) which include the core coursework (an overview course, foundation study in software development and project management theory and practice, and a business elective), an upper-level three-course concentration, and the SD&M Capstone experience.

- The **SD&M Core**:
 - 4002-752 Themes in Software Development and Management
 - The **Software Development** concentration consists of three (3) courses:
4002-710 Object Technologies
4002-720 Data Modeling and Database Implementation (2-course OOP sequence)
4002-725 Component Development (4002-710)
 - The **Project Management** concentration consists of three (3) courses:
4002-830 Project Management
4002-831 Process Management
4002-820 Economics of Software Development (4002-830 and 4002-831 recommended)
 - One (1) **business** elective typically selected from:
0102-740 Organizational Behavior (distance and on-campus formats)
0102-763 Behavior Skill for Managers and Professionals (on-campus only)
For more information, contact Ms. Peggy Tirrell, the Graduate Coordinator in the College of Business, at (585) 475-2795 or via email at ptirrell@cob.rit.edu.
- One Upper-Level, three-course concentration selected from the following options:
 - **Enterprise Architecture**
4002-819 Integration Technologies (4002-725)
4002-821 Data Architecture and Management (4002-710 and 4002-720)
4002-825 System Architectures (4002-725; 4002-819 recommended)
The courses in this concentration focus on system architecture theory and practical approaches to design and integration for IT solutions in today's modern corporate enterprises.
 - **Human Computer Interaction (HCI)**
4004-745 Foundations of HCI
And two (2) courses from the following list:
4002-765 User-Centered Design Methods (4004-745)
4004-781 Usability Economics (4004-745 only for SD&M students)
4002-892 CSCW & Groupware (4004-745)
This concentration focuses on the foundation concepts and major issues in the design of effective user interfaces for interactive computing systems. Topics include: cognitive psychology, human factors, interaction styles, user analysis, task analysis, interaction design techniques, and evaluation methodologies. Current developments in this field will be investigated. Other courses may be available; contact the Graduate Coordinator for details.

- **Architecture Fundamentals**
4002-821 Data Architecture & Management (4002-710 and 4002-720)
4004-745 Foundations of HCI
A 3rd course in consultation with the Graduate Coordinator
This concentration provides an overview of fundamental enterprise architecture concepts appropriate for individuals in IT management positions.
- **Special Topics:** three (3) courses on advanced topics directly related to software development with prior approval of the MS/SD&M faculty.
- **The SD&M capstone:** 4002-895 Software Development and Management Capstone
The SD&M capstone experience is the satisfactory completion of the one-quarter project-based course, 4002-895. Approval of a capstone proposal or recruitment of a faculty capstone committee is not required.

Students with a business degree or prior academic study that included the required business elective may replace that course with another graduate business course the Saunders College of Business or a graduate course from Information Sciences & Technologies, Computer Science, Computer Engineering, or Electrical Engineering departments. Refer to the “Restrictions on Coursework” section in the Graduate Student Handbook for more information. Graduate courses from outside Information Technology require the prior approval of the Graduate Coordinator.

Up to six (6) months of optional cooperative-educational work experience (co-op) is available for those students who wish to add an employment dimension to their studies. The Office of Cooperative Education and Career Services can assist students in finding a co-op position, or students can find jobs on their own and have them approved. Students are registered for the course 4002-999, Graduate Co-op, for zero credits (no cost). You must have completed at least thirty-six (36) program credits with a 3.0/4.0 (‘B’ average) or better to qualify for co-op.

Program Cost

The RIT graduate costs and financial website is at <http://www.rit.edu/~w-ptgrd/financial.html>. The cost of graduate tuition is available at <http://finweb.rit.edu/sfs/billing/tuitionandfees/0910/>. See <http://www.rit.edu/emcs/financialaid/costs.html> for estimates of the full cost of graduate study at RIT.

Financial Aid

Financial aid information is available on the RIT website at <http://www.rit.edu/emcs/financialaid/index.php>.

The department of Information Sciences & Technologies can offer a Merit Scholarship to qualified students who are not receiving full financial support from other sources, such as from an employer, etc. The merit scholarship can be awarded on a quarter-by-quarter basis to balance employer support for up to one (1) academic year (three academic terms) from the term in which the student is admitted. For terms beyond the initial award, the student must submit an application to request continuation of the scholarship (<http://ist.rit.edu/?q=node/70>). The award will, in general, be extended if the student has made continual progress and has maintained at least a 3.0/4.0 (‘B’ average) grade-point average, which is the minimum required to graduate from a MS program at RIT.

Information

Additional information may be obtained by contacting:

US Mail:

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102 Lomb Memorial Drive
Rochester, New York 14623-5603

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Program Director:

Prof. Jeffrey Lasky

E-mail: Jeffrey.Lasky@rit.edu

Telephone: (585) 475-2284

FAX: (585) 475-2181

Software Development & Management Curriculum

Course Descriptions

Bridge Program Course Descriptions

4002 217 Programming for Information Technology I

This is the first course in the introductory programming sequence required for all Information Technology students. Topics include elementary data types, arithmetic and logical operations, control structures and error handling, methods and functions, and an introduction to object-oriented programming design and implementation. Emphasis is placed on the development of problem-solving skills. Programming projects are required.

Prerequisites: 4002-206 or computer literacy

Credit 4

4002 218 Programming for Information Technology II

This is the second course in the introductory programming sequence required for all students majoring in Information Technology. Topics include further exploration of classes and objects, programming through composition and inheritance, reusability, input/output, and object oriented design. Emphasis is placed on the development of problem-solving skills. Moderately large programming assignments are required.

Prerequisites: 4002-217 or 4002-220

Credit 4

4002 219 Programming for Information Technology III

This is the third course in the introductory programming sequence required for all students majoring in Information Technology. Topics include advanced interface concepts, traditional programming data structures, programming utilities and reusability, introductory project design and management concepts and other concepts as time permits. Emphasis is placed on the development of problem-solving skills. Large programming assignments are required.

Prerequisites: 4002-218 or 4002-221

Credit 4

4002 414 Java for Programmers

An intensive survey of the Java programming language for experienced programmers. This course covers the creation of application programs. Topics include: basic language concepts (declaring and evaluation of data, statements, expressions, control flow, and input/output), object-oriented fundamentals, GUI interfaces, exception handling, debugging, threads, and the client/server environment. Programming projects will be required.

Prerequisites: a two-course programming sequence in any OOP language other than Java

Credit 4

4002 714 Java for Programmers

An introduction to an object-oriented programming language, such as Java, for the World Wide Web. This course will cover the creation of applet and application programs. Topics include: Internet concepts, basic language concepts (declaring and evaluation data, statements, expressions, control flow, and input), the development environment, essentials of applet programming (URL, audio, image, text, animation), classes and objects, error handling, debugging, threads, and the client/server environment. Programming projects will be required.

Prerequisites: 4002-210 or 4002-218 or 4002-518 or prior programming experience in a language other than Java

Credit 4

Software Development & Management Core Course

4002 752 Themes in Software Development & Management

This course will present prominent and emerging views of technologies, approaches, and issues in application development to entering graduate students in the Software Development and Management Program. The range of topics will encompass a broad spectrum of the software development lifecycle using readings from a variety of books and periodicals, independent research, and presentations by leading experts on application development.

Prerequisites: Completion of SD&M Degree Program Prerequisite Requirements

Credit 4

Software Development Core Concentration

4002 710 Object Technologies

This is a course in the principles and techniques of designing and implementing software objects. Current software environments are used to explore effective design methods and concepts. Topics include basic object design, class definition and syntax, object-oriented design, software quality and object evaluation. Software design and programming projects are required.

Prerequisites: Completion of SD&M bridge or permission

Credit 4

4002 720 Data Modeling & Database Implementation

This course provides a theoretical and practical introduction to the design and development of relational database systems. Current software environments are used to explore effective database design and implementation concepts. Topics include data modeling, database design, data query and manipulation, and transaction management along with current topics. Database design and implementation projects are required.

Prerequisites: Completion of 2-course object-oriented programming sequence

Credit 4

4002 725 Component Development

A programming course focused on the use, design and implementation of reusable software components. Students create and test components based on current technology. Issues of reusable design, quality, component libraries, and interoperability are included. Design and programming project is required.

Prerequisite: 4002-710

Credit 4

Project Management Core Concentration

4002 830 Project Management

This is a course in the methods and techniques of managing a software development project. Topics include defining project goals, work breakdown structure, defining tasks, project plans, estimation and scheduling techniques, work monitoring and measurements.

Prerequisites: Completion of SD&M bridge. We recommend that this course be taken before 4002-820.

Credit 4

4002 831 Process Management

This is a course in the methods and techniques of managing a software development environment. Topics include development organization structure, team management, staff development, project selection and prioritization, cost/benefit analysis, role of standards, and organization communication.

Prerequisites: Completion of the SD&M Bridge. We recommend that this course be taken before 4002-820.

Credit 4

4002 820 Economics of Software Development

This course is an analysis of the factors that determine software cost, quality, and time to delivery. Topics include fundamentals of software development, identification of cost drivers, and analysis of productivity and quality data. Students use models to estimate software cost, delivery time, and operational reliability.

Prerequisites: Completion of SD&M bridge. We recommend that 4002-830 and 831 be taken before this course.

Credit 4

Enterprise Architecture Upper-Level Concentration

4002 819 Integration Technologies

This course is an in-depth study of the major interoperability technologies. Exercises are used to illustrate how modern integration technologies address the economic and technical issues related to the development of integrated systems. Programming projects are required.

Prerequisite: Completion of Software Development core concentration (minimally 4002-710 and 4002-725)

Credit 4

4002 821 Data Architecture and Management

This course will focus on data architectures, issues, and strategies for managing enterprise data as an organizational information asset. The fundamental meaning and management of data is emphasized as an enabler to enterprise data integrity, enterprise data structure, and satisfaction of enterprise business requirements. Topics include metadata management, business process integration, data and process governance, repository management, data quality, data architectures, and current technologies in information exchange. Data integration and programming projects are required.

Prerequisites: 4002-710 and 4002-720

Credit 4

4002 825 Systems Architecture

A programming course focused on the application of interoperability technologies. Students develop integrated systems based on software components, applications, databases, web sites, heterogeneous operating systems and networks.

Prerequisites: 4002-725; 4002-819 recommended

Credit 4

Human-Computer Interaction Upper-Level Concentration

Note: The HCI course offerings below are part of our MS in Human-Computer Interaction program.

Prerequisites are adjusted here for SD&M students.

4004 745 Foundations of Human-Computer Interaction

Human-computer interaction (HCI) is a field of study concerned with the design, evaluation and implementation of interactive computing systems for effective human use and with the study of major phenomena surrounding them. This course surveys the foundation concepts and major issues of the HCI field including: cognitive psychology, human factors, interaction styles, user analysis, task analysis, interaction design methods and techniques, and evaluation. The primary focus of this course will be on the users and their tasks.

Prerequisites: None

Credit 4

4002 765 User-Centered Design Methods

This course will focus on the major user-centered design methodologies used in the development of applications and environments. Topics include: evolution of software design methods, emergence of user-centered design, and key concepts and attributes of contextual, scenario-based, and performance-centered design. Case studies will be used to illustrate the different design methods. Software design projects will be required.

Prerequisites: 4004-745

Credit 4

4004-781 Usability Economics

User-centered design methodologies are proven enablers for developing successful systems and are important to realizing enterprise benefits. An understanding of usability economics is needed to effectively integrate usability engineering into the systems development process. This course provides students with the necessary background and methods to prepare cost-benefit analyses of applying usability engineering in a variety of system development domains. Other topics include: strategies for introducing the usability engineering lifecycle into an organization; developing a usability culture; and developing enterprise usability standards.

Prerequisites: 4004-745; 4004-748 or 4004-775

Credit 4

4002 892 CSCW and GroupWare

This course will examine the role of information technology in collaborative work settings. An overview of relevant theory, technologies, and standards will provide the context for examining the integration and strategic use of email distributed networking, the WWW, conferencing and enhanced messaging.

Prerequisites: 4004-745

Credit 4

SD&M Capstone

4002 895 Software Development and Management Capstone

A presentation demonstrating current awareness and understanding of trends impacting the software development and management field. Students prepare a portfolio summarizing their course work in the SD&M program and discuss the relationship of their course work to advances in software development technology and practice.

Prerequisite: Enrollment in last quarter of study

Credit 4

Business Elective Options

Note: Depending upon your background, other courses may be available; consult the Graduate Coordinator.

0102-740 Organizational Behavior & Leadership (distance & on-campus formats)

This course examines why people behave as they do in organizations, and what managers can do to improve organizational performance by influencing people's behavior. Students will be exposed to the ways in which organizations and their members affect one another and to different frameworks for diagnosing and dealing with problems in organizational settings. Topics include motivation, team building, conflict resolution, leadership, organizational change, and managing organizational cultures.

Prerequisites: None

Credit 4

0102 763 Behavior Skills for Managers & Professionals (on-campus format only)

This course provides the opportunity to develop individual and interpersonal skills that enhance managerial performance in today's high-performance organization. Each participant is given the opportunity to perform in each of the major skill dimensions, given evaluative feedback and given the opportunity to incorporate the implications of that feedback into additional performance opportunities. Course participants are also provided with the opportunity to assess their career work preferences and to compare them with the performance expectations of managerial positions. The administrative styles of each participant are also assessed, and the impact of the behaviors that flow from each style on the perceptions and performance of others in the organization is clarified.

Prerequisites: None

Credit 4

Other Courses

4002 899 Independent Study

A faculty-directed study of special-interest topics. This course may be used by a graduate student to study particular applications of computers that are not covered in depth in other courses.

Prerequisites: Permission of instructor

Credit variable 2 – 4

4002 999 Graduate Co-op

An optional cooperative educational experience is available for those students who wish to participate in order to gain industrial experience.

Prerequisites: Students must have completed any program bridge courses and 32 credits (the eight (8) core software development and management courses) towards the degree with a 3.0/4.0 grade-point average or better.

Credit 0

2009-2010 Academic Calendar

(not included)

2010-2011 Academic Calendar

(not available at this time)

Worksheet for MS in Software Development & Management

(not included)