

IS 2009

Curriculum Guidelines for Undergraduate Degree Programs in Information Systems

Association for Computing Machinery (ACM)
Association for Information Systems (AIS)

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FOREWORD

The IS 2009 report is the latest output from model curriculum work for Information Systems that began in the early 1970s. Prior to this current effort, the most recent version of the IS undergraduate model curriculum is IS 2002 (Gorgone et al. 2003), published in early 2003. IS 2002 was a relatively minor update of IS'97 (Davis et al. 1997). Both IS 2002 and IS '97 were joint efforts by ACM, AIS, and DPMA/AITP (Data Processing Management Association/Association of Information Technology Professionals). IS'97 was preceded by DPMA'90 (Longenecker and Feinstein 1991) and ACM Curriculum Recommendations 1983 (ACM 1983) and 1973 (Couger 1973). IS 2002 has been widely accepted, and has also been the basis for accreditation of undergraduate programs of Information Systems. This report represents the combined effort of numerous individuals and reflects the interests of thousands of faculty. It is grounded in the expected requirements of industry, represents the views of organizations employing the graduates, and is supported by other interested organizations.

This report is one of the undergraduate curriculum volumes that have been produced for the core computing disciplines (see the CC2005 Overview Report; Shackelford 2005). In addition to IS 2009, curriculum recommendations exist for computer science (CS 2008), computer engineering (CE 2004), software engineering (SE 2004), and information technology (IT 2008) [<http://www.acm.org/education/curricula-recommendations>]. All of these reports are under the control of separate committees; updates are published as they are completed.

All aspects of the global computing field continue to face rapid and frequent change. As a result, university-level Information Systems (IS) curricula need frequent updating to remain effective. Since most academic units have mechanisms to maintain currency of curricula, what is the role of professional society curriculum committees? If an IS academic unit were providing graduates solely to local business and government, the input on program contents could be derived from representatives of local organizations that hire the graduates. However, local employment is not the sole objective for undergraduate majors in Information Systems. Students from IS programs accept jobs in widely dispersed geographic areas. Therefore, the availability of curriculum models enables local academic units to maintain academic programs that are consistent both with regional, national, or global employment needs and with the common body of knowledge of the IS field. The first IS curriculum models were introduced in the early 1970s. This early work was followed by model curricula developed by ACM and AITP. Details of this history are reviewed in Appendix 1: Background of IS Curricula and Related Disciplines.

Professional society curriculum reports serve several other objectives. One important use is to provide a local academic unit with rationale to obtain proper resources to support its program. Often, the administration at a local institution is not aware of the resources, course offerings, computing hardware, software, and laboratory resources needed for a viable program. The administration may be unaware of the specialized classroom technology, library resources, or laboratory assistants essential for proper education of IS undergraduates. Finally, the administration might not recognize the rapid turnover of knowledge in the field and the need for resources to support constant retooling of faculty. Curriculum reports provide recommendations in these resource areas as well as recommended content for the body of knowledge to be taught.

This document has incorporated the comments and suggestions based on feedback from senior scholar, numerous panels, presentations, and solicitation, in many forms, to the IS committee at large. We are very grateful for these contributions, which have significantly improved this report. Further, we encourage you to get engaged in the ongoing curriculum development process on

1 blogsandwikis.bentley.edu/iscurriculum that has been launched in the context of this curriculum
2 revision project. We believe these efforts can be truly successful only if the broad global IS
3 community participates widely.

4
5 The editors of IS 2009 thank those who have helped in this project. We also acknowledge with
6 gratitude the permission we received from Communications of the AIS to include material in this
7 report from the two CAIS papers that the task force published during the course of this project
8 (Topi et al., 2007; Topi et al., 2008). We hope this ongoing cooperative curriculum development
9 effort will continue to serve your needs. We are interested in your input and encourage you to let
10 us know how you are using these materials and how they might be improved.

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EXECUTIVE SUMMARY

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IS 2009 is the latest in a series of model curricula for undergraduate degrees in Information Systems. It builds on the foundation formed by this earlier work, but it is a major revision of the curriculum and incorporates several significant new characteristics. IS 2009 is the third collaborative effort by ACM and AIS. Both organizations have worldwide membership, and therefore, IS 2009 includes elements that make it more universally adaptable than its predecessors. IS 2009 is not directly linked to a degree structure in any specific environment but it provides guidance regarding the core content of the curriculum that should be present everywhere and suggestions regarding possible electives and career tracks based on those.

13

There are several reasons motivating this revision. The work leading to the previous significant revision, IS'97, took place more than 10 years ago, and in a rapidly changing field this alone is an important reason to re-evaluate the curriculum. There has been a great deal of change in technology and industry practices, including the globalization of IS development processes, introduction of Web technologies, emergence of a new architectural paradigm, widespread utilization of large-scale ERP systems, ubiquitous availability of mobile computing, and broad use of IT control and infrastructure frameworks, such as ITIL and COBIT. This curriculum is also introduced after a period when the interest in studies in Information Systems has significantly declined, and the field has to be able to reverse this trend. This curriculum revision also represents an effort to re-evaluate the core principles of the discipline through a very careful specification of the degree learning outcomes. Finally, new social networking technologies made it possible to attempt to include the IS community as broadly as possible.

26

This revision has four broad key characteristics that have shaped the outcome significantly. First, the curriculum reaches beyond the schools of management and business. Previous versions of the IS curriculum have been targeted to a typical North American business school; this model curriculum is, however, guided by the belief that even though business will likely continue to be the primary domain for Information Systems, the discipline provides expertise that is critically important for an increasing number of domains. Second, the outcome expectations of the curriculum have been very carefully re-evaluated and articulated first in the form of high-level IS capabilities and then in three knowledge and skills categories: IS specific knowledge and skills, foundational knowledge and skills, and domain fundamentals. Third, the curriculum is structured so that it separates the core of the curriculum from electives with the intent of supporting the concept of career tracks. Finally, the design of this curriculum includes enough flexibility to allow its adoption in a variety of educational system contexts.

39

The high-level IS capabilities that the curriculum specifies as the highest level outcome expectations are as follows:

42

- Improving organizational processes
- Exploiting opportunities created by technology innovations
- Understanding and addressing information requirements
- Designing and managing enterprise architecture
- Identifying and evaluating solution and sourcing alternatives
- Securing data and infrastructure, and
- Understanding, managing and controlling IT risks.

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50

1 These high-level capabilities are translated into knowledge and skills in three categories:
2

- 3 1. IS specific knowledge and skills, including
 - 4 a. Identifying and designing opportunities for IT-enabled organizational
5 improvement
 - 6 b. Analyzing trade-offs
 - 7 c. Designing and implementing information systems solutions, and
 - 8 d. Managing ongoing information technology operations
 - 9 2. Foundational knowledge and skills, including
 - 10 a. Leadership and collaboration
 - 11 b. Communication
 - 12 c. Negotiation
 - 13 d. Analytical and critical thinking, including creativity and ethical analysis, and
 - 14 e. Mathematical foundations
 - 15 3. Domain fundamentals, including
 - 16 a. General models of a domain
 - 17 b. Key specializations within a domain and
 - 18 c. Evaluation of performance within a domain.
- 19

20 The curriculum itself is designed to educate graduates who are prepared to enter the workforce
21 equipped with the knowledge and skills specified in these three categories. As discussed above, it
22 separates the core from career track electives and includes seven core courses: Foundations of
23 Information Systems, Data and Information Management, Enterprise Architecture, IS Project
24 Management, IT Infrastructure, Systems Analysis & Design, and IS Strategy, Management, and
25 Acquisition. It is obviously not possible to offer a complete collection of career track electives in
26 a model curriculum document, but we include a number of elective course descriptions as
27 examples. Notable changes in the included courses are as follows: a) application development is
28 no longer included in the core of the curriculum; b) data networking and computer architecture
29 are covered at a higher level of abstraction in an IT Infrastructure course; c) enterprise
30 architecture and IS project management are now part of the core; d) the personal productivity
31 tools course has been removed from the curriculum, and e) the prerequisite structure has been
32 simplified. Notably, both data & information management and systems analysis & design have
33 maintained their central roles in core of the curriculum.
34

35 The task force believes that the outcome expectations, structure, and content of the new
36 curriculum make it significantly more broadly applicable than the previous IS model curricula
37 were. We hope that this document demonstrates that Information Systems as a discipline can
38 make significant contributions to a number of domains, including but not limited to business, and
39 that its core areas of expertise are highly valuable and even essential for the best practices and
40 further advancement of a variety of collaborating domains.
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1. USE OF THE IS 2009 CURRICULUM REPORT

The Information Systems undergraduate model curriculum report has several intended classes of users who have a stake in the achievement of quality IS degree programs:

- academic executives to whom the Information Systems program reports
- academic heads responsible for Information Systems programs
- accrediting bodies
- Information Systems faculty
- non-Information Systems faculty in the school or college where the Information Systems program resides
- Information Systems practitioners
- students in Information Systems programs

In this section, the uses of the report by these intended stakeholders are described and its value explained. First, a detailed explanation of resources is discussed. This included information about faculty needs, classroom needs and computing needs. Next, responsibilities for the stakeholders are discussed.

For Academic Executives to Whom the Information Systems Program Reports

The IS discipline contributes in a significant way to a number of domains, including business and government. Information systems are complex systems requiring both technical and organizational expertise for design, development, and management. They affect not only operations but also the organization's strategy.

The nature of this rapidly changing field requires a unique set of resources. The minimal level of resources required to provide a viable undergraduate degree program in Information Systems is outlined below. Specifics of the resource requirements are detailed elsewhere in the document. Additional resources are necessary to support the service courses provided by the IS faculty to other academic units of the university.

1. Faculty Resource Requirements

The number of faculty will depend upon the number of students majoring in Information Systems. At a minimum, a critical mass of faculty is needed to provide the degree of specialization essential for the proper coverage of the curriculum. The interests, qualifications, and scholarly contributions of the faculty members must be sufficient to teach the courses, plan and modify the courses and curriculum, and remain abreast of current developments in Information Systems. The rapid increase and change in knowledge in the Information Systems field require that faculty continuously upgrade their skills. Thus, all faculty members must remain current in the discipline. Further, the inclusion of pertinent research would also benefit students and the faculty alike. It is recommended that a significant part of each faculty member's workload be spent in receiving training in new technologies and acquiring new knowledge and skills. The changes in the field place heavy demands on IS faculty who are required to tailor the curriculum to meet local and regional conditions, develop up-to-date instructional

1 materials, and manage student projects and internships while also maintaining their own
2 scholarly productivity in a way that is compatible with local university expectations.

3

4 2. Physical Space Requirements

5

6 Physical space requirements for the Information Systems program are often similar to
7 those of engineering, biological and physical sciences. The facilities should include:

8

9 a. Access to specialized software (such as integrated development environments,
10 modeling tools, etc.) either by making the software available to the students so
11 that they can install it on their laptops or in sufficiently equipped laboratories.

12

13 b. Laboratories to provide experience in designing, installing, and running
14 networks.

15

16 c. Project team laboratories to accommodate team projects essential to the IS
17 program.

18

19 d. Classrooms equipped with computer projection, Internet, and local network
20 access, and appropriate computing and software infrastructure, so that the entire
21 curriculum can be adequately delivered.

22

23 3. Computing Infrastructure Requirements

24

25 Computing infrastructure consists of hardware, software, and technical support. Because
26 of the need to keep abreast of the rapidly changing technology environment, Information
27 Systems students and faculty must have access to computing facilities at least equivalent
28 to those used in a typical organization operating within a program's domain. This is
29 necessary to prepare the students for their profession and for the faculty to contribute to
30 the creation of new knowledge in the field. The rate of change in technology suggests a
31 rapid replacement cycle, with some technologies reaching obsolescence in less than 12
32 months. While some of the general university or school computing laboratories may meet
33 some of the needs of Information Systems, special infrastructure resources are necessary
34 to support the requirements of the curriculum, including systems development, network
35 infrastructure, and other advanced and emerging technologies. In addition to software and
36 hardware, it is paramount to the success of Information Systems programs that adequate
37 technical support is provided.

38

39

40 **For Academic Heads Responsible for Information Systems Programs**

41

42 The report provides the rationale for adopting the curriculum recommendations for an
43 undergraduate degree program in Information Systems. The curriculum recommendations are
44 based on an assessment of industry expectations for entry-level professional employees in the
45 Information Systems field. As discussed at a detailed level later in the report, the outcome
46 expectations for Information Systems graduates have changed significantly with many schools
47 increasing the emphasis on the design of domain solutions, such as the implementation of
48 business processes using information technology. Written and oral communication skills and
49 team skills continue to be important: graduates need to be able to interact effectively with clients
50 and to work effectively in teams. This report gives the specific recommendations necessary to
51 successfully implement and maintain a program in Information Systems stressing technical,

1 behavioral, and organizational elements. A summary of the resource requirements necessary to
2 support a viable Information Systems program is outlined later in the document.

3 4 **For Accreditation Bodies that Accredite Information Systems Programs and Others** 5 **Interested in Program Assessment**

6
7 Accreditation of IS programs and other processes that assess the quality of these programs require
8 a widely accepted definition of the discipline and curriculum. This report, developed by the major
9 professional and academic societies in Information Systems, provides the basis for the curriculum
10 criteria employed in IS accreditation. This report provides a significantly more detailed
11 discussion regarding educational outcomes of IS programs than the previous versions did, which
12 is fully compatible with the recent direction in program assessment and accreditation.

13 14 **For Information Systems Faculty**

15
16 The IS model curriculum is intended to provide flexibility in designing IS curricula to satisfy
17 various local requirements. IS faculty may be affiliated with schools of business, schools of
18 public administration, stand-alone schools of Information Systems, or other variations. To better
19 serve the diversity of IS programs, this model curriculum is the first IS curriculum to separate
20 core and elective courses and explicitly acknowledge the significant local differences in the
21 requirements for IS curricula. As a practical illustration of the flexibility this provides, we later
22 present an IS Specific Course Matrix to provide examples of curriculum solutions that can be
23 developed within the framework that this document provides.

24
25 The guidance and the structural flexibility that this curriculum provides enable faculty members
26 to tailor and experiment with curriculum design. Based on local conditions, the desired number
27 of core and elective courses with tailored depth of coverage for appropriate topics may be
28 fashioned. This allows faculty to flexibly design IS curricula to meet career track expectations
29 for graduates.

30
31 At the course level, this model curriculum continues to follow the tradition of IS curriculum
32 recommendations and provides descriptions for core courses and a subset of key electives. These
33 descriptions include a catalog description, learning objectives and topics for each of the courses.
34 This material will be helpful for both individual faculty members who are working on course
35 design and for departments that are making decisions regarding the direction their curricula
36 should take.

37 38 **For Non-Information Systems Faculty**

39
40 The use of information technology is pervasive in society. The requirement of the workforce to
41 utilize this technology is increasing. Users of information technology are now expected to take
42 personal responsibility for much of what has been handled in the past by a centralized computing
43 services unit. While many organizations provide some user training in information technology,
44 graduates who have an in-depth understanding of the opportunities IT capabilities can provide to
45 their organization are in a stronger position compared to their peers without this understanding. A
46 strong, capable Information Systems program can benefit all students in a school and provide
47 special benefits to non-majors who desire more competence in information technology and its
48 application to their areas of interest.

49

1 IS 2009 identifies prerequisite skills needed by all students in basic personal productivity
2 software. Students in all majors should have a working knowledge of how to effectively utilize
3 software for word processing, electronic mail, Web browsing, spreadsheet modeling, database
4 management, presentation graphics, statistical analysis, and external database retrieval. Although
5 these skills are prerequisite and not part of the exclusive domain of Information Systems, the
6 Information Systems faculty can provide useful competence for managing the self-study modules,
7 course modules, and testing-out examinations for the prerequisites.

8
9 The IS 2009 curriculum specifies a general course (Foundations of Information Systems) to
10 provide an understanding of and skills related to Information Systems suitable for all students.
11 This course establishes a foundation for specialized courses related to functional area information
12 systems.

13
14 Students majoring in other subjects may wish to have a minor in Information Systems. The IS
15 2009 curriculum defines a subset of the courses in the major suitable for a minor. The courses
16 include IS Strategy, Management & Acquisition, Enterprise Architecture, and Data and
17 Information Management.

18 19 **For Information Systems Practitioners**

20
21 The report provides a basis for practitioner interaction with IS academic units in at least three
22 ways: to gain an understanding of the model curriculum and therefore, the competencies of the
23 graduates of the program, to identify opportunities for enhancing the educational experience for
24 the students (for example, guest speakers, internships, advisory board memberships, and so forth),
25 and to enable a continuous dialogue to improve the curriculum and the educational experience of
26 students.

27 28 **For Information Systems Students**

29
30 For students who are enrolled in an IS program, this report can add to their understanding of the
31 breadth and depth of the IS field and the career opportunities. Information in this report can
32 prepare students for discussions with academic advisors as to options and choices in the program
33 and strategies for entering the job market. Further, IS programs can prepare students for advanced
34 IS studies. This can include both research-oriented and practitioner-oriented advanced programs.

35 36 **Other Stakeholders**

37
38 The primary audiences for this report are the stakeholders listed above. Other constituents may
39 also find value in this report and should not be precluded. These groups include parents, career
40 advisors, potential applicants and so on.

41 42 43 **2. INFORMATION SYSTEMS MODEL CURRICULA**

44
45 *IS 2009 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems* is
46 the latest report on the model curriculum work in the Information Systems field. The work of IS
47 curriculum task forces began in the early 1970s and has continued for the past 30+ years. The
48 Association for Computing Machinery (ACM) has been a major organizer for these task forces
49 including the first efforts in the 1970s. Other organizations, including AIS (Association for

1 Information Systems), AITP (formerly DPMA) and IFIP (International Federation for
2 Information Processing), have contributed significantly to model curriculum development.

3
4 IS 2009 is the third collaborative effort by ACM and AIS. Both organizations have worldwide
5 membership. ACM has both professional and academic members in the broad field of computing.
6 Through its Education Board, it supports a wide range of curriculum development including
7 Computer Engineering, Computer Science, Information Systems, Information Technology, and
8 Software Engineering. AIS, established in 1994, is primarily composed of faculty members in
9 Information Systems. The partnership of ACM and AIS, therefore, combines the breadth of
10 pedagogical and curriculum interests of these organizations.

11
12 Since ACM and AIS are worldwide organizations, IS 2009 includes elements that make it more
13 universally adaptable than its predecessors. The separation of the core courses from the electives
14 makes it easier to create curricula that both are compatible with the model curriculum and address
15 local requirements that vary widely. IS 2009 is not directly linked to a degree structure in any
16 specific environment but it provides guidance regarding the core content of the curriculum that
17 should be present everywhere and suggestions regarding possible electives and career tracks
18 based on those.

19
20 IS 2002 (Gorgone et al. 2003) was a relatively minor update of IS'97, the latest comprehensive
21 revision of the IS model curriculum. IS 2002 included new material related to the explosive
22 growth of the Internet and electronic business, to the extent that it included a new course
23 specifically targeted to this topic area. The previous curriculum model, IS '97 (Couger et al.
24 1997; Davis et al. 1997) was circulated in draft form in 1994 (Gorgone et al. 1994; Longenecker
25 et al. 1994) and 1995 (Couger et al. 1995) and finalized in 1996. Therefore, a significant revision
26 of the model curriculum is clearly needed and overdue. These reasons will be discussed at a more
27 detailed level in Section 4.

28
29 The next sections present the principles guiding the curriculum revision and provide further
30 motivation for updating IS 2002. This is followed by a review of guiding assumptions about the
31 IS profession that helped to shape the curriculum design and evolution. A summary of key
32 differences between IS 2002 and IS 2009 will follow. Next, the report provides a description of
33 Information Systems as a field of academic study. The relationship of the IS courses and
34 programs at various levels is explained. This document presents an entirely new, significantly
35 expanded section on outcome expectations for the Information Systems graduates. This is
36 followed by a brief presentation of the curriculum architecture, the resources needed for IS degree
37 programs, and courses shared with other computing disciplines. Finally, the report concludes by
38 providing high-level course descriptions of the IS 2009 model curriculum and appendices for
39 reference.

40 41 **3. PRINCIPLES GUIDING THE CURRICULUM DESIGN**

42
43 The key principles that guided this effort were as follows:

- 44
45 1. The model curriculum should represent a consensus from the Information Systems
46 community.
- 47
48 2. The model curriculum should be designed to help Information Systems programs to produce
49 competent and confident entry-level graduates well suited to workplace responsibilities or
50 further studies of Information Systems.

- 1
- 2 3. The model curriculum should guide but not prescribe. Using the model curriculum
- 3 guidelines, faculty can design their own courses and schools can design their own programs.
- 4
- 5 4. The model curriculum should be based on sound educational methodologies and make
- 6 appropriate recommendations for consideration by Information Systems faculty.
- 7
- 8 5. The model curriculum should be flexible and adaptable to most Information Systems
- 9 programs.
- 10
- 11 6. The model curriculum is not restricted to a specific domain; all Information Systems
- 12 programs are, however, linked to some domain.
- 13
- 14 7. The model curriculum has a core of content that is common to all Information Systems
- 15 programs.
- 16
- 17 8. The model curriculum has career targets that require both core and elective content.
- 18
- 19 9. The model curriculum does not focus on specific issues related to pedagogy. This is not a
- 20 reflection of our understanding of the importance of pedagogical decisions; we simply
- 21 believe that these highly significant issues are outside the scope of this document.
- 22

23 **4. MOTIVATION FOR REVISING IS 2002**

24

25 There are several factors motivating the IS curriculum revision. This section will provide an

26 overview of the reasons why it was critically important for the IS community to go through the

27 curriculum revision process.

28

29 The first, and most obvious, reason is the time elapsed since the previous revision. As discussed

30 above, the last comprehensive undergraduate curriculum revision was IS'97 (Davis et al. 1997);

31 Most of the work done on IS'97 was completed in the mid-1990s, making the curriculum

32 elements closely linked to a specific set of technologies quite antiquated.

33

34 Second, there has been a great deal of change in technology and industry practices. This major

35 contextual change has several factors driving it, including:

- 36 1. Complex globally distributed information systems development – The full extent of the
- 37 distributed nature of IT development was not fully visible during the development of the
- 38 previous curriculum. The skills needed by IS graduates have, consequently, changed
- 39 significantly. Increasingly, many IS jobs require skills in working with colleagues and
- 40 development team members around the world. Further, for business school graduates
- 41 capabilities in the management of globally distributed development resources are
- 42 increasingly in demand.
- 43 2. Web technologies and development – Mature modeling and development platforms for
- 44 the web environment have become a core part of IS development.
- 45 3. Emergence of a new architectural paradigm. Service-oriented architecture, web services,
- 46 software-as-a-service, and cloud computing are all important elements in the new way of
- 47 organizing the fundamental architecture for computer-based systems and solutions that is
- 48 gradually becoming the dominant paradigm of organizational computing.
- 49 4. ERP/package software – Information systems and business processes have become
- 50 closely integrated, and increasingly often, core infrastructure applications are based on

- 1 large-scale enterprise systems so that the focus has shifted from development to
2 configuration.
- 3 5. Ubiquitous mobile computing – Global organizational life using a variety of devices has
4 become dependent on mobile and ubiquitous platforms.
- 5 6. IT control and infrastructure frameworks – Frameworks and standards such as COBIT,
6 ITIL, and ISO 17799, have become very important sources of guidance for IT/IS
7 practices in organizations. We have to at least ask the question about what their role is in
8 IS curricula.

9
10 Clearly, the professional context in which our graduates do their work has changed considerably
11 over the past decade, and this change should be reflected in the curriculum. Not only should the
12 new concepts be covered in the curriculum but also the new model they collectively specify for
13 computing in organizations has a profound impact on the capabilities that Information Systems
14 graduates need.

15
16 Third, the interest in the study of IS as a field has dramatically declined among students at most
17 institutions. Therefore, it is imperative that the IS community as a whole addresses this problem
18 from several different perspectives, including curriculum design. The response to the enrollment
19 crisis cannot only be based on curriculum changes; however, an outdated curriculum can be a
20 sufficient reason to turn a prospective student away from the discipline.

21
22 Fourth, the IS discipline must address its core principles and values within and through the
23 curriculum. By doing so, the importance of clearly articulating the identity of the IS discipline
24 can be established and strengthened. The recent approval of the model curriculum for the
25 emerging IT discipline has made this reason particularly important.

26
27 Finally, the revision process was seen as a mechanism to engage the IS community in a more
28 comprehensive way than was possible during earlier update efforts. The task force believed that
29 the Internet and, specifically, Web 2.0 technologies would provide a strong set of technical
30 capabilities to enable and encourage collaboration among IS academics and practitioners around
31 the world.

32
33 Of course, this list cannot be inclusive of all motivations for the curriculum revision. We hope,
34 however, that these issues clearly stress the importance of substantially and systematically
35 overhauling the current curriculum.

36
37

38 **5. GUIDING ASSUMPTIONS ABOUT THE INFORMATION** 39 **SYSTEMS PROFESSION**

40

41 In conceptualizing the role of information systems in the future and the requirements for IS
42 curricula, several elements remain important and characteristic of the discipline. These
43 characteristics evolve around four major areas of the IS profession and therefore must be
44 integrated into any IS curriculum:

45

- 46 1. IS professionals exist in a broad variety of domains, including, for example, business,
47 health care, government, and non-profit organizations. Students must therefore
48 understand that:
- 49 • IS professionals are enablers of successful performance in a multitude of
50 organizations

- 1 • IS professionals span and integrate all organizational levels and functions
- 2 • IS professionals need both an excellent understanding of the domain within
- 3 which they work and appropriate technology knowledge for their organizational
- 4 role
- 5 • Information systems in organizations are increasingly of strategic significance
- 6 because of the scope of the organizational systems involved and the role systems
- 7 play in enabling organizational processes and strategies.
- 8 2. IS professionals must have strong analytical and critical thinking skills to thrive in a
- 9 competitive global environment. Students must therefore:
- 10 • Be problem solvers and critical thinkers
- 11 • Use systems concepts for understanding and framing problems
- 12 • Be capable of applying both traditional and new concepts and skills
- 13 • Understand that a system consists of people, procedures, hardware, software, and
- 14 data within a global environment.
- 15 3. IS professionals must exhibit strong ethical principles and have good interpersonal
- 16 communication and team skills. Students must understand that:
- 17 • IS professionals should be able to critically evaluate and possibly act on
- 18 current ethical issues in the IS field
- 19 • IS professionals should be able to apply professional codes of conduct
- 20 • IS professionals should be able to collaborate with other professionals as well as
- 21 perform successfully at the individual level
- 22 • IS professionals should have excellent communication skills (oral, written, and
- 23 listening)
- 24 • IS professionals should be able to demonstrate persistence, curiosity, creativity,
- 25 risk taking, and a tolerance of these abilities in others.
- 26 4. IS professionals must design and implement information technology solutions that
- 27 enhance organizational performance. Students must therefore:
- 28 • Possess skills in understanding and modeling organizational processes and data,
- 29 defining and implementing technical and process solutions, managing projects,
- 30 and integrating systems within and across organizations.
- 31 • Be fluent in techniques for acquiring, converting, transmitting, and storing data
- 32 and information
- 33 • Focus on the application of information technology in helping individuals,
- 34 groups, and organizations achieve their goals within a competitive global
- 35 environment.
- 36
- 37

38 **6. KEY ELEMENTS OF THIS CURRICULUM REVISION**

39
40 The Information Systems landscape has changed significantly over the past several years.
41 Therefore, the foundations of the curriculum must be evaluated. There are four key elements of
42 the revision:

43 44 **1. Reaching beyond the business school.**

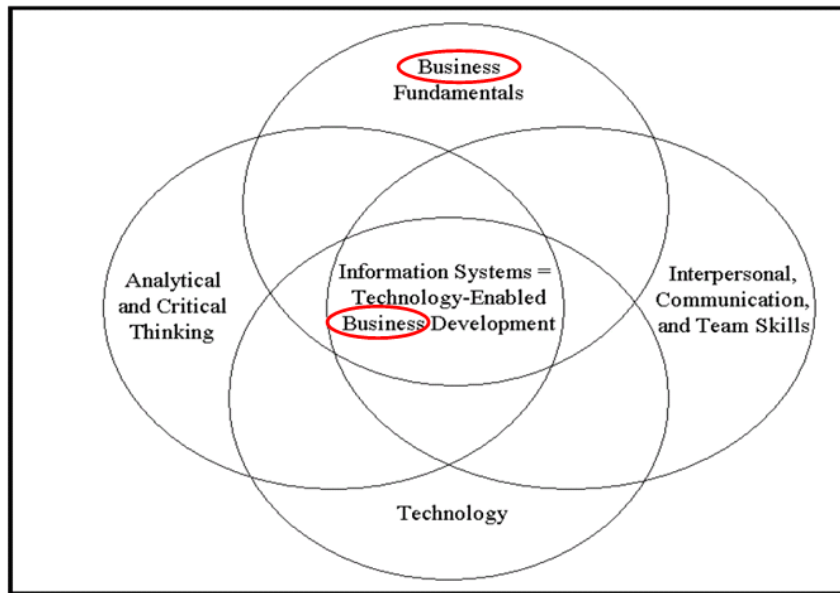
45
46 There is an ongoing debate regarding the nature and identity of Information Systems as a
47 discipline. At the center of this debate is whether Information Systems is exclusively a business
48 discipline (i.e., exists only within a business domain), or whether Information Systems can exist
49 in a variety of domains, including law, biology, healthcare, and so on. Earlier model curricula
50 have clearly identified business as the domain in which IS was located. As shown in Figure 1

1 below (excerpted from IS 2002), business was the exclusive domain for prior versions of the
 2 model curriculum where domain content was shown as “business fundamentals.” Although IS
 3 2002 clearly acknowledges that IS programs could and do exist outside business schools, it also
 4 took the position that the primary (exclusive) domain for graduates was business and
 5 “technology-enabled business development” (further clarified as systems analysis and design,
 6 business process management, systems implementation, and IS project management).

7
 8 No longer should the Information Systems paradigm be exclusive to the business school context.
 9 Even though business will likely continue to be the primary domain for Information Systems, the
 10 discipline provides expertise that is critically important for an increasing number of domains.

11
 12 **2. Revising the outcome expectations for IS graduates and proposing subsequent changes**
 13 **to the curriculum topics.**

14
 15 This category includes subsequent changes to the curriculum topics to reflect the changed
 16 outcome expectations. This change centers on the radical contextual change both in terms of
 17 technology and business discussed above. These actions are a critically important and natural part
 18 of the revision process.



20
 21
 22 Figure 1: Demonstration of the close linkage between Information Systems and Business
 23 in IS2002.

24
 25
 26 The IS 2002 curriculum had taken a “one size fits all” philosophy, whereby there is no separate
 27 core specified within the curriculum. In essence, all courses are required. Unfortunately, this
 28 model left little room for local innovation and adaptation in institutions that wanted to adopt the
 29 model curriculum in its entirety. For many schools, it was impossible to follow the curriculum
 30 guidelines because they had fewer courses in their program than the 10 specified in IS 2002. On
 31 the other hand, at other institutions there might be much more room available for IS courses, and
 32 again, the fixed-size model curriculum is an obstacle. As a result, many institutions did not find
 33 IS 2002 to be responsive to their particular situations. To overcome this limitation of IS 2002, the

1 task force wanted to introduce greater flexibility into the new curriculum. To do so, the task force
2 identified a set of core courses that will be common to all Information Systems programs.

3
4 The seven core courses are:

- 5
- 6 1. Foundations of Information Systems
- 7 2. Data and Information Management
- 8 3. Enterprise Architecture
- 9 4. IT Infrastructure
- 10 5. IS Project Management
- 11 6. Systems Analysis and Design
- 12 7. IS Strategy, Management, and Acquisition
- 13

14 It is important to note that these seven courses in the model can be implemented in a specific
15 local context as independent courses or as components within fewer courses if need be. The key
16 point is that the task force strongly believes that there is indeed a core content that should be
17 incorporated in every undergraduate Information Systems program, and that this content is
18 captured in this list of core courses. In essence, the task force is making a strong statement
19 regarding what defines Information Systems at the undergraduate level by specifying the core.
20 The proposed model curriculum acknowledges that not all programs are able to cover all aspects
21 of the core at the same level of depth, but some level of coverage of these topics is required for a
22 program to be identified as an Information Systems program.

23
24 Particularly taking into account the radical contextual change both in terms of technology and
25 business discussed above, these actions are a very important and natural part of the revision
26 process.

27 28 **3. Evaluating the assumptions underlying the curriculum structure and modifying it** 29 **accordingly.**

30
31 Past revisions have ended by providing a basket of classes that were recommended for IS
32 programs. This curriculum revision process hopes to be more inclusive by providing a short list of
33 core topics that are essential pedagogically to Information Systems, allowing programs to
34 customize other topics by creating a list of electives.

35
36 This can be done by offering a curriculum that does not specify a single career objective (i.e.,
37 technology-enabled business development or career as a systems analyst) but will provide
38 numerous career tracks. These career tracks will integrate a combination of the core courses and
39 some set of career track electives. How the core courses are instantiated depends on the needs of a
40 specific career track (e.g., either briefly or very comprehensively, depending on the needs of the
41 target career track selected by a particular program). Career tracks, obviously, can be associated
42 with one or several domains. For example, a database administrator career track is compatible
43 with business, government, nonprofit, and healthcare domains (and many others).

44 45 **4. Involving the global IS community**

46
47 Traditionally, curriculum projects have been largely based on the work of a small task force that
48 has shared its work at a variety of conferences and incorporated the feedback from the sessions to
49 the model curriculum. In addition, written drafts have been shared widely and comments
50 solicited. Also, surveys have been used to gather industry input. This process is driven by a few
51 individuals with little input from the academy as a whole. We are using the wiki environment to

1 allow for global community involvement in the revision process. This is critical if the new
2 undergraduate Model Curriculum is to reflect the perspectives of the global Information Systems
3 discipline.

4
5 Engaging the entire IS community will be a metric of success for this task force's work. One of
6 the first tasks in the current curriculum revision project was to establish a feedback mechanism
7 that is globally accessible. For this, the task force turned to current thinking in system design,
8 expressly Web 2.0 (O'Reilly 2005). Through the use of Web 2.0 technologies, we created a
9 platform for discussion and harnessing the collective intelligence of the global IS community.
10 The specific Web 2.0 platform selected was MediaWiki, an open source wiki platform originally
11 written for Wikipedia. By using this Web-based platform, the task force believes that it can better
12 engage the broader IS community to assist in developing and maintaining the curriculum. Despite
13 its relative simplicity, ours appears to be a novel approach for developing curricula. It is our hope
14 that the task force's work can help other academic disciplines find ways to improve their
15 curriculum development processes.

16
17 The current version of the IS curriculum wiki is available at:
18 <http://blogsandwikis.bentley.edu/iscurriculum>.

19 20 **5. Implementation of the Key Elements**

21
22 In order to meet the goals outlined in the four key elements above, it was noted by the Joint
23 AIS/ACM Curriculum Task Force early on in the process that the IS 2009 document would have
24 to include a very different course structure than previous curriculum revisions. Therefore, the task
25 force started the process of evaluating the target high-level capabilities of an IS graduate. By
26 doing so, the committee believed that it could draw the knowledge and skills from the high-level
27 capabilities and further draw the curriculum topic for the knowledge and skills. This process was
28 very labor intensive and is described in detail in the outcome expectation section below.

29
30 This IS 2009 revision process required that we evaluated new ways the curriculum course
31 structure could be offered. The first option was staying with a standard structure similar to that
32 presented in IS 2002 and its predecessors. By doing so the task force would offer the IS
33 committee a very rigid outline that included a basket of courses that could be implemented, in its
34 entirety or in part, by IS programs. This was problematic for the committee as the rigid structure
35 would not allow the IS 2009 curriculum to meet the needs of 1) global IS programs and 2)
36 programs outside business schools. For this reason another approach was needed.

37
38 The task force proposed an innovative course structure to address the need of the different global
39 constituents. By doing so, the revised curriculum could be tailored to the strengths and needs of
40 any program around the world while also recommending a structured core that would standardize
41 the foundational knowledge and skills for all IS graduates. This semi-flexible curriculum clearly
42 met the goal stated in the key elements for IS 2009. For this reason, the task force proceeded to
43 develop the structure of the core topics while also allowing for specializations in IS. The
44 following will describe the need for Information Systems as a distinct academic field.

45 46 **7. INFORMATION SYSTEMS AS A FIELD OF ACADEMIC** 47 **STUDY**

48
49 Computer-based information systems continue to be a critical part of the products, services,
50 operations, and management of organizations. Indeed, information systems and information

1 technology can be so critical as to disrupt classic business models, threatening traditional revenue
2 streams and even driving industry sectors to extinction. The print newspaper industry, travel
3 agencies, real estate agencies, and video rental stores represent industries that have been forced to
4 change their business models and operations in response to the introduction of new information
5 technologies and systems. The effective and efficient use of information and communications
6 technologies is an important element in maintaining or achieving competitive advantage for
7 business organizations and excellence in service for government and non-profit organizations.
8 The information technology/information systems strategy is an integral part of organizational
9 strategy. Information systems support management processes at all levels – operational, tactical,
10 and strategic management. Information systems are vital to problem identification, analysis, and
11 decision making. The importance of information technology and information systems to
12 organizations and the need for well-educated professionals in the field is the basis for a strong
13 link between educational programs and the professional community of IS practitioners (Bullen et
14 al. 2009; Dick et al. 2007; Mawhinney et al. 1994; Trauth et al. 1993).

15
16 Information Systems as a field of academic study began in the 1960s, a few years after the first
17 use of computers for transaction processing and reporting by organizations. As organizations
18 extended the use of information processing and communication technology to operational
19 processes, project management, decision support, and enterprise and industry strategy, the
20 academic field also grew in scope and depth. An IS organization function emerged to manage
21 computer and communications technologies and information resources within an organization. In
22 the same way that universities have degree programs reflecting important organizational
23 functions, such as financial resource management, marketing resource management, and human
24 resource management, a degree program emerged for management of information technology and
25 information resources. During this nearly half century of growth and change, different names
26 have been used and the definition of the field has been enlarged. The simple term Information
27 Systems (IS) has become the most commonly accepted, generic term to describe the discipline.
28

29 **Differing Names for the Academic Field of Information Systems**

30
31 Information Systems as a field of academic study exists under a variety of different names. The
32 different labels reflect historical development of the field, different ideas about how to
33 characterize it, and different emphases when programs were begun. The names of computer-
34 related majors offered in undergraduate institutions accredited by the Association to Advance
35 Collegiate Schools of Business (AACSB) in the United States, for example, are represented by
36 the following terms) (Pierson et al. 2008):
37

38
39
40 Management Information Systems, representing 40.5% of programs

41 Information Systems, representing 20.6% of programs

42 Computer Information Systems, representing 18.0% of programs
43

44 The remaining 20.9% of programs are known by names such as:

45
46 Information Management

47 Information Systems Management

48 [Business] Information Systems

49 [Business] Computer Systems

50 [Business] Computer Information Systems

51 [Business] Information Technology Management

1 [Business] Informatics
2 Information Resources Management
3 Information Technology
4 Information Technology Systems
5 Information Technology Resources Management
6 Accounting Information Systems
7 Information Science
8 Information and Quantitative Science
9
10
11

12 **The Scope of Information Systems**

13
14 Information Systems as a field of academic study encompasses the concepts, principles, and
15 processes for two broad areas of activity within organizations: (1) acquisition, deployment,
16 management, and strategy for information technology resources and services (the information
17 systems function; IS strategy, management, and acquisition; IT infrastructure; enterprise
18 architecture; data and information) and (2) packaged system acquisition or system development,
19 operation, and evolution of infrastructure and systems for use in organizational processes (project
20 management, system acquisition, system development, system operation, and system
21 maintenance). The systems that deliver information and communications services in an
22 organization combine both technical components and human operators and users. They capture,
23 store, process, and communicate data, information, and knowledge.
24

25 The information systems function in an organization has a broad responsibility to plan, develop or
26 acquire, implement, and manage an infrastructure of information technology (computers and
27 communications), data (both internal and external), and enterprise-wide information processing
28 systems. It has the responsibility to track new information technology and assist in incorporating
29 it into the organization's strategy, planning, and practices. The function also supports
30 departmental and individual information technology systems. The technology employed may
31 range from large centralized to mobile distributed systems. The development and management of
32 the information technology infrastructure and processing systems may involve organizational
33 employees, consultants, and outsourcing services.
34

35 The activity of developing or acquiring information technology applications for organizational
36 and inter-organizational processes involves projects that define creative and productive use of
37 information technology for transaction processing, data acquisition, communication,
38 coordination, analysis, and decision support. Design, development or acquisition, and
39 implementation techniques, technology, and methodologies are employed. Processes for creating
40 and implementing information systems in organizations incorporate concepts of systems analysis
41 and process design, innovation, quality, human-machine systems, human-machine interfaces, e-
42 business design, sociotechnical systems, and change management.
43

44 Information systems professionals work with information technology and must have sound
45 technical knowledge of computers, communications, and software. Since they operate within
46 organizations and with organizational systems, they must also understand organizations and the
47 functions within organizations (administration, accounting, finance, marketing, operations,
48 human resources, and so forth). They must understand concepts and processes for achieving
49 organizational goals with information technology. In addition to sound technical knowledge and
50 organizational understanding, they must possess systems thinking, the ability to analyze business
51 problems, communication skills, and teamwork skills (Overby 2006). The academic content of

1 an Information Systems degree program therefore includes information technology, information
2 systems strategy and management, information systems development and implementation,
3 organizational functions, and concepts and processes of organizational management.

4
5 In recent years, Information Technology has emerged as a new academic discipline under the
6 broad umbrella of computing. Its role has been recognized in two recent documents produced by
7 the computing education community. CC 2005 Overview Report, a broad survey of five
8 established computing disciplines (Computer Engineering, Computer Science, Information
9 Systems, Information Technology, and Software Engineering) was the first published work to
10 identify the formal role of Information Technology as a computing discipline (Shackelford et al.
11 2005). Based on published and draft curriculum documents, the overview report compares and
12 contrasts computing disciplines, and it clearly positions Information Systems and Information
13 Technology as disciplines that on one hand operate in the same space (focusing on organizational
14 needs) but on the other hand address a very different set of questions. The document presents the
15 contrast as follows:

16
17 *Professionals in the [Information Systems] discipline are primarily concerned with the*
18 *information that computer systems can provide to aid an enterprise in defining and*
19 *achieving its goals, and the processes that an enterprise can implement or improve*
20 *using information technology. ... Information Systems focuses on the information*
21 *aspects of information technology. Information Technology is the complement of that*
22 *perspective: its emphasis is on the technology itself more than on the information it*
23 *conveys. IT programs exist to produce graduates who possess the right combination of*
24 *knowledge and practical, hands-on expertise to take care of both an organization's*
25 *information technology infrastructure and the people who use it. (CC 2005, p. 14).*
26

27 The other recently published document that specifies the Information Technology discipline is the
28 IT model curriculum, IT 2008. This document, approved in late 2008, defines the Information
29 Technology Body of Knowledge and an undergraduate curriculum for the IT discipline. In
30 comparing the curriculum specified in IT 2008 and the core of this IS curriculum, we can clearly
31 see that the disciplines share areas of interest, such as Data and Information Management, IT
32 Infrastructure, and Human Computer Interaction, but that there are also specific areas of
33 distinction. Particularly important is the IS emphasis on Systems Analysis and Design (including
34 Business Analysis and Business Process Design and Management), IT Strategy, Management,
35 and Acquisition, and Enterprise Architecture. It is very likely that the discussion regarding the
36 identities of the IT and IS disciplines will continue actively during the next several years.

37 38 **8. RELATIONSHIP BETWEEN THE FOUNDATIONS OF IS** 39 **COURSE, THE MINOR, AND THE MAJOR**

40
41 **Prerequisite Technology Skills:** The prerequisite skills level provides a personal capability for
42 student use of information technology. Several applications useful to students and graduates are
43 covered, including: word processing, Web browsing, electronic mail, spreadsheet processing,
44 database management, presentation graphics, and external database retrieval. Although word
45 processing is included here, it is typically acquired prior to formal courses. Some institutions
46 provide the prerequisite IS skills level via a course required of all students. Other institutions
47 enable students to acquire this competency through laboratories with computer-based tutorial
48 modules. Others assume proficiency gained at high school or based on personal experience.
49 Competency tests may be used to ensure adequacy of prior knowledge. The Information Systems
50 faculty may also have major responsibilities for remedial work relative to the prerequisite skills.

1
2 **All Students:** The Foundations of Information Systems course provides all students with an
3 introduction to the purposes, uses, and value of information systems and information resources in
4 organizations. It introduces concepts and methods by which IT professionals design and
5 implement systems and explains the technologies and processes for providing information and
6 communications resources. The course illustrates opportunities for business professionals to
7 employ technology resources. Students can build on their prerequisite understanding to
8 investigate useful concepts, functions, and capabilities provided by information systems.
9 Exercises will assist students in understanding system development processes, effective use of
10 information systems, and quality concepts in providing inputs and using outputs from systems.

11
12 Exercises may enable students majoring in functional areas to gain additional IS skills and system
13 understanding through use of application packages in their major fields of study, such as
14 accounting, finance or marketing. Team projects with actual clients demonstrate applied learning.

15
16 **IS Minors:** In addition to the courses all students take, an IS minor consists of a subset of the
17 major courses that form a cohesive set of knowledge complementary to the student's major field
18 of study. Individuals with a minor in IS often act as technology liaisons and as functional area
19 representatives on teams to develop and enhance major applications. A minor may be tailored to
20 these unique functional area requirements, such as marketing or accounting, or a second field,
21 such as health sciences.

22
23 **IS Majors:** An IS major consists of the entire model curriculum targeted for a particular career
24 track. Students proficient at this level are prepared to enter a career in the IS field. They have
25 competencies in basic technical areas and apply these to business processes and project
26 management. Graduates of IS programs can work for different industries such as manufacturing,
27 financial services, health care, and others including information technology providers of
28 hardware, software, and services.

Student Groups	Curriculum Model
All Students	IS 2009.1 Foundations of Information Systems
IS Majors and Minors	IS 2009.7 IS Strategy, Management, and Acquisition IS 2009.3 Enterprise Architecture IS 2009.2 Data and Information Management
IS Majors	IS 2009.6 Systems Analysis & Design IS 2009.5 IT Infrastructure IS 2009.4 IS Project Management

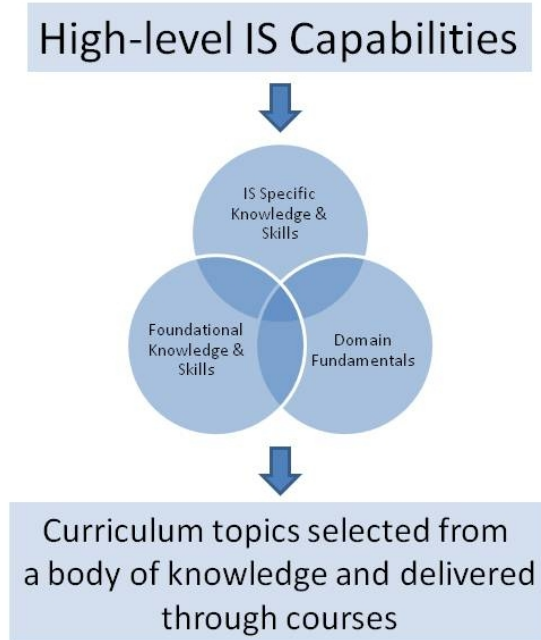
31 **Figure 2. Representative IS 2009 Curriculum Design for All Students, IS Minors, and IS**
32 **Majors**

33 34 **9. OUTCOME EXPECTATIONS FOR INFORMATION** 35 **SYSTEMS GRADUATES**

36 37 **Overall Structure of Basic Concepts**

38
39 The restructuring of the Model Curriculum is clearly driven by changes in high-level
40 organizational needs and graduate capabilities. The work underlying the curriculum specification
41 first identified the high-level capabilities needed by IS graduates. These overall capabilities, in
42 turn, are based on knowledge and skills that have been categorized as IS-specific Knowledge and

1 Skills, Foundational Knowledge and Skills, and Domain Fundamentals. By doing so, the revised
 2 Model Curriculum links curriculum content and structure to graduate capabilities in a well-
 3 defined and transparent way. Figure 3 shows how the high-level IS capabilities are extrapolated
 4 to the final curriculum topics delivered through courses.
 5



6
7

8 **Figure 3: Overall Structure of the Basic Concepts.**

9

10 **High-level IS Capabilities**

11

12 The new curriculum will be based on a significantly revised set of degree outcome expectations,
 13 that is, expectations regarding the capabilities of graduating IS students when entering the full-
 14 time workforce. The new capability set recognizes the change in the nature of the jobs IS
 15 graduates are likely to have by focusing on business analysis, organizational processes, enterprise
 16 architecture, sourcing options, and security/risk management. The curriculum acknowledges
 17 explicitly the contribution that the Information Systems discipline can make to domains outside
 18 business (such as governments, non-profits, health care, etc.) and, therefore, the high-level
 19 capabilities are not limited to a specific domain. They are, however, driven by organizational
 20 needs and more abstract and stable than knowledge and skills. The following will give a more
 21 detailed description of each capability.

22

23 *Improving Organizational Processes*

24

25 The new curriculum assumes that understanding and improving organizational processes is one of
 26 the key capabilities of all IS graduates. This requires the graduates to be functional in:

27

- 28 • Understanding the fundamental concepts related to organizational processes
- 29 • Understanding general principles of process analysis in order to apply them to specific
30 situations
- 31 • Analyzing existing processes based on interviewing, observation, documentation
32 analysis, and other similar methods

- 1 • Understanding how the very large amounts of data collected by modern organizations can
- 2 be used to review, redesign, and improve processes
- 3 • Identifying and capturing the essential findings from the large amount of data produced
- 4 by the analysis process
- 5 • Researching and applying industry reference models and best practices in order to
- 6 improve process designs
- 7 • Using the analysis results as a basis for designing revised processes based on the
- 8 graduates' strong understanding of both organizations and information technology
- 9 • Simulating a proposed process and revising it as necessary
- 10 • Negotiating a solution that satisfies the political requirements for the new process
- 11 • Understanding the limitations of what can be achieved with available technology,
- 12 financial resources, and organizational capabilities.
- 13 • Leading the implementation of new processes.

14
15 The specification of high-level IS capabilities does not include a particular set of process
16 improvement methods or techniques, but the graduates are expected to be aware of and benefit
17 from at least one such method.

18 19 *Exploiting Opportunities Created by Technology Innovations*

20
21 Graduates of Information Systems programs are experts in seeing how organizations can benefit
22 from technology capabilities, converting opportunities created by information technology
23 innovations into sustainable organizational value through systematic processes. An essential
24 element of this high-level capability is the ability to understand both information technology and
25 the needs of an organization within a specific domain at such a deep level that IS graduates see
26 new opportunities to create value faster and with greater clarity during various analysis processes
27 than their non-IS counterparts. Achieving a high level of performance related to this capability
28 requires in-depth knowledge of technology and the domain, skills in analyzing problems and
29 designing solution alternatives, ability to analyze the strengths and weaknesses of various
30 alternatives, understanding issues related to the feasibility of possible solutions, as well as
31 demonstrable skills in sourcing, designing, and implementing technology solutions.

32 33 *Understanding and Addressing Information Requirements*

34
35 Another key capability of all IS graduates is the ability to analyze and document organizational
36 information requirements at various levels, starting from those of individual knowledge workers
37 responsible for specific tasks and ending with very high level institutional requirements. IS
38 graduates are experts in analyzing the information needs of an individual, organizational unit, or
39 an organization in order to determine how information technology-based solutions can best be
40 designed to support these information needs. Increasingly, the core capabilities in this area are
41 related to effective utilization and integration of data that is generated in a rich variety of
42 organizational systems and includes multiple types and formats.

43 44 *Designing and Managing Enterprise Architecture*

45
46 Information Systems graduates are experts in high level design and management of IT
47 capabilities that are fully aligned with general organizational goals. Currently, these capabilities
48 are typically organized and presented as an enterprise architecture, consisting of high-level
49 internally compatible representations of organizational business models, data, applications, and
50 information technology infrastructure. The capabilities of the graduates of undergraduate IS
51 programs are typically at a level suitable for focusing on the component architectures. One of the

1 knowledge and skill areas that is directly derived from this high-level IS capability is related to IT
2 infrastructure, including networking technology, data centers, and so on. This high-level
3 capability also requires an understanding of the IT management and control frameworks, such as
4 ITIL and COBIT.

5 6 *Identifying and Evaluating Solution and Sourcing Alternatives*

7
8 Graduates of IS programs are capable of producing high-level design alternatives for various
9 organizational IT-based solutions. There are always a large number of ways to achieve a specific
10 set of organizational capabilities using information technology, but not all of approaches are
11 feasible in a specific context. An essential high-level capability that IS graduates have is an
12 ability to identify a small subset of realistic, financially and technically feasible solution
13 alternatives and the mechanisms through which an organization can acquire these technology
14 resources. Most projects require reusing or building on the existing components (such as
15 modules, reusable objects, databases, information architectures, etc.) used in the current systems,
16 and therefore, it is essential that graduates have the capability to understand a variety of
17 technologies and their integration.

18
19 In particular, the globalization of the IS/IT supply chain has made the traditional "buy vs. build"
20 questions significantly more complex to answer, but the core issues are still the same: once an IT
21 capability need has been identified, what is its high-level design and how should an organization
22 acquire this capability?

23 24 *Securing Data and Infrastructure*

25
26 It has been increasingly important for organizations to ensure that their data and IT infrastructure
27 resources are protected from a variety of security threats, which can potentially create significant
28 financial liabilities as well as damage the organizational image. Understanding these threats and
29 identifying high-level solutions to protecting the organization are essential capabilities of all
30 graduates of Information Systems degree programs.

31 32 *Understanding, Managing and Controlling IT Risks*

33
34 IS graduates should have strong capabilities in understanding, managing, and controlling
35 organizational risks that are associated with the use of IT-based solutions (e.g., security, disaster
36 recovery, obsolescence, etc.). At the undergraduate level, the emphasis should be on in-depth
37 understanding of a variety of risks. Because IT solutions are so closely integrated with all aspects
38 of a modern organization, it has become essential to manage the risks related to their use in a
39 highly systematic and comprehensive way.

40 41 **Knowledge and Skills of IS Graduates**

42
43 Graduates of Information Systems undergraduate degree programs need a wide variety of specific
44 skills and knowledge as a foundation for the high-level IS capabilities specified earlier. The high-
45 level capabilities typically encompass skills and knowledge from various areas. For example, in
46 order to determine and address information requirements, an IS graduate needs to understand and
47 apply data management technologies, have excellent interpersonal, analytical, and problem
48 solving skills as well as have a strong command of the organizational domain for which the
49 information requirements are specified. The knowledge and skills that graduates in Information
50 Systems are expected to have can be divided into three categories:

51

- 1 1. Information Systems Specific Knowledge and Skills
- 2 2. Foundational Knowledge and Skills
- 3 3. Knowledge and Skills Related to Domain Fundamentals

4
5 The category "Information Systems Specific Knowledge and Skills" includes elements that are in
6 the core of the IS discipline. These knowledge and skills would not be developed by other types
7 of educational programs; they are specific to Information Systems as a discipline. "Foundational
8 Knowledge and Skills" are shared by many disciplines that educate knowledge professionals, and
9 they include broad categories such as leadership and collaboration, communication, and
10 analytical and critical thinking. Finally, "Domain Fundamentals" covers skills and knowledge
11 related to the domain to which a specific Information Systems program applies computing. For
12 most IS programs the domain is general business, but it could focus on a specific business
13 specialty (e.g., finance), industry (e.g., health care), organization type (e.g., government, non-
14 profit), and so on. As discussed above, undergraduate IS programs will develop knowledge and
15 skills in each of these three categories. When combined over the course of a student's studies,
16 they will lead to the high-level IS capabilities.

17 *Information Systems Specific Knowledge and Skills*

18
19
20 Information Systems specific knowledge and skills are divided into four main categories (and
21 subcategories), as follows:

- 22
23 1. **Identifying and designing opportunities for IT-enabled organizational**
24 **improvement.** The integrating theme of this category is the focus on an organization and
25 the ways it can develop its capabilities using information technology. In many ways, the
26 specific items in this category are related to requirements analysis and specification at a
27 high level of abstraction, including strategic alignment, the analysis of information needs,
28 and the evaluation of user experience.
29 These include:
 - 30 a. Ensuring alignment between IT strategy and organizational strategy
 - 31 b. Improving organizational processes with information technology solutions
 - 32 c. Understanding and designing the role of information systems in managing
33 organizational risks and establishing controls
 - 34 d. Identifying and exploiting opportunities created by emerging technology innovations
 - 35 e. Understanding and documenting information requirements
 - 36 f. Improving various stakeholders' experience in interacting with the organization,
37 including issues in human-computer interaction.
- 38
39 2. **Analyzing trade-offs.** One of the most important knowledge and skill categories for
40 Information Systems graduates is the ability to design and compare solution and sourcing
41 alternatives in a way that takes into account various sources of risks and dimensions of
42 feasibility, including technology characteristics, availability of and organizational ability
43 to utilize human resources, scheduling, organizational politics, regulatory issues, and
44 return on investment. A particular strength of Information Systems graduates is the
45 ability to integrate a variety of these perspectives and avoid analysis that narrowly
46 focuses on only technology or business requirements. A key element of this capability is
47 to be able to evaluate sourcing alternatives. Subcategories include:
 - 48
49 a. Identifying and designing high-level solution and sourcing options
 - 50 b. Analyzing and documenting the feasibility of various options
 - 51 c. Comparing solution options using multiple decision criteria

- 1 d. Capital budgeting for IT-intensive projects; creating a financial justification for
2 choosing between alternatives
3
- 4 3. **Designing and implementing information systems solutions.** Although the knowledge
5 and skills that IS graduates need have recently moved significantly in the direction
6 toward higher levels of abstraction, individual skills related to design and implementation
7 are still essential for IS graduates. Those who can demonstrate the ability to integrate
8 high performance in design and implementation, along with strong business capabilities,
9 are typically the most highly sought after graduation. This category of knowledge and
10 skills also includes the management of people and organizations that are used to develop
11 IS/IT capabilities, whether internal or external, regardless of their geographic location.
12 Knowledge and skills related to specific issues of IS project management are in this
13 category. The specific subcategories include:
14
- 15 a. Designing enterprise architectures
16 b. Identifying, evaluating, and procuring detailed solution and sourcing options;
17 configuring and integrating organizational solutions using packaged solutions
18 c. Designing and implementing solutions that provide a high-quality user experience
19 d. Designing secure systems and data infrastructures
20 e. Designing and implementing applications, application architectures and integrated
21 systems
22 f. Managing and exploiting organizational data and information; designing data and
23 information models
24 g. Managing information systems development/procurement resources
25 h. Managing information systems projects.
26
- 27 4. **Managing ongoing information technology operations.** IS graduates need knowledge
28 and skills related to the management of the ongoing information systems operations
29 within the organization, including the management, operation, and securing of the IT
30 infrastructure. This can include:
31 a. Managing the use of enterprise technology resources
32 b. Managing application performance and scalability
33 c. Maintaining existing information systems
34 d. Managing relationships with technology service providers
35 e. Securing data and systems infrastructure
36 f. Ensuring business continuance
37
38

39 *Foundational Knowledge and Skills*

40

41 Foundational knowledge and skills are not unique to Information Systems as a discipline. Instead,
42 most programs that educate knowledge professionals intend to develop some or all of these skills
43 and capabilities. Still, they are very important for Information Systems programs because it is
44 impossible for IS graduates to exhibit the required high-level IS capabilities without these
45 foundational knowledge and skills. Individual IS programs typically implement educational
46 experiences that develop these areas in an IS specific context.
47

- 48 1. **Leadership and collaboration.** The graduates of Information Systems programs will
49 be required to act in various collaborative roles during their professional careers, and
50 it is likely that most of them will be assuming leadership positions at various levels.
51 Increasingly, these roles are performed in a genuinely global context. It is essential

- 1 that programs prepare their graduates to be effective collaborators and inspiring
2 leaders. Capabilities should include:
3
4 a. Leading cross-functional global teams
5 b. Managing globally distributed projects
6 c. Working effectively in diverse teams
7 d. Structuring organizations effectively
8
- 9 2. **Communication.** It is impossible for an IS professional to perform effectively in any
10 organizational role without excellent oral and written communication skills. IS
11 professionals work closely with colleagues in a variety of different organizational
12 roles, and invariably, their job performance is partially dependent on their ability to
13 communicate. Capabilities should include:
14
15 a. Listening, observing, interviewing, and analyzing archival materials
16 b. Writing memos, reports, and documentation
17 c. Using global collaboration tools (such as wikis, blogs, shared collaboration
18 spaces, etc.)
19 d. Giving effective presentations
20
- 21 3. **Negotiation.** Related to the previous category, negotiation skills are also very
22 important for IS professionals. In their organizational roles, they have to navigate
23 carefully between different, competing interests within the organization. In these
24 situations, excellent negotiation skills are essential. Finally, IS professionals
25 increasingly play a role in the negotiations with external IT service providers and
26 other vendors. Capabilities should include:
27
28 a. Negotiating with users about funding, resources of time, staff, and features
29 b. Negotiating with providers about service levels
30 c. Negotiating with providers about quality and performance of deliverables
31 d. Facilitating negotiations between competing internal interests.
32
- 33 4. **Analytical and critical thinking, including creativity and ethical analysis.** Strong
34 analytical and critical thinking skills are a foundation for everything IS professionals
35 do – it is essential that they are able to systematically analyze complex systems and
36 situations, break them down into manageable components, understand deep
37 connections within systems, and create solutions based on the results of a systematic
38 analysis. Problem solving is also omnipresent in the life of IS professionals.
39 Capabilities should include:
40
41 a. Analyzing the ethical and legal implications of complex situations
42 b. Analyzing the risks associated with complex systems
43 c. Solving complex problems
44 d. Using quantitative analysis techniques appropriately and effectively
45 e. Enhancing innovation and creativity in oneself and others
46
- 47 5. **Mathematical foundations.** Even though IS professionals do not need the same
48 level of mathematical depth as many other computing professionals, there are,
49 however, some core elements that are very important for IS professionals (of course,
50 these needs will vary depending on an individual's specialty). To support in-depth
51 analysis of data, IS professionals should have a strong background in statistics and

1 probability. For those who are interested in building a strong skills set in algorithmic
 2 thinking, discrete mathematics is important.

3
 4 *Knowledge and Skills Related to Domain Fundamentals*

5
 6 Domain Fundamentals is the third category of knowledge and skills. It is equally important as the
 7 other two, but different because its contents vary significantly depending on the domain that
 8 together with the other two categories forms the outcome expectations for an Information
 9 Systems degree. The most common domain for Information Systems is business in general, but
 10 many other domains are possible components, including business specialties (such as accounting
 11 or finance), government, health care, the legal profession and non-governmental organizations.
 12 Within each domain, it is typically possible to identify at least three subcategories of domain
 13 knowledge:

- 14
 15 • General models of the domain. This subcategory refers to the general foundational
 16 material that provides an overall understanding of the domain at the level that is needed
 17 to both understand the general concepts within the area and form a basis for studying the
 18 key specializations within the domain.
 19 • Key specializations within the domain. Within each domain, there is a core set of the
 20 most important specializations that are essential for understanding the domain and
 21 operating within it. It is, obviously, typical that with the domains there is vigorous
 22 discussion regarding what these specializations are, but, for example, within business it
 23 appears that few experts would dispute the need to include finance, accounting,
 24 marketing, and management (both organizational behavior and strategy).
 25 • Evaluation of performance within the domain. Within many domains, issues related to
 26 performance analysis and evaluation are essential for understanding the domain fully,
 27 and, therefore, we include it as a separate subcategory. Performance evaluation also
 28 reveals important aspects of the philosophy of a domain. For example, both general
 29 models and key specializations might be essentially the same for businesses and non-
 30 profit organizations, but their key performance metrics could differ quite significantly.

31
 32 Examples of these three subcategories within the general business domain are as follows:

33
 34 General models of business

- 35 • Business models
 36 • Business process design and management
 37 • Organizational theory
 38 • Business strategy

39 Key business specializations

- 40 • Finance
 41 • Accounting
 42 • Marketing
 43 • Operations management; service science and management
 44 • Organizational behavior
 45 • Business law

46 Evaluation of business performance

- 47 • Analysis of organizational performance
 48 • Analysis of individual and team performance
 49 • Business analytics
 50 • Business intelligence

51

10. ARCHITECTURE OF THE INFORMATION SYSTEMS CURRICULUM

Architecturally, IS 2009 is quite different from its predecessors. IS 2002 was largely organized around the concept of a course, and it simply consisted of ten courses without any opportunities to vary the curriculum depending on the local requirements or other contextual factors. The Body of Knowledge included in IS 2002 was largely unchanged from IS'97, and the linkage between the courses in the curriculum and the Body of Knowledge was relatively weak.

Key Concepts

The structural architecture of IS 2009 is informed by the concept structure represented in Figure 4, which illustrates a proposed structure for a computing curriculum. This structure includes three major elements: Course, Learning Objective, and the three-level Knowledge Area – Knowledge Unit – Topic hierarchy that is used also in all other computing curriculum volumes (CS 2008, IT 2008, SE 2004, and CE 2004). The concept of Coverage represents the coverage of a specific Topic within a Course in order to support the achievement of a specific Learning Objective. Please note that Topics themselves can be organized hierarchically into multiple levels. A Level is specified for each Learning Objective, indicating the type of cognitive processing that the student is required to demonstrate in order to achieve the learning objective. A slightly revised version of Bloom's taxonomy described in Appendix 4 of IS 2002 and included in Appendix 3 of this document will be used for the Levels.

Optimal Curriculum Architecture

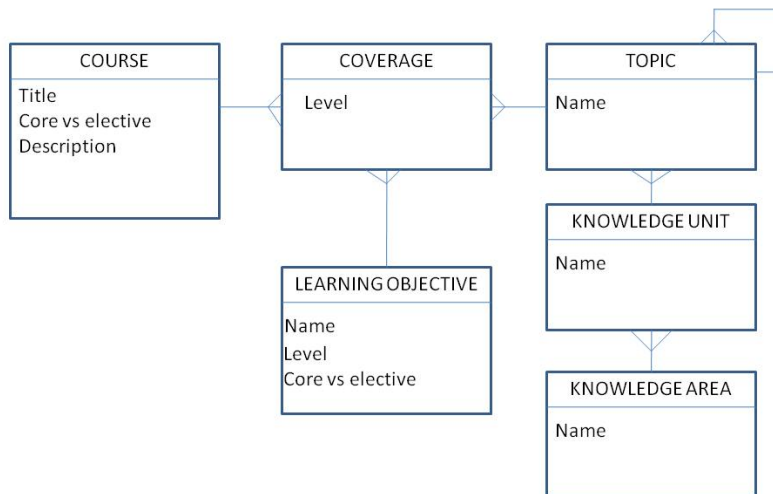


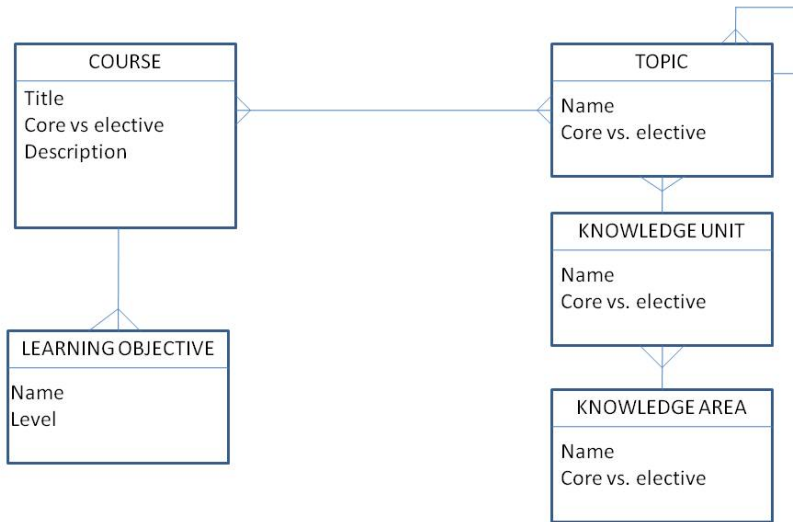
Figure 4: Proposed Optimal Curriculum Architecture

Fundamentally, the intent is to specify the goal state regarding the students' abilities in relation to a concept/topic: whether the students are required to be aware of a topic, understand it at a deeper level, use the concept in an analysis, or create new concepts or artifacts in the context of a learning outcome.

1 At the current time, the process of organizing IS knowledge is not, however, specified at a
 2 sufficiently advanced level to allow us to fully implement the curriculum using the optimal
 3 structure described above. Instead, IS 2009 uses a simplified model (see Figure 5) that links the
 4 Learning Objectives to Courses and Courses directly to Topics with a many-to-many relationship.
 5 The Knowledge Area – Knowledge Unit – Topic hierarchy is used for the first time in an IS
 6 model curriculum, which brings this document structurally closer to the other computing
 7 curricula. Each Knowledge Area, Knowledge Unit, and Topic is specified as either core or
 8 elective. The Level of coverage is specified at the course level.

10 The Core Information Systems Body of Knowledge is presented in Appendix 4 of this document.
 11 This Body of Knowledge organizes the IS curriculum core content into four different Knowledge
 12 Area categories: General Computing, IS Specific, Foundational, and Domain-specific. We believe
 13 that Information Systems as a discipline can effectively borrow content from other computing
 14 disciplines for the General Computing Knowledge Areas and that the content in Foundational and
 15 Domain-specific Knowledge Areas is largely determined outside computing. Therefore, the IS
 16 discipline will only have to develop and maintain a Body of Knowledge structure for the
 17 Knowledge Areas that are truly IS Specific.

Implemented Curriculum Architecture



19
 20
 21 **Figure 5: Simplified Curriculum Architecture Model**

22
 23
 24
 25
 26 **General Curriculum Structure for Courses focusing on IS Specific Skills and**
 27 **Knowledge**

28
 29 In this section, we discuss the general architecture for the courses that focus on the development
 30 of Information Systems specific skills and knowledge. The coverage of content that focuses on
 31 the development of Foundational and Domain-specific knowledge and skills is discussed later in
 32 this section (see p. 29).

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As discussed earlier in this document, IS 2009 introduces a separation between core and elective courses. IS 2009 consists of seven **core courses**, which specify the required knowledge units and topics that have to be covered in every Information Systems program. We acknowledge that the time available to cover the core material and the needs of the program vary depending on the local context. Therefore, the depth and type of coverage of the core topics differ between programs, even though every core topic has to be covered in every Information Systems curriculum. Also, every instance of a Course is not always technically a separate course in the schedule; it is possible that an implemented curriculum may, for example, combine two instances of a Course into one.

In addition, the model curriculum includes examples of **elective courses**, which either expand on the coverage provided by the core course within a specific knowledge area or introduce new knowledge areas to the curriculum. The elective courses are essential building blocks of **career tracks**, which consist of the core and a set of elective courses. The matrix included in Figure 6 includes the core courses and sample electives mapped to a number of suggested career tracks.

Structure of the IS Model Curriculum: Information Systems specific courses																					
Career Track:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q				
Core IS Courses:																		A = Application Developer			
Foundations of IS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	B = Business Analyst			
Enterprise Architecture	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	C = Business Process Analyst			
IS Strategy, Management and Acquisition	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	D = Database Administrator			
Data and Information Management	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	E = Database Analyst			
Systems Analysis & Design	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	F = e-Business Manager			
IT Infrastructure	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	G = ERP Specialist			
IT Project Management	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	H = Information Auditing and Compliance			
																		I = IT Architect			
Elective IS Courses:																		J = IT Asset Manager			
Application Development	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	K = IT Consultant			
Business Process Management		●	●															L = IT Operations Manager			
Collaborative Computing																		M = IT Security and Risk Manager			
Data Mining / Business Intelligence		●		●	●													N = Network Administrator			
Enterprise Systems		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	O = Project Manager			
Human-Computer Interaction	●																	Q = Web Content Manager			
Information Search and Retrieval		○		○	○																
IT Audit and Controls	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
IT Security and Risk Management	○			○	○	○	○	○	○	○	○	○	○	○	○	○	○				
Knowledge Management		●		○		○	○														
Social Informatics																					

Key:
 ● = Significant Coverage
 ○ = Some Coverage
 Blank Cell = Not Required

18
19
20
21

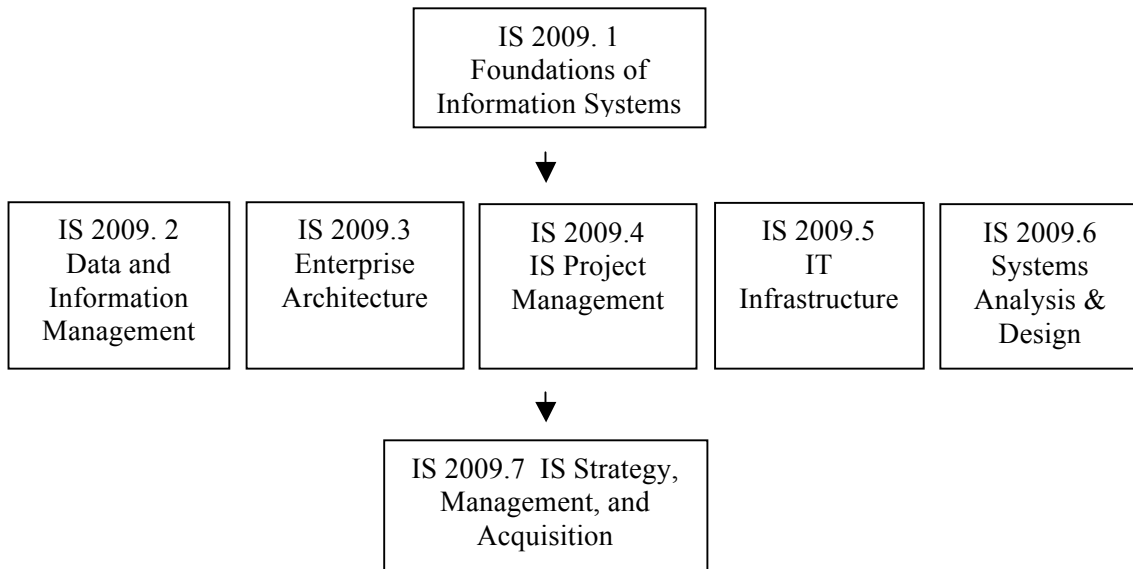
Figure 6: Structure of the IS 2009 Model Curriculum

The IS Specific Course Matrix is structured based on career track outcomes. This approach allows a high level of local flexibility and variability while maintaining the core of the discipline. Students undertaking a program’s course of study could be preparing for career tracks such as Application Developer, Business Analyst, Business Process Analyst, Database Administrator, and

1 so on. Based on the career track focus of an IS program, recommendations for the relative
 2 importance of core and elective knowledge areas are provided in the IS Specific Course Matrix.
 3 Specific course implementations may thereby be tailored to include an emphasis on one or more
 4 knowledge areas, forming the required and elective courses, appropriate to the career track
 5 outcomes of individual instances of IS programs of study.

6
 7 Further definition of each of the career tracks is provided on the website
 8 blogsandwikis.bentley.edu/iscurriculum. Included are a description of the career track, skills
 9 necessary to the career track, and coverage level for core and elective topics. Depth of coverage
 10 for the topics is specified as significant, some, and no coverage.

11
 12 The core courses and their recommended sequence are presented in Figure 7 as follows:



31 **Figure 7: IS 2009 Core Courses**

32
 33
 34 The IS 2009.1 *Foundations of Information Systems* course is a prerequisite for all the other
 35 courses, and the IS 2009.7 *IS Strategy, Management, and Acquisition* course is a capstone that
 36 should be either the last or one of the last courses that students take.

37
 38 The elective courses can be offered in the curriculum at any point that fits course-specific
 39 prerequisite requirements.

40 41 **Core Course Changes in IS 2009**

42
 43 For those readers who know IS 2002 well and in order to illustrate recent changes in the field, this
 44 section will discuss the differences between this and the previous curriculum recommendation.
 45 There are several major differences between the course recommendations in these two
 46 independent volumes. The following will list these major differences while also describing in
 47 detail why these changes were implemented by the task force.

- 48
 49 1. **Status of Application Development in the curriculum.** One of the more noticeable
 50 changes to the IS model curriculum is the removal of application development (IS 2002.5
 51 Programming, Data, File, and Object Structures) from the prescribed core. It is important

1 to understand that although application development is not included in the core, it has not
2 been removed from the IS program, and the task force acknowledges that a strong case
3 can be made for inclusion of programming, computational thinking, data structures, and
4 related material in an IS program (see, for example, (Topi et al. 2008)). In fact,
5 application development can still be offered in most IS programs. By offering application
6 development as an elective the IS 2009 model curriculum increases its reach into non-
7 business IS programs while also creating flexibility for curricula that choose to include an
8 application development course. In addition, the programs that want to go even further
9 and include a sequence of programming courses can choose from approaches introduced
10 either in the Computer Science or in the Information Technology curriculum volumes
11 (CS 2008 or IT 2008, respectively).
12

- 13 **2. Inclusion of both enterprise architecture and IT infrastructure** – The IS 2002 model
14 curriculum includes both an IT Hardware and System Software course (IS 2002.4) and a
15 Network and Telecommunication course (IS 2002.6) to edify the concepts and practices
16 related to IT infrastructure. The IS 2009 model curriculum proposes a different approach,
17 which integrates the material included in IS 2002 into IS 2009.5 IT Infrastructure course
18 and introduces a new IS 2009.3 Enterprise Architecture course that focuses on concepts
19 at a higher level of abstraction. IT Infrastructure includes computer and systems
20 architecture and communication networks, with an overall focus on the services and
21 capabilities that IT infrastructure solutions provide in an organizational context.
22 Enterprise Architecture focuses on organizational level issues related to planning,
23 architecting, designing, and implementing IT-based solutions that utilize the platform
24 technologies covered in the IT Infrastructure (IS 2009.5) course and the application and
25 data & information management solutions covered in the Systems Analysis & Design (IS
26 2009.6) and Data and Information Management (IS 2009.2) courses, respectively This
27 course adopts a strongly integrative perspective related to the design and utilization of
28 information and organizational processes across functional areas with a unified system
29 view. IT Infrastructure covers the core technical foundations whereas Enterprise
30 Architecture provides an integrated organizational perspective to planning and designing
31 institutional solutions.
32
- 33 **3. Removal of Personal Productivity Tools Course** – The revised IS 2009 curriculum
34 recommends dropping the course focusing on personal productivity tools from IS
35 programs. The task force has found that typically institutions now require all students to
36 be proficient in personal productivity applications such as word processing, spreadsheets,
37 and presentation software prior to enrolling in any major. Further, most high schools also
38 are preparing students in this area before they reach a higher education environment.
39
- 40 **4. Sequencing** – The IS 2002 model curriculum recommended various levels of sequencing
41 in the curriculum (e.g., Foundations of IS is a prerequisite to Analysis and Logical
42 Design, IT Hardware and Systems Software was a prerequisite to Networks and
43 Telecommunications and so on). By flattening the sequencing constellation of the
44 curriculum, IS 2009 offers a flexible structure that can integrate electives easily. Also, the
45 flattened curriculum structure allows students to pass more easily through IS programs
46 avoiding possible sequencing bottlenecks.
47

48 Detailed descriptions of the seven core courses and a set of sample electives are included in the
49 last section of this document.
50
51

Foundational and Domain-specific Skills and Knowledge

This curriculum recommendation does not provide specific courses that address the outcome expectations related to foundational skills and knowledge or domain-specific skills and knowledge. As specified earlier in the document in the section related to IS program outcome expectations, these two areas are essential for IS graduates and need to be covered in every IS curriculum in a way that ensures that the high-level outcome expectations are met.

Fundamentally, there are two ways to accomplish this: either, the degree programs are offered in an environment (for example, a business school or a school of public policy) in which general curriculum requirements for the school as a whole ensure that these educational objectives are met or the school specifically designs and implements courses that are intended to develop capabilities in these two areas. Without sufficient coverage related to foundational skills and knowledge and to domain-specific skills and knowledge a curriculum is not compatible with this curriculum recommendation, even if this document does not specifically articulate how these requirements should be met.

For example, in a typical business school context, the foundational knowledge and skills would be covered in both general education and business core courses, whereas the business core would be used to develop the domain-specific skills and knowledge.

11. RESOURCES FOR IS DEGREE PROGRAMS

The resources for the IS degree programs have changed substantially since the last curriculum revision. Similar to past curriculum revisions a capable faculty is the first required resource (Firth et al. 2008). In addition to faculty the resources needed for an IS degree program are Internet access, laboratories and library resources. In a rapidly changing technical environment, students should be exposed to a variety of up-to-date hardware and software systems that adequately represent the professional setting in which they will be employed.

Faculty Requirements

Faculty members are vital to the strength of an Information Systems program. Its faculty needs both academic training and practical experience (Looney et al. 2007). There must be enough faculty to provide course offerings that allow the students to complete a degree in a timely manner. The interests and qualifications of the faculty must be sufficient not only to teach the courses but also to plan and modify the courses and curriculum.

Faculty members must remain current in the discipline. Professional development and scholarly activities are a joint obligation of the institution and the individual faculty members. The school should support continuing faculty development. Given the rapidly changing technology, it is particularly critical that faculty members have sufficient time for professional development and scholarly activities. Resources should be provided for faculty to regularly attend conferences, workshops, and seminars, and to participate in academic and professional organizations. The program is enhanced significantly when faculty acquire practical experience in the profession through activities such as consulting, sabbatical leaves, and industry exchange programs. Faculty must also be equipped to develop teaching materials for their students. Faculty must have available technology at least equivalent to and compatible with that available to students so that they may prepare educational materials for use by students. In addition, faculty must be

1 connected to the Internet in order to have access to students and to the larger academic and
2 professional community.

3
4 The number of full-time faculty needed by the program is influenced by such factors as the
5 number of students in the program, the number of required courses, the number of service and
6 elective courses offered, and the teaching load of the faculty. A program should have a minimum
7 number of full-time faculty with primary commitment to the Information Systems program in
8 order to meet the teaching and advising needs of the program and to provide depth and breadth of
9 faculty expertise. Courses must be offered with sufficient frequency for students to complete the
10 program in a timely manner. The professional competence of the faculty should span a range of
11 interests in information systems including computer systems concepts, information systems
12 concepts, data management, telecommunications and networks, systems design and development,
13 systems integration, and information systems management and policy. Additional faculty will be
14 needed to teach the service courses that provide foundation-level knowledge across the campus.

15 16 **Computing Infrastructure Requirements**

17
18 Computing infrastructure consists of hardware, software, and technical support. Adequate
19 computing facilities are essential for effective delivery of the IS program though the form in
20 which this infrastructure is allocated has changed significantly. These formerly involved a blend
21 of computer facilities of varying capabilities and complexity. Now with most freshmen entering
22 college with computer resources, access plays a much more significant role (Lee 2009).
23 Therefore, network access should be available for faculty and students to use with their own
24 computers. Students at different levels in the curriculum have different needs. Substantial
25 resources must be provided to support the courses targeted to all students. More sophisticated
26 resources are necessary for Information Systems minors and majors who are developing skills in
27 computing and IS fundamentals. Specialized laboratories or access to specialized simulation
28 software is needed for advanced students where group and individual projects are developed.
29 Contemporary and emerging software development tools should be available to create the most
30 current enterprise solutions.

31
32 In addition to software and hardware, it is paramount to the success of the program that adequate
33 technical support be provided. Modern computing infrastructure is highly complex requiring
34 technically trained support staff to maintain the equipment. This is beyond the scope of faculty
35 duties, a waste of precious faculty resources, and often outside their individual expertise.

36 37 **Laboratory Requirements**

38
39 Systems require hardware and software for structured, open/public, and specialized laboratories.
40 Students must have an opportunity to use learning materials in both structured and unstructured
41 laboratories.

42
43 Hardware and software are rapidly changing and improving. It is critical that faculty and students
44 have access to facilities reflecting an environment that graduates will be expected to use
45 professionally. All computing systems should be kept current. A plan should exist to continuously
46 upgrade and/or replace software and equipment in a timely manner. The rate of change in
47 technology suggests a rapid replacement cycle, with some technologies reaching obsolescence in
48 less than 12 months.

49
50 Having said this, simulation software is becoming more prevalent for teaching advanced IS
51 topics. This can include simulations for utilizations of applications to managing the single

1 workstation to complex enterprise-level networks. Many companies including Microsoft, Cisco,
2 and even the textbook companies have developed sophisticated simulation software that does not
3 require the latest equipment.

4
5 Students should be provided opportunities to work together on team-oriented projects. The group
6 skills developed in this mode are critical to a successful information systems professional.
7 Technological support, such as groupware, is expected for group and team activities.

8
9 All laboratories must have adequate technical support in terms of professional staff to provide for
10 installation and maintenance of the equipment. The staff should be proficient in both the
11 hardware and software applications. Complete documentation must also be available.

12
13 Laboratories should be able to support the following types of functions:

14
15 1. Structured Laboratories

16
17 A structured laboratory is a closed, scheduled, supervised experience in which students
18 complete specified exercises. An instructor who is qualified to provide necessary support
19 and feedback to the students provides supervision. Exercises are designed to reinforce
20 and complement the lecture material.

21
22 2. Open/Public Laboratories

23
24 Student ownership of computers has continued to increase. However, laboratories remain
25 essential for those students who do not own a computer and for providing additional
26 resources not available on personal machines.

27
28
29 3. Specialized Laboratories

30
31 Laboratory facilities are necessary to support team projects and special computing
32 environments. Special facilities may be needed for systems development, network
33 infrastructure, and other advanced technologies.

34
35 **Classrooms**

36
37 Suitable classroom facilities, equipped with information technology teaching resources, should be
38 provided. A computing system with multimedia facilities is necessary for demonstrating the
39 development, implementation, and application of information technology as well as conducting
40 walkthroughs and making presentations. Classrooms should have access to the Internet and
41 extranet networks, either with port per seat or wireless networking capabilities.

42
43 **Library**

44
45 Library support is an important part of an academic program. It is especially important for
46 disciplines with rapid development of knowledge such as the Information Systems field. Libraries
47 should provide both traditional and digital access wherever possible to journals, proceedings,
48 monographs, and reference books. The holdings should include access to digital journals and
49 proceedings of the computing professional societies.

12. SHARED COURSES WITH OTHER COMPUTING DISCIPLINES

As explained earlier in the report, there is a close relationship between the academic fields of Information Systems and other computing disciplines, and there are also very significant differences. The context for Information Systems is an organization and its systems. In contrast, the context for Computer Science would typically include algorithmic processes for information processing and associated technical and technology issues. There are complementary strengths for these academic units in preparing graduates for information systems work in organizations.

An Information Systems academic unit is typically strong in preparing students for the organizational environment. This advantage is especially strong when the Information Systems program is within or closely tied to organizational or business studies. The challenge for an IS unit may be in maintaining adequate depth of instruction in some technology subjects. On the other hand, a Computer Science program sometimes reverses the comparative position of an IS unit. It is typically strong in teaching technology and related algorithmic processes, but organizational functions and systems may not be an area of emphasis for them.

Of course, there is so much variety in the actual organization of academic units that these remarks cannot be taken too literally. Even in the case of a single academic unit that covers multiple computing curricula, one often sees these complementary strengths among programs.

This high level perspective of complementary strengths suggests that there may be opportunities for courses taught by any computing area that also meets the needs of IS majors; similarly for courses taught by IS for students desiring more IS knowledge from other areas. It is also possible to conceptualize a common core for multiple programs, and in fact, such shared core courses are taught at a number of institutions. This report has not attempted a formal definition of such a course sequence because there is no fixed organizational model of the relationship between the varied programs to which such a definition could be addressed. If a common core sequence appears to be useful for an institution, a useful approach is for the institution to take the core requirements for IS as described in this report and, considering the local situation in terms of organization of academic units and distribution of strengths of faculty and laboratory resources, to design a common core sequence.

13. IS 2009 COURSE SPECIFICATIONS

In this section, we provide high-level course descriptions for IS 2009, including the seven core courses and a subset of the electives discussed above. Each course is described with a catalog description and a scope statement followed by a topic list. Finally, the explanations and expectations for each course are discussed.

The courses included are as follows:

Core Courses

IS 2009.1 Foundations of Information Systems

IS 2009.2 Data and Information Management

IS 2009.3 Enterprise Architecture

- 1 IS 2009.4 IS Project Management
- 2 IS 2009.5 IT Infrastructure
- 3 IS 2009.6 Systems Analysis and Design
- 4 IS 2009.7 IS Strategy, Management and Acquisition
- 5
- 6 **Sample Elective Courses**
- 7
- 8 Application Development
- 9 Business Process Management
- 10 Enterprise Systems
- 11 Introduction to Human-Computer Interaction
- 12 IT Audit and Controls
- 13 IS Innovation and New Technologies
- 14 IT Security and Risk Management
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Title: Foundations of Information Systems

Core Course

Catalog description

Today, information systems are an integral part of all business activities and careers. This course is designed to introduce students to contemporary information systems and demonstrate how these systems are used throughout global organizations. The focus of this course will be on the key components of information systems - people, software, hardware, data, and communication technologies, and how these components can be integrated and managed to create competitive advantage. Though the knowledge of how IS provides a competitive advantage students will gain an understanding of how information is used in organizations and how IT enables improvement in quality, speed, and agility. This course also provides an introduction to systems and development concepts, technology acquisition, and various types of application software that have become prevalent or are emerging in modern organizations and society.

Learning objectives

Students will learn to

1. Understand how and why information systems are used today
2. Explain the technology, people, and organizational components of information systems.
3. Understand globalization and the role information systems has played in this evolution.
4. Understand how businesses are using information systems for competitive advantage vs. competitive necessity.
5. Understand the value of information systems investments as well as learn to formulate a business case for a new information system, including estimation of both costs and benefits.
6. Know the major components of an information systems infrastructure
7. Mitigate risks as well as plan for and recover from disasters.
8. Understand how information systems are enabling new forms of commerce between individuals, organizations, and governments.
9. Be aware of emerging technologies that enable new forms of communication, collaboration, and partnering.
10. Understand how various types of information systems provide the information needed to gain business intelligence to support the decision making for the different levels and functions of the organization.
11. Understand how enterprise systems foster stronger relationships with customers and suppliers and how these systems are widely used to enforce organizational structures and processes.
12. Understand how organizations develop and acquire information systems and technologies.
13. Understand how to secure information systems resources, focusing on both human and technological safeguards.
14. Evaluate the ethical concerns that information systems raise in society and the impact of information systems on crime, terrorism, and war.

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Topics

- Characteristics of the Digital World
- Information systems components
 - Hardware
 - Software
 - Data
 - Networks
 - Facilities
 - Personnel
 - Services
 - Partners
- Information Systems in organizations
 - Characteristics of IS professionals
 - IS career paths
 - Cost/value information
 - Quality of information
 - Competitive advantage of information
 - IS and organizational strategy
 - Value chains and networks
- Globalization
 - What is globalization?
 - Technology enabled change
 - Digital divide
 - Global information systems strategies
- Valuing information systems
 - How information systems enable organizational processes
 - Making a business case for information systems
 - Productivity paradox of information systems
 - Investment evaluation
 - Multi-criteria analysis
 - Cost-benefit analysis
 - Identifying and implementing innovations
- Information Systems infrastructure
 - Hardware
 - Software
 - Collaboration and communication technologies
 - Data and knowledge
 - Facilities
 - Services
 - Personnel
 - Partnerships
- The Internet and WWW
 - E-business
 - B-to-C
 - B-to-B
 - Intranets, Internet, Extranets
 - E-government
 - Web 2.0
 - Technologies: e.g., wikis, tags, blogs, netcasts, self-publishing

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- Students with practical end-user knowledge will study systems theory and quality concepts as an introduction to information technology concepts and information systems development. Structure and functions of computers, telecommunications, and other infrastructure components will be examined.
 - The concept that information is of significance in stating and attaining organizational goals will be used as the basis for exploring the need for various types of information systems. Information systems will be introduced as a method for not only processing information, but as a method for enhancing communication and collaboration within and outside the organization. The dynamic nature of organizations and the necessity for growth and re-design of the organization as well as its information systems will be presented and used as the motivator for understanding information systems development methodologies and approaches for technology acquisition.
 - The development path for entry level to senior information systems professionals will be explained. Professional ethical expectations and obligations will be reviewed. The necessity for personal and interpersonal communications skills will be discussed.

Title: Data and Information Management**Core Course****Catalog Description**

This course provides the students with an introduction to the core concepts in data and information management. It is centered around the core skills of identifying organizational information requirements, modeling them using conceptual data modeling techniques, converting the conceptual data models into relational data models and verifying its structural characteristics with normalization techniques, and implementing and utilizing a relational database using an industrial-strength database management system. The course will also include coverage of basic database administration tasks. In addition to developing database applications, the course helps the students understand how large-scale packaged systems are highly dependent on the use of DBMSs. Building on the transactional database understanding, the course also provides an introduction to data and information management technologies that provide decision support capabilities under the broad business intelligence umbrella.

Learning Objectives

Students will learn to

1. Understand the role of databases and database management systems in managing organizational data and information.
2. Understand the historical development of database management systems and logical data models.
3. Understand the basics of how data is physically stored and accessed.
4. Understand the fundamentals of the basic file organization techniques.
5. Apply information requirements specification processes in the broader systems analysis & design context.
6. Use at least one conceptual data modeling technique (such as entity-relationship modeling) to capture the information requirements for an enterprise domain.
7. Link to each other the results of data/information modeling and process modeling.
8. Design high-quality relational databases.
9. Understand the purpose and principles of normalizing a relational database structure
10. Design a relational database so that it is at least in 3NF.
11. Implement a relational database design using an industrial-strength database management system, including the principles of data type selection and indexing.
12. Use the data definition, data manipulation, and data control language components of SQL in the context of one widely used implementation of the language.
13. Perform simple database administration tasks.
14. Understand the concept of database transaction and apply it appropriately to an application context.
15. Understand the basic mechanisms for accessing relational databases from various types of application development environments.
16. Understand the role of databases and database management systems in the context of enterprise systems.
17. Understand the difference between on-line transaction processing (OLTP) and on-line analytic processing (OLAP), and the relationship between these concepts and business intelligence, data warehousing and data mining.

- 1 18. Create a simple data warehouse (“data mart”).
2 19. Understand how structured, semi-structured, and unstructured data are all essential
3 elements of enterprise information and knowledge management. In this context, the
4 students will learn the principles of enterprise search.
5

6 **Topics**

- 7
8 • Database approach
9 • Types of database management systems
10 • Basic file processing concepts
11 • Physical data storage concepts
12 • File organizations techniques
13 • Conceptual data model
14 o Entity-relationship model
15 o Object-oriented data model
16 o Specific modeling grammars
17 • Logical data model
18 o Hierarchical data model
19 o Network data model
20 o Relational data model
21 ▪ Relations and relational structures
22 ▪ Relational database design
23 • Mapping conceptual schema to a relational schema
24 • Normalization
25 • Physical data model
26 o Indexing
27 o Data types
28 • Database languages
29 o SQL: DDL, DML, and DCL
30 • Data and database administration
31 • Transaction processing
32 • Using a database management system from an application development
33 environment
34 • Use of database management systems in an enterprise system context
35 • Business intelligence
36 o On-line analytic processing
37 o Data warehousing
38 o Data mining
39 o Enterprise search
40

41 **Discussion**

- 42
43 • The course still has a strong focus on traditional data management: conceptual
44 data modeling (using ER modeling as the primary technique), logical data
45 modeling using the relational data model (including ER – relational conversion
46 and normalization), and physical database implementation and manipulation
47 using SQL.
48 • It is essential that the information requirements specification processes are firmly
49 linked to the organizational SA&D processes and that students understand the
50 role of conceptual data modeling as an integral part of the process of making
51 sense of the domain.

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- The focus on the physical data model and the DBA-level work on database implementation has been reduced to give more time on improved understanding of the role of databases in the enterprise application context and various business intelligence topics, including enterprise search. Still, the students should understand the basic nature of the DBA tasks and be able to make intelligent decisions regarding DBMS choice and the acquisition of DBA resources.
 - It is critically important that the students will fully understand how dependent various large-scale packaged systems (including ERP systems) are on relational databases and how strongly success in maintaining them and in supporting their use in organizations is dependent on understanding data structures and data manipulation with SQL.
 - The course should provide a practical understanding of how relational databases are used to support web-based applications.

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Title: Enterprise Architecture¹

Core Course

Catalog description

This course explores the design, selection, implementation and management of enterprise IT solutions. The focus is on applications and infrastructure and their fit with the business. Students learn frameworks and strategies for infrastructure management, system administration, content management, distributed computing, middleware, legacy system integration, system consolidation, software selection, total cost of ownership calculation, IT investment analysis, and emerging technologies. These topics are addressed both within and beyond the organization, with attention paid to managing risk and security within audit and compliance standards. Students also hone their ability to communicate technology architecture strategies concisely to a general business audience.

Learning objectives

Students will learn to

1. Understand a variety of frameworks for enterprise architecture analysis and decision making.
2. Evaluate the total cost of ownership and return on investment for architecture alternatives.
3. Utilize techniques for assessing and managing risk across the portfolio of the enterprise.
4. Evaluate and plan for the integration of emerging technologies.
5. Administer systems, including the use of virtualization and monitoring, power and cooling issues.
6. Manage proliferating types and volume of content.
7. Plan for business continuity.
8. Understand the benefits and risks of service oriented architecture.
9. Understand the role of audit and compliance in enterprise architecture.

Topics

- Service oriented architecture
- Enterprise architecture frameworks
- Systems integration
- Enterprise resource software
- Monitoring and metrics for infrastructure and business processes
- Green computing
- Virtualization of storage and systems
- The role of open source software

¹ Acknowledgement: This material is largely based on work by Dr. Bill Schiano, Bentley University.

- 1 • Risk management
- 2 • Business continuity
- 3 • Total cost of ownership and return on investment
- 4 • Software as a service
- 5 • Content management
- 6 • Audit and compliance
- 7 • System administration
- 8 • IT control and management frameworks
- 9 • Emerging technologies

10

11 **Discussion**

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- 13 • The course can be structured at varying levels of technical depth
- 14 • The course can be a relatively easy way to introduce newer technologies into the
- 15 curriculum, e.g. Web 2.0.
- 16 • This course operates at a higher level of abstraction than a typical infrastructure
- 17 course, and it includes significant coverage of business issues related to an
- 18 enterprise's technology architecture.
- 19 • This is the context in which the students are introduced to modern enterprise IT
- 20 concepts, such as SoS, green computing, and SaaS.
- 21 • This course would also cover the topics related to IT control and service
- 22 management frameworks (COBIT, ITIL, etc.)
- 23

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2 **IT Infrastructure**
3 **Core Course**

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6 **Catalog Description**
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8 This course provides an introduction to IT infrastructure issues for students majoring in
9 Information Systems. It covers topics related to both computer and systems architecture and
10 communication networks, with an overall focus on the services and capabilities that IT
11 infrastructure solutions enable in an organizational context. It gives the students the knowledge
12 and skills that they need for communicating effectively with professionals whose special focus is
13 on hardware and systems software technology and for designing organizational processes and
14 software solutions that require in-depth understanding of the IT infrastructure capabilities and
15 limitations. It also prepares the students for organizational roles that require interaction with
16 external vendors of IT infrastructure components and solutions. The course focuses strongly on
17 Internet-based solutions, computer and network security, business continuity, and the role of
18 infrastructure in regulatory compliance.
19

20 **Learning objectives**
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22 Students will learn to
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- 24 1. Understand key principles of data representation and manipulation in computing
25 solutions.
- 26 2. Understand the principles underlying layered systems architectures and their
27 application to both computers and networks.
- 28 3. Understand the differences and similarities between the core elements of an IT
29 infrastructure solution, such as clients, servers, network devices, wired and wireless
30 network links, systems software, and specialized security devices.
- 31 4. Understand how IT infrastructure components are organized into infrastructure
32 solutions in different organizational environments.
- 33 5. Understand the principles underlying service virtualization.
- 34 6. Understand through practical examples how protocols are used to enable
35 communication between computing devices connected to each other.
- 36 7. Configure an IT infrastructure solution for a small organization, including a network
37 based on standard technology components, servers, security devices, and several
38 different types of computing clients.
- 39 8. Apply the core concepts underlying IP networks to solve simple network design
40 problems, including IP subnetting.
- 41 9. Understand the role and structure of the Internet as an IT infrastructure component
42 and to design simple infrastructure solutions based on the use of the Internet.
- 43 10. Understand the components and structure of a large-scale organizational IT
44 infrastructure solution at a level that allows them to utilize it effectively
- 45 11. Understand the role of IT control and service management frameworks in managing a
46 large-scale organizational IT infrastructure solution
- 47 12. Negotiate with vendors providing design and implementation solutions.
- 48 13. Understand the opportunities that virtual computing service provision models, such
49 as cloud computing, create for organizations.
- 50 14. Analyze and understand the security and business continuity implications of IT
51 infrastructure design solutions.

- 1 15. Configure simple infrastructure security solutions.
2 16. Minimize the environmental and resource consumption impacts of IT infrastructure
3 decisions
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7 **Topics**
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- 9 • Core computing system architecture concepts
10 • Core computing system organizing structures
11 • Core technical components of computer-based systems
12 • Role of IT infrastructure in a modern organization
13 • Operating systems
14 ○ Core operating systems functionality
15 ○ Internal organization of an operating system
16 ○ Types of devices that require and utilize operating systems
17 ○ Multitasking and multithreading
18 ○ File systems and storage
19 ○ User interfaces
20 ○ Operating system configuration
21 ○ Securing an operating system
22 ○ Virtualization of computing services
23 • Networking
24 ○ Types of networks
25 ○ Core network components
26 ○ TCP/IP model
27 ○ Physical layer: wired and wireless connectivity
28 ○ Data link layer: Ethernet
29 ○ Network layer: IP, IP addressing and routing
30 ○ Transport layer: TCP
31 ○ Application layer: Core Internet application protocols
32 ○ Network security and security devices
33 ○ The Internet as a key networking platform
34 ○ Network device configuration
35 • Organizing storage on organizational networks
36 • Data centers
37 • Securing IT infrastructure
38 ○ Principles of encryption and authentication
39 ○ Component level security: clients, servers, storage network devices, data
40 transport, applications
41 ○ Perimeter security: firewalls
42 ○ Using public networks for secure data transport: VPNs
43 • The role of IT control and service management frameworks (COBIT, ITIL, etc.) in
44 managing the organizational IT infrastructure
45 • Ensuring business continuity
46 • Grid computing
47 • Cloud computing, computing as a service
48 • System performance analysis and management
49 • Purchasing of IT infrastructure technologies and services
50 •
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1 **Discussion**

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- 3 • This course recognizes that Information Systems programs are increasingly preparing
4 students for organizational roles that do not require in-depth skills in designing or configuring
5 hardware and systems software solutions. The key focus is on helping the students
6 understand the infrastructure issues at a level that is required for effective work as business
7 and systems analysis.
 - 8 • The course also forms the foundation for further study related to both computer architecture
9 and communication networks. Specifically, it is important to recognize that many technically
10 focused IT risk management, security, and forensics jobs require more in-depth
11 understanding of technology issues than this single course can provide.
 - 12 • Whenever possible, it is recommended that this course uses hands-on laboratory work and
13 practical exercises to teach the complex concepts that are often too abstract to grasp without
14 practical examples.
- 15

Title: Information Systems Project Management**Core Course****Catalog description**

This course discusses the processes, methods, techniques and tools that organizations use to manage their information systems projects. The course covers a systematic methodology for initiating, planning, executing, controlling, and closing projects. This course assumes that project management in the modern organization is a complex team-based activity, where various types of technologies (including project management software as well as software to support group collaboration) are an inherent part of the project management process. This course also acknowledges that project management involves both the use of resources from within the firm, as well as contracted from outside the organization.

Learning objectives

Students will learn to

1. Initiate, specify, and prioritize information systems projects and to determine various aspects of feasibility of these projects.
2. Understand the foundations of project management, including its definition, scope, and the need for project management in the modern organization.
3. Understand the phases of the project management lifecycle.
4. Manage project teams, including the fundamentals of leadership and team motivation.
5. Manage project communication, both internal to the team, and external to other project stakeholders.
6. Initiate projects, including project selection and defining project scope.
7. Manager project schedules with appropriate techniques and tools.
8. Manage project resources, including human resources, capital equipment, and time.
9. Manage project quality, including the identification of the threats to project quality, techniques for measuring project quality, and the techniques for ensuring project quality is achieved.
10. Manage project risk, including the identification of project risk, and the techniques for ensuring project risk is controlled.
11. Manage the project procurement process, including understanding external acquisition and outsourcing, as well as the steps for managing external procurement.
12. Manage project execution, including monitoring project progress and managing project change, and appropriately documenting and communicating project status.
13. Control projects through information tracking and cost and change control techniques.
14. Close projects, including administrative, personnel, and contractual closure.
15. Understand the mechanisms for dealing with legal issues in complex project contexts.

Topics

- Introduction to Project Management
 - Project management terminology
 - Project failures and project successes

- 1 ○ Unique features of IT projects
- 2 ○ What is project management?
- 3 • The Project Management Lifecycle
- 4 ○ What is the project management lifecycle?
- 5 ○ Project management and systems development or acquisition
- 6 ○ The project management context
- 7 ○ Technology and techniques to support the project management lifecycle
- 8 ○ Project management processes
- 9 • Managing Project Teams
- 10 ○ What is a project team?
- 11 ○ Project team planning
- 12 ○ Motivating team members
- 13 ○ Leadership, power and conflict in project teams
- 14 ○ Managing global project teams
- 15 • Managing Project Communication
- 16 ○ Managing project communication
- 17 ○ Enhancing team communication
- 18 ○ Using collaboration technologies to enhance team communication
- 19 • Project Initiation and Planning
- 20 • Managing Project Scope
- 21 ○ Project initiation
- 22 ○ How organizations choose projects
- 23 ○ Activities
- 24 ○ Developing the project charter
- 25 • Managing Project Scheduling
- 26 ○ What is project scheduling?
- 27 ○ Common problems in project scheduling
- 28 ○ Techniques for project scheduling
- 29 • Managing Project Resources
- 30 ○ What are resources?
- 31 ○ Types of resources (human, capital, time)
- 32 ○ Techniques for managing resources
- 33 • Managing Project Quality
- 34 ○ What is project quality?
- 35 ○ What are the threats to project quality?
- 36 ○ How can we measure project quality
- 37 ○ Tools for managing project quality
- 38 • Managing Project Risk
- 39 ○ What is project risk?
- 40 ○ What are the threats to project risk?
- 41 ○ Tools for managing project risk
- 42 • Managing Project Procurement
- 43 ○ Alternatives to systems development
- 44 ○ External acquisition
- 45 ○ Outsourcing
- 46 ○ Steps in the procurement process
- 47 ○ Managing the procurement process
- 48 • Project Execution, Control & Closure
- 49 ○ Managing project execution
- 50 ○ Monitoring progress and managing change
- 51 ○ Documentation and communication

- 1 ○ Common problems in project execution
- 2 • Managing Project Control & Closure
- 3 ○ Obtaining information
- 4 ○ Cost control
- 5 ○ Change control
- 6 ○ Administrative closure
- 7 ○ Personnel closure
- 8 ○ Contractual closure
- 9 ○ Project auditing

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11 Discussion

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- 13 • The core course in information systems project management is primarily focused
- 14 on initiating, planning, executing, controlling, and closing information systems
- 15 projects. Project charters, schedules, resource assignments, communication, risk
- 16 and quality control plans, as well as an understanding of leadership and group
- 17 processes are all tools which can enhance effective project management. This
- 18 course will teach the student methods that allow them to manage projects
- 19 resources, including those internal and external to the organization.
- 20 • The course specification intentionally leaves discussion regarding specific
- 21 methods and approaches unanswered. While there are common techniques to
- 22 project management institutions, programs will still have the ability to make local
- 23 decisions regarding specific tools and techniques based on the capabilities of
- 24 their faculty, their available resources, and the needs of the companies hiring the
- 25 students.
- 26 • Using a course project to teach the concepts in this course is highly
- 27 recommended.

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Title: Systems Analysis & Design

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Core Course

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Catalog description

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Learning objectives

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Topics

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This course discusses the processes, methods, techniques and tools that organizations use to determine how they should conduct their business, with a particular focus on how computer-based technologies can most effectively contribute to the way business is organized. The course covers a systematic methodology for analyzing a business problem or opportunity, determining what role, if any, computer-based technologies can play in addressing the business need, articulating business requirements for the technology solution, specifying alternative approaches to acquiring the technology capabilities needed to address the business requirements, and specifying the requirements for the information systems solution.

Students will learn to

1. Understand the types of business needs that can be addressed using information technology-based solutions.
2. Initiate, specify, and prioritize information systems projects and to determine various aspects of feasibility of these projects.
3. Use at least one specific methodology for analyzing a business situation (a problem or opportunity), modeling it using a formal technique, and specifying requirements for a system that enables a productive change in a way the business is conducted.
4. Within the context of the methodologies they learn, write clear and concise business requirements documents and convert them into technical specifications.
5. Communicate effectively with various organizational stakeholders to collect information using a variety of techniques and to convey proposed solution characteristics to them.
6. Manage information systems projects using formal project management methods.
7. Articulate various systems acquisition alternatives, including the use of packaged systems (such as ERP, CRM, SCM, etc.) and outsourced design and development resources.
8. Use contemporary CASE tools for the use in data modeling
9. Compare the acquisition alternatives systematically.
10. Incorporate principles leading to high levels of security and user experience from the beginning of the systems development process.
11. Design high-level logical system characteristics (user interface design, design of data and information requirements).

- Identification of opportunities for IT-enabled organizational change
- Business process management
- Analysis of business requirements
 - Business process modeling
 - Information requirements
- Structuring of IT-based opportunities into projects
- Project specification

- 1 • Project prioritization
- 2 • Analysis of project feasibility
- 3 • Fundamentals of IS project management in the global context
- 4 • Using globally distributed communication and collaboration platforms
- 5 • Analysis and specification of system requirements
 - 6 ○ Data collection methods
 - 7 ○ Methods for structuring and communicating requirements
 - 8 ○ Factors affecting user experience
 - 9 ○ User interface design
 - 10 ○ System data requirements
 - 11 ○ Factors affecting security
 - 12 ○ Ethical considerations in requirements specification
- 13 • Different approaches to implementing information systems to support business
 - 14 requirements
 - 15 ○ Packaged systems; enterprise systems
 - 16 ○ Outsourced development
 - 17 ○ In-house development
- 18 • Specifying implementation alternatives for a specific system
- 19 • Impact of implementation alternatives on system requirements specification
- 20 • Methods for comparing systems implementation approaches
- 21 • Organizational implementation of a new information system
- 22 • Different approaches to systems analysis & design: structured SDLC, unified
 - 23 process/UML, agile methods

25 Discussion

- 26
- 27 • The focus of the core course in systems analysis & design is primarily focused
 - 28 clearly on analyzing and documenting business requirements as well as
 - 29 converting these requirements into detailed systems requirements and high-level
 - 30 design specifications (e.g., mock-ups of forms, reports, HCI, and so other user
 - 31 interface components), not on internal design or system implementation design.
 - 32 The course content is will explicitly be built on the assumption that most
 - 33 organizational systems are built based on various types of packaged systems,
 - 34 system components, or implemented by using outsourced development
 - 35 capabilities (whether on- or off-shore). The course will teach the student
 - 36 methods that allow them to specify requirements precisely and communicate
 - 37 effectively with both business stakeholders and developers, but it will not include
 - 38 material related to the design or /implementation of the technical structure of the
 - 39 system.
- 40 • The course specification intentionally leaves discussion regarding specific
 - 41 methods and approaches unanswered. Institutions have to make these decisions
 - 42 regarding the capabilities of their faculty and the needs of the companies hiring
 - 43 the students. It is, however, important that the course will provide some exposure
 - 44 to the structured SDLC, object-oriented analysis and design (some Unified
 - 45 Process variant using UML as a grammar) and agile methods.
- 46 • Using a course project is highly recommended.
- 47 • The course specifically emphasizes the importance of incorporating security
 - 48 issues and user experience from the earliest stages of the process.
- 49 • The course includes the first exposure to project management concepts and
 - 50 practice. The importance of this element will depend on the extent to which
 - 51 project management is covered elsewhere in the curriculum.
- 52

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3 **Title: IS Strategy, Management & Acquisition**
4 **Core Course**

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7 **Catalog description**
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9 This course explores the issues and approaches in managing the information systems
10 function in organizations and how the IS function integrates / supports / enables various
11 types of organizational capabilities. It takes a senior management perspective in
12 exploring the acquisition, development and implementation of plans and policies to
13 achieve efficient and effective information systems. The course addresses issues relating
14 to defining the high-level IS infrastructure and the systems that support the operational,
15 administrative and strategic needs of the organization. The remainder of the course is
16 focused on developing an intellectual framework that will allow leaders of organizations
17 to critically assess existing IS infrastructures and emerging technologies as well as how
18 these enabling technologies might affect organizational strategy. The ideas developed and
19 cultivated in this course are intended to provide an enduring perspective that can help
20 leaders make sense of an increasingly globalized and technology intensive business
21 environment.

22
23 **Learning objectives**
24

25 Students will learn to

- 26
- 27 1. Understand the various functions and activities within the information systems area,
28 including the role of IT management and the CIO, structuring of IS management
29 within an organization, and managing IS professionals within the firm.
 - 30 2. View an organization through the lens of the information systems used to enable core
31 and supportive business processes as well as those that interface with suppliers and
32 customers.
 - 33 3. Understand the concepts of information economics at the enterprise level.
 - 34 4. Appreciate into how IS represents a key source of competitive advantage for firms.
 - 35 5. Structure IS-related activities to maximize the business value of IS within and outside
36 the company.
 - 37 6. Understand existing and emerging information technologies, the functions of IS and
38 its impact on the organizational operations.
 - 39 7. Evaluate the issues and challenges associated with successfully and unsuccessfully
40 incorporating IS into a firm.
 - 41 8. Understand how strategic decisions are made concerning acquiring IS resources and
42 capabilities including the ability to evaluate the different sourcing options.
 - 43 9. Apply information to the needs of different industries and areas.
 - 44 10. Understand the role of IT control and service management frameworks from the
45 perspective of managing the IS function in an organization.
- 46

47 **Topics**
48

- 49 • The IS function
- 50 • IS strategic alignment
- 51 • Strategic use of information

- 1 • Impact of IS on organizational structure and processes
- 2 • IS economics
- 3 • IS planning
- 4 • Role of IS in defining and shaping competition
- 5 • Managing the Information Systems function
 - 6 ○ IS leadership: The role of the CIO and IS management
 - 7 ○ Structuring the IS organization
 - 8 ○ Hiring, retaining, and managing IS professionals
 - 9 ○ Managing a mixed set of internal and external resources
- 10 • Financing and evaluating the performance of Information Technology
- 11 investments and operations
- 12 • Acquiring Information Technology resources and capabilities
 - 13 ○ Acquiring infrastructure capabilities
 - 14 ○ Sourcing Information Systems services
 - 15 ○ Sourcing Information Systems applications
- 16 • Using IS/IT governance frameworks
- 17 • IS risk management
 - 18 ○ Managing business continuity
 - 19 ○ Managing security and privacy
- 20

21 Discussion

- 22
- 23 • The core course in IS Strategy, Management and Acquisition will take a high-
- 24 level approach to the management and acquisition of IS-resources within the
- 25 firm.
- 26 • The course will deliver the student specific strategies used in firms today to help
- 27 form the basis of IS strategic management. Based on this knowledge student will
- 28 then be asked to apply said strategies to management issues within an IS context.
- 29 • Specifics on what frames of strategic thinking are used in this course are left
- 30 unanswered. Institutions may have certain capabilities or constraints that can be
- 31 optimized to offer the best thinking for the companies that are hiring their
- 32 graduates. Also, there are different regional issues that need to be addressed in
- 33 order to match the current thinking with specific IS strategies.
- 34 • Using a case study methodology is highly recommended for this course as it will
- 35 help the students strategically identify issues in a real-world setting. In general, it
- 36 is essential that the pedagogical approaches chosen for this course will carefully
- 37 consider the fact that the issues covered are at a higher level of abstraction than
- 38 what the students are used to based on their practical experience in organizations.
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Title: Application Development
Elective Course

Catalog description

The purpose of this course is to introduce the students to the fundamental concepts and models of application development so that they can understand the key processes related to building functioning applications and appreciate the complexity of application development. Students will learn the basic concepts of program design, data structures, programming, problem solving, programming logic, and fundamental design techniques for event-driven programs. Program development will incorporate the program development life cycle: gathering requirements, designing a solution, implementing a solution in a programming language, and testing the completed application.

Learning objectives

Students will learn to

1. Use primitive data types and data structures offered by the development environment
2. Choose an appropriate data structure for modeling a simple problem
3. Understand basic programming concepts
4. Write simple applications that relate to a specific domain
5. Design, implement, test, and debug a program that uses each of the following fundamental programming constructs: basic computation, simple I/O, standard conditional and iterative structures, and the definition of functions.
6. Test applications with sample data
7. Apply core program control structures

Topics

Program design
Program development lifecycle
Requirements determinants and analysis
Modular design
Techniques for modeling program structures
Programming concepts

- Variables
- Literals
- Types
- Expressions
- Procedures
- Functions
- Parameters
- Operators and operations
- Decision logic
- Looping
- Subprocedures
- Passing parameters

Coding
Unit testing

- 1 Control structures
- 2 • Sequential
- 3 • Conditional
- 4 • Iterative
- 5 Input/Output (I/O) design
- 6 • Text-based
- 7 • Graphical user interface (GUI)
- 8 Data structures
- 9 • Primitive data types, composite data types, arrays
- 10 • Memory management
- 11 • Sequential and random file processing
- 12 Database access
- 13 Development approaches
- 14 • Object-oriented
- 15 • Procedural
- 16 • Declarative
- 17 • Rapid application
- 18 • Structured
- 19 Application integration
- 20 Prototyping
- 21 Overview and history of programming languages

22

23 **Discussion**

24

25 The course benefits from computer lab resources either in class or available for licensing on
26 individual students' computers. The choice of language should reflect commonly used languages
27 and tools with the expectation that learning any language will generalize to other languages. For
28 this reason it may be best to concentrate on one language to develop depth rather than breadth
29 across several languages.

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Title: Business Process Management
Elective Course

Catalog description

In this course students will be introduced to key concepts and approaches to business process management and improvement. The main focus of this course is both understanding and designing business processes. Students will learn how to identify, document, model, assess, and improve core business processes. Students will be introduced to process design principles. The way in which information technology can be used to manage, transform, and improve business processes is discussed. Students will be exposed to challenges and approaches to organizational change, outsourcing, and inter-organizational processes.

Learning objectives

Students will learn to

1. Model business processes
2. Benchmark business processes performance
3. Assess business processes performance
4. Design business process improvements
5. Understand the role and potential of IT to support business process management
6. Understand the challenges of business process change
7. Understand how to support business process change
8. Understand different approaches to business process modeling and improvement
9. Understand the challenges and risks concerning business process outsourcing
10. Use basic business process modeling tools
11. Simulate simple business processes and use simulation results in business process analysis

Topics

Overview

- Challenges in managing business processes
- Approaches to business process management & improvement

Understanding organizational processes

- Business process definition and classification
- Identifying core processes
- Modeling processes
- Documenting processes

Process Assessment

- Measuring performance
- Benchmarking
- Statistical techniques for process measurement

Process Improvement

- Process design guidelines and principles
- Continuous process improvement

- 1 • Change management
2

3 Using IT for process management and improvement

- 4 • Business process improvement and modeling software
5 • Tools of business process simulation
6 • ERP Systems
7

8 Organizational issues in business process management

- 9 • Understanding the customer
10 • Business process outsourcing
11 • Managing processes that cross organizational borders
12

13 **Discussion**

- 14
15 • The course description does not identify specific approaches and methods for business
16 process management and improvements, such as BPR, TQM, or Six Sigma. This will allow
17 instructors and institutions to decide which specific approaches to cover.
18 • The demonstration of leading ERP systems such as SAP is highly recommended.
19 • The use of case studies for discussion and reflection in this course is highly recommended.
20 • The use of group project in this course is highly recommended.
21 • The organization of an SAP Practicum can be considered.
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1 Title: Enterprise Systems**2 Elective Course****4 Catalog description**

6 This course is designed to provide students with an understanding of the theoretic and practical
7 issues related to the application of Enterprise Systems within organizations. The main focus of
8 this course is to demonstrate how Enterprise Systems integrate information and organizational
9 processes across functional areas with a unified system comprised of a single database and shared
10 reporting tools. Enterprise systems, by their multi-dimensional integrative nature, offer the depth
11 of functionality and breadth of integration to demonstrate how global operations of organizations
12 are managed. Thus, students will gain an appreciation of the scope of Enterprise Systems and the
13 motivation for implementing them. [Optional: Example software will be used to illustrate how
14 Enterprise Systems work. An integrated project, which requires the application of conceptual as
15 well as technical (software) skills of students, will be required.]

17 Learning objectives

18
19 Students will learn to:

- 21 1. Understand the fundamentals of Enterprise Systems and issues associated with their
22 implementation.
- 23 2. Evaluate the costs and benefits of implementing an Enterprise System.
- 24 3. Understand how enterprise systems integrate functional areas into one enterprise-wide
25 information system.
- 26 4. Explain how “best practices” are incorporated in Enterprise Systems.
- 27 5. Recognize how an organizational process often spans different functional areas.
- 28 6. Describe the role of Enterprise Systems in carrying out processes in an organization.
- 29 7. Learn to integrate key concepts from functional-oriented courses, such as accounting,
30 marketing, and organizational behavior, to promote the development of integrative skills.
- 31 8. Explain how integrated information sharing increases organizational efficiencies.
- 32 9. Identify, describe, and evaluate the major Enterprise System software providers and their
33 packaged systems.
- 34 10. Understand current trends related to Enterprise Systems.

36 Topics

- 38 • Business processes and business process integration
- 39 • Making the case for acquiring and implementing Enterprise Systems
- 40 • Analyzing business requirements for selecting and implementing an Enterprise System
- 41 • Selection of Enterprise Systems software
- 42 • Challenges associated with the implementation of global Enterprise Systems applications
- 43 • Organizational change
- 44 • Strategic alignment
- 45 • User commitment
- 46 • Communications
- 47 • Training
- 48 • Job redesign
- 49 • Governance of processes and data
- 50 • Post-implementation issues
- 51 • Enterprise System processes

- 1 • Order processing
- 2 • Purchasing
- 3 • Production logistics
- 4 • Accounting
- 5 • Planning & Control
- 6 • Human resource functions
- 7 • How Enterprise Systems support e-business
- 8

9 Discussion

- 10
- 11 • The course specification intentionally leaves Enterprise System software unspecified.
- 12 Institutions have to make the decision of whether and how to provide students with
- 13 experience with actual Enterprise System software. It is, however, preferable that the
- 14 course include exposure to and hands-on use of one of the two large Enterprise System
- 15 vendors in the market place, SAP or Oracle, or one of the several smaller vendors such as
- 16 SSA Global, Microsoft (Axapta, Great Plains and Solomon), Intuit, or Minicom, to name
- 17 a few. The importance of actual use is clear. Enterprise System software is in place in a
- 18 majority of large organizations and increasing in use in small and medium sized
- 19 organizations.
- 20 • A group project is highly recommended to assess both practical/applied aspects and the
- 21 conceptual/theoretical content of the course. For example, a group project could require
- 22 students to study a real-world organization and evaluate the suitability of SAP R/3 or
- 23 another software solution. This evaluation would then be compared with other Enterprise
- 24 System software products in terms of product functionality, support and flexibility for
- 25 configuration and customization, architecture and technology compatibility, web-based
- 26 functionality, ease of interfacing with other legacy systems, and implementation costs. If
- 27 software resources permit, the group could then design and configure a simple workable
- 28 integrated Enterprise System, using SAP R/3 for example, that demonstrates the
- 29 integration of information from several modules, such as accounts receivable, sales,
- 30 manufacturing/production, procurement, accounts payable, or general ledger. Student
- 31 groups would analyze the functional areas in a real-world organization and map them into
- 32 SAP R/3. Students would create an enterprise structure, relevant master data in the
- 33 software, transactions that demonstrate integration of core processes, and provide
- 34 documentation. Students thereby apply specialist skills and knowledge drawn from other
- 35 traditional disciplines to an actual organization and demonstrate the development of skills
- 36 such as analytical skills, communication, critical thinking, problem solving, and
- 37 teamwork.
- 38 • The course provides a pedagogical basis for a change in the delivery of education from a
- 39 functional orientation to a process orientation, leading to the integration of curriculum
- 40 across functions.
- 41

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Title: Introduction to Human-Computer Interaction

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Elective Course

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Catalog description

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Learning objectives

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Students will learn to

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This course provides an introduction to the field of human-computer interaction (HCI). HCI is an interdisciplinary field that integrates cognitive psychology, design, computer science and others. Examining the human factors associated with information systems provide the students with knowledge to understand the factors that influence usability and acceptance of IS. This course will examine human performance, components of technology, methods and techniques used in design and evaluation of IS. Societal impacts of HCI such as accessibility will also be discussed. User-centered design methods will be introduced and evaluated. This course will also introduce students to the contemporary technologies used in the empirical evaluation methods.

1. Design, implement and evaluate effective computer interfaces.
1. Understand the concepts of user differences, user experience and collaboration as well as how to design contextually.
2. Understand the basic cognitive psychology issues involved in HCI.
3. Understand the different devices used for input and output and the issues / opportunities associated with these devices.
4. Interact with the software design process in order to create computer interfaces.
5. Understand the role of theory and frameworks in HCI.
6. Apply a number of design techniques.
7. Apply contemporary techniques to evaluate computer interfaces.

- Relevance of HCI
- Principles in HCI design
 - Ergonomic engineering
 - Cognitive engineering
 - Affective engineering
- User-Centered Design
 - Users
 - Capabilities
 - Conceptual models
 - Metaphors
 - Mental models
 - Individual differences
 - Learning
 - Errors
 - Training
- Special HCI Issues Related to
 - Users
 - Children
 - Elderly

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Title: IT Audit and Controls
Elective Course

Catalog description

This course introduces the fundamental concepts of the information technology audit and control function. The main focus of this course is on understanding information controls, the types of controls and their impact on the organization, and how to manage and audit them. The concepts and techniques used in information technology audits will be presented. Students will learn the process of creating a control structure with goals and objectives, audit an information technology infrastructure against it, and establish a systematic remediation procedure for any inadequacies. The challenge of dealing with best practices, standards, and regulatory requirements governing information and controls is addressed.

Learning objectives

Students will learn to

1. Understand the role and objectives of the information technology audit.
2. Develop an appropriate information technology audit process.
3. Identify risks to the confidentiality, integrity, and availability of information and processes.
4. Describe the risks inherent in various types of information systems ranging from manual, basic accounting, to advanced operational information and knowledge for decision making.
5. Understand how to design and implement assurance procedures and control measures to effectively manage risks.
6. Understand best practices, standards, and regulatory requirements governing information and controls. Gain the ability to measure the degree of compliance with them.
7. Understand the role of auditing in systems development, including the review of the development process and participation in systems under development.
8. Understand data forensics
9. Secure and preserve evidence.
10. Develop disaster recovery and business continuity plans.

Topics

- The need for information technology audit & controls
- Information technology risks – Business Process and Business Continuity

- 1 ○ Protection of information assets
- 2 ○ Business process evaluation and risk management
- 3 ○ Systems development and maintenance activities
- 4 ○ Disaster recovery and business continuity
- 5 • Auditing ethics, guidelines, and standards of the profession
- 6 ○ Control Objectives for Information and related Technology (COBIT)
- 7 ○ ISACA
- 8 ○ Val IT
- 9 • Undertaking an information system audit
- 10 ○ Internal audit and external audit
- 11 • Controls over information and processes
- 12 ○ Physical and environmental controls
- 13 ○ Network controls
- 14 ○ System software controls
- 15 ○ Database controls
- 16 ○ Application controls
- 17 ○ Internet and e-commerce controls
- 18 ○ Installation and operational controls
- 19 ○ Change controls
- 20 ○ Access controls
- 21 ○ Encryption, authentication and non-repudiation
- 22 ○ End-user controls
- 23 ○ Software licensing controls
- 24 ○ Governance
- 25 • Controls Assessment
- 26 ○ Separation of duties
- 27 ○ Delegation of authority & responsibility
- 28 ○ System of authorizations
- 29 ○ Documentation & records
- 30 ○ Physical control over assets & records
- 31 ○ Management supervision
- 32 ○ Independent checks
- 33 ○ Recruitment & training

34
35 **Discussion**

- 36
- 37 • The use of case studies, professional standards, and sample audit software programs
- 38 are encouraged to exemplify concepts covered.
- 39

1
2 **Title: IS Innovation and New Technologies**
3 **Elective Course**

4
5 **Catalog description**

6
7 New IS technologies are being used to change how organizations communicate both
8 internally and as well as with external partners. These technologies have been integrated
9 into an exciting academic discipline that is integral to all business activities. This course
10 is designed to introduce students to new and innovative technologies and examine how
11 these powerful systems have fundamentally reshaped modern organizations along with
12 our society. Using online collaborative technologies that were developed in the context of
13 social networking and online communities, corporations are reengineering both internal
14 business processes and those related to customers, suppliers, and business partners.
15 Developing innovative ways to communicate and collaborate can lead to new business
16 opportunities, and new efficiencies. This course investigates the technologies, methods
17 and practices of developing new innovations such as online communities, and how this
18 knowledge and these skills are applied to re-engineer business processes. For example,
19 how products, services and information systems are developed, and how geographically
20 disperse virtual teams collaborate.

21
22 **Learning objectives**

23
24 Students will learn to

- 25
26 9. Understand how technologies are increasing the ability of organizations to globalize
27 business processes and to extend their reach to global customers.
28 10. Apply the techniques used to innovate IS technologies.
29 11. Understand how businesses have used IS technologies to innovate and reengineer
30 business processes.
31 12. Understand the concepts associated with network effects.
32 13. Understand how the web as a platform enhances creativity, information sharing and
33 functionality.
34 14. Understand the role of web technologies such as online communities in the business
35 world, and how they deliver value.
36 15. Apply popular community-oriented tools, such as online social networking tools, to
37 business problems.
38 16. Apply basic tools of economics to digital goods and services.
39 17. Deal with the challenges associated with new technologies and innovation.
40

41 **Topics:**

- 42 • Globalization
43 • Conversation about the commoditization of IT
44 • Technologies that have shaped the electronic world
45 • Process of IS innovation
46 ○ Diffusion
47 ○ Innovation cycles
48 • Strategic importance of the web as a platform
49 ○ Web services
50 ○ Collective intelligence
51 ○ Peer-to-peer networking

- 1 ○ Social networking
- 2 • Web 2.0 tools
- 3 ○ RSS
- 4 ○ Podcasts
- 5 ○ Wikis
- 6 ○ Blogs
- 7 ○ Mash-ups
- 8 • Information organization
- 9 ○ Categorization
- 10 ○ Taxonomies
- 11 ○ Tagging
- 12 • Virtual Teams
- 13 • Economics of digital goods and services
- 14 ○ Ecommerce distribution
- 15 ▪ The Long Tail
- 16 ▪ Wikinomics
- 17 ▪ The Free Economy
- 18 • Search space
- 19 ○ How search works
- 20 ○ How search is monetized
- 21 ○ Strategic importance of search
- 22 • Knowledge Management
- 23 • Future trends

24 **Discussion**

- 25
- 26
- 27 • It is essential for the health of the IS discipline to actively recruit IS students.
- 28 This course will focus on topics designed to excite students about the IS
- 29 discipline. Specifically, this course will look at how IS is used in the world
- 30 around the student and how IS can be utilized to create powerful applications.
- 31 This is done by delivering topics that will gain traction with the target audience.
- 32 In turn, by exposing students to a variety of business views of IS the students
- 33 would better understand the possibilities within the field.
- 34 • This course is different from the introduction to IS as it does not provide a
- 35 comprehensive overview of IS, rather topics are selected that may peak students’
- 36 interest in IS. The topics are a means to delivering an understanding of the IS
- 37 field.
- 38 • It is critically important that we expose students to how IS is impacting the world
- 39 around them and more specifically how IS functions in the business world.
- 40 • This course should include hands on demonstrations and projects that allow
- 41 students to manage these online tools; understand the importance of information
- 42 flows and provide the strategic importance of such systems.
- 43

1

2 **Title: IT Security and Risk Management**3 **Elective Course**

4

5 **Catalog description**

6

7 This course provides an introduction to the fundamental principles and topics of Information
8 Technology Security and Risk Management at the organizational level. Students will learn critical
9 security principles that enable them to plan, develop, and perform security tasks. The course will
10 address hardware, software, processes, communications, applications, and policies and
11 procedures with respect to organizational IT Security and Risk Management.

12

13 **Learning objectives**

14

15 Students will learn to:

16

17

- 18 1. Understand the fundamental principles of Information Technology security.
- 19 2. Understand the concepts of threat, evaluation of assets, information assets, physical,
20 operational, and information security and how they are related.
- 21 3. Understand the need for the careful design of a secure organizational information
22 infrastructure.
- 23 4. Perform risk analysis and risk management.
- 24 5. Understand both technical and administrative mitigation approaches.
- 25 6. Understand the need for a comprehensive security model and its implications for the
26 security manager.
- 27 7. Create and maintain a comprehensive security model.
- 28 8. Understand and apply security technologies.
- 29 9. Understand basic cryptography, its implementation considerations, and key
30 management.
- 31 10. Design and guide the development of an organization's security policy.
- 32 11. Determine appropriate strategies to assure confidentiality, integrity, and availability
33 of information.
- 34 12. Apply risk management techniques to manage risk, reduce vulnerabilities, threats,
35 and apply appropriate safeguards/controls.

35

36 **Topics**

37

- 38 • Introduction to Information Security
- 39 • Inspection
 - 40 • Resource Inventory
 - 41 • Threat Assessment
 - 42 • Identifying Vulnerabilities
 - 43 • Assigning Safeguards
- 44 • Protection
 - 45 • Awareness
 - 46 • Access
 - 47 • Identification
 - 48 • Authentication
 - 49 • Authorization
 - 50 • Availability
 - 51 • Accuracy

- 1 • Confidentiality
- 2 • Accountability
- 3 • Administration
- 4 • Detection
- 5 • Intruder Types
- 6 • Intrusion Methods
- 7 • Intrusion Process
- 8 • Detection Methods
- 9 • Monitoring Systems
- 10 • Reaction
- 11 • Incident Determination
- 12 • Incident Notification
- 13 • Incident Containment
- 14 • Assessing Damage
- 15 • Incident Recovery
- 16 • Automated Response
- 17 • Reflection
- 18 • Incident Documentation
- 19 • Incident Evaluation
- 20 • Legal Prosecution
- 21 • Risk Assessment Frameworks
- 22 • COSO Integrated Control Framework
- 23 • CoBiT – ISACA
- 24 • Australia/New Zealand Standard – Risk Management
- 25 • ISO Risk Management – Draft Standard
- 26 • Security Engineering
- 27 • Protocols
- 28 • Passwords
- 29 • Access Controls
- 30 • Cryptography
- 31 • Physical Aspects
- 32 • Biometrics
- 33 • Physical Tamper Resistance
- 34 • Security Printing and Seals
- 35 • Security in Connected Systems and Networks
- 36 • Distributed Systems
- 37 • Telecom System Security
- 38 • Network Attack and Defense
- 39 • Protecting E-Commerce Systems
- 40 • Policy and Management Issues
- 41 • Copyright and Privacy Protection
- 42 • E-Policy

43

44 Discussion

45

- 46 • This course is intended as a first course in Information Assurance at the undergraduate level.
- 47 This course will be a pre-requisite for additional information and network security courses for
- 48 an Information Security track in the undergraduate program.
- 49 • The course description does not prescribe the specific approaches and methods for inspection,
- 50 protection, detection, reaction, reflection, risk assessment and mitigation. This will allow
- 51 instructors and institutions to decide which specific approaches to cover.

- 1 • The use of case examples for discussion and reflection in this course is highly recommended.
- 2 • It is recommended to include an applied project for a potential client in which students
- 3 conduct a risk assessment of a part of the client's IT infrastructure.
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APPENDIX 1 — BACKGROUND OF IS CURRICULA AND RELATED DISCIPLINES

Computer Science Curricula

A curriculum for Computer Science (CS) was first outlined in 1968 (see list in Figure A2.1; ACM, 1968) and revised a decade later (ACM, 1979). These curricula helped define the field of Computer Science. A joint task force of the IEEE-CS and ACM revised the curriculum in 1991 (Turner and Tucker, 1991). The next comprehensive revision was called Computing Curricula 2001, Computer Science Volume (Engel and Roberts, 2001), which was updated in with an interim revision in 2008 (CS2008 Review Task Force, 2008).

Information Systems Curricula

Curriculum development for Information Systems (IS) began in the early 1970s (Ashenhurst, 1972; Couger, 1973); both the ACM and DPMA published versions of IS model curricula in the 1980s (DPMA, 1981, 1986; Nunamaker, Couger, and Davis, 1982). The IS'97 model curriculum (Davis et al., 1997) represented the first formal and combined effort of ACM, AIS, and AITP, and it was followed with IS 2002 (Gorgone et al, 2003). Key events leading to that recommendation are listed in Figure A1.1.

Figure A1.1 – Key Chronology of IS Curriculum Events leading to

May, 1972	ACM Graduate Professional Programs in Information Systems (Ashenhurst, 1972)
December, 1973	ACM Undergraduate Programs in Information Systems (Couger, 1973)
March, 1981	ACM Educational Programs and Information Systems (Nunamaker, Couger and Davis, 1982)
1981	DPMA Curriculum for Undergraduate Information Systems Education (DPMA, 1981)
1983	ACM Information Systems Curriculum Recommendations for the 80s, Undergraduate and Graduate Programs (ACM, 1983; Nunamaker, Couger and Davis, 1982)
October, 1984	DPMA Secondary Curriculum on Information Technology and Computer Information Systems
October, 1985	DPMA Associate-Level Model Curriculum in Computer Information Systems
October, 1985	DPMA Model Curriculum for Undergraduate Computer Information Systems
May, 1990	ACM/IEEE Computing Curriculum for Computer Science for Undergraduates
October, 1990	DPMA IS'90 draft document (Longenecker and Feinstein, 1991c)
June, 1991	DPMA IS'90 Curriculum for Undergraduate Programs in Information Systems
July, 1991	ACM CS Curriculum (Turner and Tucker, 1991)
January, 1994	DPMA IS'94 Curriculum for Two Year Programs in Information Systems (Longenecker, Feinstein et al., 1994)
January, 1994	ACM Curriculum for Two Year Programs in Computer Information Systems
December, 1994	First Draft of IS'95 from the Joint ACM, AIS, DPMA Task Force (Gorgone et al., 1994; Longenecker et al., 1995; Couger, 1996)
February, 1996	First Draft of IS'97 from the Joint ACM, AIS, DPMA Task Force
December, 1997	ACM, AIS, AITP IS'97 Model Curriculum and Guidelines for Undergraduate Programs of Information Systems
December, 1999	ISCC An Industry Based Curriculum
December, 2002	IS 2002 Model Curriculum and Guidelines for Undergraduate Programs of Information Systems

The DPMA IS'90 model was begun in November 1988 and completed by July of 1991 (Longenecker and Feinstein, 1991b, 1991c). This model was based on a survey of Information Systems programs in approximately 1,000 colleges and universities in North America (Longenecker and Feinstein, 1991a). Participants in the effort, the Curriculum Task Force (CTF 90), were drawn from an international community of industry, business, and academia including both two and four year institutions. The work was supported by the DPMA but participants were also active in other organizations. Material from the unpublished work of the ACM-IS curriculum committee that met in the late 1980s was incorporated into the model.

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2 The draft version “Information Systems – The DPMA Model Curriculum for a Four Year Undergraduate
3 Degree (IS’90),” was released in October 1990. This draft was presented at ISECON (Information Systems
4 Educational Conference) in Chicago, at the DSI (Decision Sciences Institute) meeting in San Diego, and at
5 ICIS (International Conference for Information Systems) in Copenhagen. A final document was released in
6 June 1991. IS’90 prompted considerable dialogue. A partial list of papers that discuss various aspects of IS
7 education is found in the bibliography (Aggarwal and Rollier, 1994; Burn et al., 1994; Cale, 1994; Chow,
8 Dick and Edmundson, 1994; Cohen, 1993, 1994; Daigle and Kemp, 1993, 1994; Daniels et al., 1992;
9 Denison, 1993; Doran, Longenecker and Pardu, 1994; Granger and Schroeder, 1994; Haney, 1994; Klein,
10 Stephens, and Bohannon, 1994; Lim, 1993; Longenecker, Feinstein, and Gorgone, 1994; Longenecker et
11 al., 1996; Longenecker et al., 1997; Lorents and Neal, 1993; Mawhinney, Morrell, and Morris, 1994;
12 McKinney, Agarwal, and Sanati, 1994; Pick and Schenk, 1993; Pick, Baty, and Phoenix, 1994; Sanati,
13 McKinney, and Agarwal, 1994; Smith, 1994; Waguespack, 1994).

14 15 16 **Characteristics of IS’97 Development**

17
18 In February 1994, the initial meeting of a Joint Task Force for ACM, AIS, and DPMA collaboration on a
19 model IS curriculum was held. At the meeting, the IS’90 body of IS knowledge was reviewed and updated.
20 During subsequent meetings, curriculum presentation areas were described. Courses were also developed
21 based on specific goals and objectives. Statements specifying the characteristics of graduates were
22 reviewed and extended. Preliminary versions of the curriculum were presented in 1994 and 1995 at
23 ISECON (Information Systems Educational Conference, Louisville), DSI (Decision Science Institute,
24 Honolulu), IAIM (International Academy for Information Management, Las Vegas), ICIS (International
25 Conference on Information Systems, Vancouver), and SIGCSE (Special Interest Group for Computer
26 Science Education, Nashville).

27
28 The IS’97 materials were presented for review to 900 faculty, chairs, and distinguished IS professionals
29 during the summer of 1995. The critique from the review process was used by the co-chairs in developing
30 the edited version now called IS’97. The ACM Education Board members and DPMA management
31 submitted significant suggestions for revision of IS’95. The upgraded materials were presented in 1995 at
32 IACIS (International Association for Computer Information Systems), ISECON, DSI, and IAIM, and in
33 1996 at SIGCSE in Philadelphia.

34
35 IS’97 and its predecessor IS’90 differed from other approaches in several fundamental ways.

- 36
37 1. Development was based on a methodology that can be replicated as the knowledge base
38 evolves.
- 39
40 2. Course content is determined in a functional manner rather than topically. For example,
41 an integrated course in systems development replaces the necessity for separate courses
42 in database, analysis, and design. These topics have always been strongly coupled and,
43 therefore, can be taught together.
- 44
45 3. The depth of coverage of elements of the body of knowledge within the objectives is
46 progressive. This allows all related topics to be covered in an integrated fashion with
47 repetition and increasing depth until the required exit competence is achieved.
- 48
49 4. Measurable educational outcome objectives are identified and used uniformly throughout
50 the methodology. Depth of knowledge is defined in a manner consistent with Bloom
51 (1956). This allows for learning of the body of knowledge to a specified competence as
52 well as continuous assessment and feedback (Argyris, 1976, 1977). Topics are revisited
53 several times within the context of given goals of instruction (Gagne, Briggs, and Wager,
54 1988).
- 55
56 5. The learning units provide small units for curriculum design. They support tailoring of

1 courses and are not as prescriptive as courses used in previous models. This allows
2 flexibility by individual academic units, yet with the ability to remain focused on overall
3 objectives of the curriculum. This approach will help ensure the quality of graduates
4 (Denning, 1992; Bemowski, 1991a, 1991b; Cherkasky, 1992).
5
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7 **IS 2002 Extensions**

8
9 IS'97 experienced a wide degree of success. It became the initial basis for IS accreditation. Yet, the
10 document was prepared largely in 1995, and was modified to keep it up-to-date until its publication in
11 1997. It was five years old at the time of the development of IS 2002. Survey research conducted by the co-
12 chairs indicated that there was still a wide agreement of practitioners and academicians regarding the
13 relevance of the spiral approach, the exit objectives, and most of the detailed learning objectives, but there
14 was a clear need to update the model curriculum because of rapid contextual and technological change. The
15 body of knowledge was expanded based on available materials from the ISCC'99 curriculum and from the
16 EC Institute body of knowledge documents. The co-chairs added a new course in e-commerce, and made
17 edits in the balance of the course descriptions to reflect current attitudes, surveyed skill elements, and
18 feedback from six national presentations at AIS, ISECON, and IAIM to Information Systems faculty.
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APPENDIX 2 — DETAILS OF THE DEVELOPMENT OF IS 2009

The joint AIS/ACM task force was launched in January of 2007, and it hopes to produce the final, approved version of the curriculum recommendations by summer 2009. The co-chairs are Heikki Topi (Bentley University) and Joe Valacich (Washington State University). Other members of the committee include Kate Kaiser (Marquette University), Jay Nunamaker (University of Arizona), Janice Sipior (Villanova University), Gert-Jan de Vreede (University of Nebraska-Omaha), and Ryan Wright (University of San Francisco). This curriculum version is the first major revision since the IS '97 report (Davis et al. 1997), for which most of the work was done in the mid-1990s.

Past curriculum projects have been largely based on the work of a small task force that has shared its work at a variety of conferences and incorporated the feedback from the sessions to the model curriculum. In addition, written drafts have been shared widely and comments solicited. Also, surveys have been used to gather industry input. Typical processes are driven by a few individuals with little input from the academy as a whole. In an effort to create an open and transparent process that is open to the IS community as broadly as possible, the IS 2009 model curriculum committee used web-based collaboration technologies in addition to several traditional approaches described above to include and hopefully engage the global IS community.

As with previous curriculum projects, the IS 2009 task force has presented the development process at several conferences. In addition, we have published reports at different stages of the project. Further we have created a wiki to support collaboration and to make it easier for the community to give feedback during the curriculum revision process. The AIS email listserv was utilized several times to solicit feedback and direct users to the wiki Web site. Table A3.1 details the timeline for this effort.

Table A3.1: Details of the IS 2009 Task Force interactions with the community

Date	Committee Interactions	Means
August 2007	Initial proposal for IS 2009 process	AMCIS Panel
August 2007	Introduction of the IS Curriculum Wiki	ISWorld list
November 2007	Summary of the AMCIS 2007 panel and further developments	Communications of the AIS Volume 20
November 2007	Invitation to review the committee's progress on the IS Curriculum Wiki	ISWorld list
December 2007	IS 2009 status review	Panel at AIS SIG-ED IAIM 2007
June 2008	The role of IS 2009 as a global curriculum	Panel at ECIS 2008
August 2008	IS 2009 status review	Panel at AMCIS 2008
November 2008	Invitation to review the course descriptions	IS World list
December 2008	Summary of the AMCIS 2008 panel and further developments	Communications of the AIS Volume 23
December 2008	Current state of the IS 2009 project	Panel at IAIM SIG-ED (Special Interest Group on Education)
April 2009	Publication of the first comprehensive draft of IS 2009 and an invitation to review and comment	ISWorld list

APPENDIX 3 – DEPTH OF KNOWLEDGE METRICS AND RELATED PEDAGOGY

A key ingredient and accomplishment of IS'97 and IS 2002 was a competency or depth of knowledge metric with five levels (with four levels specified in the curriculum). This metric is based on but not identical to the work of Bloom (1956), which describes a six level metric. The metric makes it possible to communicate specifications and expectations.

Depth of Knowledge Metric

Table A3.1 is a summary of the depth of knowledge metric. Note that there are conceptually five levels for depth of knowledge but only the first four are used for an undergraduate program. The IS model curriculum levels differ from Bloom levels in that Bloom's level 1 is divided into IS curriculum levels 1 and 2, and Bloom levels 4, 5, and 6 are mapped to IS curriculum level 5.

The characteristics of the metric include

- the definition of the levels of knowledge,
- the behavior to be demonstrated by those who have completed the learning units of the curriculum,
- how goals and objectives are developed compatible with each knowledge level,
- how to determine the level of knowledge from previously defined goal and objective statements (reverse engineer knowledge levels from existing documentation),
- how material at a given level can be delivered to students, and
- how learning at given level can be assessed.

The template shown in column 3 of Table A3.1 was consulted when writing behavioral objective and goal statements for the IS 2009 courses; these statements allow authors and faculty to be more precise in communicating expectations for both students and teachers.

Identifying Expectations

The statements of characteristics of graduates contain “keywords” that can be detected using the template of the metric. For example, if the expectation is to “apply problem solving techniques in configuring a local area network,” this is the equivalent of a level 4 objective. To a large extent, the knowledge levels specified within IS 2009 are compatible with the definitions of Table A3.1. The exit objectives of the goals and objectives have been checked and verified to assure consistency with the expectations of industry and academics.

Content Analysis of Statements of Expectation

The knowledge levels of IS 2009 are designed to give guidance to educators in planning as well as in the analysis of outcomes. Column 3 of Table A3.1 describes a template for writing objectives. This template was originally defined in IS'90 and has been expanded in the present context. The language used in writing behavioral objectives was derived from the Bloom taxonomy. The template may be used prescriptively in writing presentation goals and student performance objectives to ensure that the implied level of difficulty is presented. Likewise, given the objective, the student's behavior can be observed and compared with the objective statement to ensure that the students achieve the desired results of the presentation goal statements.

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Learning Techniques for Different Levels

Learning techniques often differ for different levels. Level 1 knowledge in IS 2009 (awareness) is knowledge that is immediately apparent. Given an appropriate stimulus, it is knowledge that is recalled. IS 2009 level 2 knowledge (literacy) requires not only recognition, but recognition of the context of the knowledge; that is, the knowledge element and its parents and descendants should be familiar to the learner. Classroom activity or participative learning strategies are sufficient in transferring this level of knowledge, although level 2 activity can be enhanced in the lab. Although knowledge at levels 1 and 2 is relatively low, these levels should be mastered before higher levels can be achieved. It is the “revisiting” of previously presented and learned knowledge that is implied in the organization of learning units.

The more complex IS 2009 level 3 (usage/comprehension) requires considerable practice and creative repetition. Level 4 (application) requires unsupervised practice. Team work, project work, and other participative learning facilitate achieving these levels. Proper sequencing is an important factor in achieving student success. Project laboratories are ideal for this level of student activity. In fact, these laboratories are beneficial at all levels of instruction (Doran, Longenecker, and Pardu, 1994; Dutt, 1994). Some institutions have been successful with total participatory project environments (Holland College 1993).

The cooperative paradigm (Litchfield, 1996; Johnson, Johnson, and Houlubec, 1993) offers many advantages to learners, although it requires considerable change on the part of faculty. The cooperative paradigm greatly increases student motivation and better simulates the work environment in which graduates are expected to perform. The cooperative paradigm supports well the development of application level competencies.

1

IS'90, '94, '95, 2002, 2009 Depth of Knowledge	Bloom Levels of Knowledge	Template for Writing Behavioral Objectives Students completing ... will be able to	Meaning of Depth of Knowledge Level and Activities Associated with Attaining that Level
0 No Knowledge			
1 Awareness	1 Knowledge Recognition	Define ... List characteristics of ... Name components of ... Diagram ... List advantages/disadvantages of ...	Introductory Recall and Recognition Class presentations, discussion groups, reading, watching videos, structured laboratories. Involves only recognition, but with little ability to differentiate. Does not involve use.
2 Literacy Strong Knowledge	1 Differentiation in context	Compare and contrast ... Explain ... Write/execute simple ... Define functional capabilities that are ... Describe interrelations of ... to related objects	Knowledge of Framework and Contents, Differential Knowledge Continued lecture and participative discussion, reading, team work and projects, structured labs. Requires recognition knowledge as a prerequisite. Requires practice. Does not involve use.
3 Concept/Use Skill	2 Comprehension Translation/ Extrapolation Use of Knowledge	Use ... Communicate the idea of ... Form and relate the abstraction of ... as ... Given a set of ..., interpolate/extrapolate to ... List concepts/major steps in ...	Comprehension and Ability to Use Knowledge <i>when Asked/Prompted</i> Requires continued lab and project participation, presentation involving giving explanations and demonstrations, accepting criticism; may require developing skills in directed labs.
4 Detailed Understanding, Application Ability	3 Application Knowledge	Search for correct solution to ... and apply it to ... Design and implement a ... for ... Write syntactically correct ... and/or debug ... Apply the principles of ... to ... Implement a ... and maintain it	Selection of the Right Thing and Using It <i>without Hints</i> Semi-structured team-oriented labs where students generate their own solutions, make their own decisions, commit to and complete assignments, and present and explain solutions.
5 Advanced	4 Analysis 5 Synthesis 6 Evaluation	Develop/originate/institute ... Construct/adapt ... Generate novel solutions to ... Come up with new knowledge regarding ... Evaluate/judge the relative value of ... with respect to ...	Identification, Use and Evaluation of New Knowledge An advanced level of knowledge for those very capable of applying existing knowledge in which <i>denovo</i> solutions are found and utilized in solving and evaluating the proposed new knowledge.

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Table A3.1. Knowledge Levels, Templates for Objective Writing, and Meaning of the Depth Levels with Associated Learning Activities

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APPENDIX 4 — IS BODY OF KNOWLEDGE

Many significant aspects of an academic discipline are defined by its associated body of knowledge. In this version of the model curriculum, the Information Systems body of knowledge has been thoroughly re-architected to highlight the unique contributions that the discipline of Information Systems makes to computing, to benefit from the work that has been done in other computing disciplines, and to recognize the major role that various domain knowledge areas play in Information Systems.

This version of the Information Systems Body of Knowledge is based on a number of streams of work in computing.

1. It builds on and is closely associated with IS 2002/IS'97 and the body of knowledge presented in these documents. The current BoK is not, however, a direct extension of the prior versions.
2. The IS 2009 body of knowledge has significantly benefited from the work done in the context of the computing ontology project (see Cassel et al., 2008), which has brought together representatives from all computing disciplines to develop a comprehensive concept structure for the entire field.
3. In addition to the ontology project, IS 2009 also directly utilizes, as described above, the work that has been done in other computing disciplines to specify their bodies of knowledge.
4. The body of knowledge was also strongly influenced by the new high-level undergraduate IS program learning objectives that were specified in this project and articulated in Section 10.

This version of the Information Systems Body of Knowledge is divided into four categories (See Figure A4.1):

1. General Computing Knowledge Areas, which are defined at a detailed level in the curriculum documents for the other computing disciplines (primarily CS 2008).
2. Information Systems Specific Knowledge Areas, which include the content to which IS contributes in a unique way that distinguishes it from other computing disciplines. Currently, it has been developed only for the core of the curriculum, as specified in Figure A4.2.
3. Foundational Knowledge Areas, primarily focusing on Leadership and Communication, and Individual and Organizational Knowledge Work capabilities. These are very important areas that form an essential part of the curriculum, but as discussed in Section 10, the foundational knowledge and skills are included in a number of different degree programs in different academic fields and therefore, not included as Information Systems Specific Knowledge Areas.
4. Domain-specific Knowledge Areas, describing the domain content required for a specific type of a Information Systems degree. As discussed earlier in this document, all Information Systems degree programs are associated with an application domain, but the domains and the relevant portions of their bodies of knowledge vary depending on the program.

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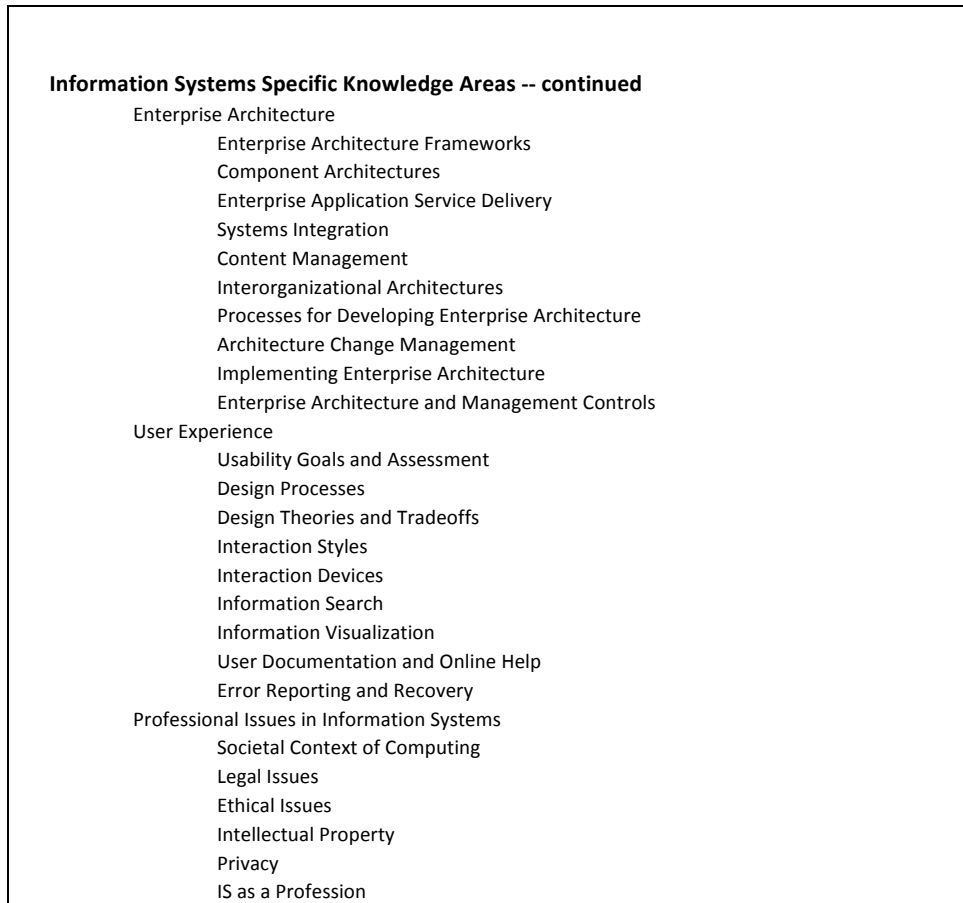
General Computing Knowledge Areas (details from CS 2008)	
	<ul style="list-style-type: none"> Programming Fundamentals Algorithms and Complexity Architecture and Organization Operating Systems Net Centric Computing Programming Languages Graphics and Visual Computing Intelligent Systems
Information Systems Specific Knowledge Areas	
	<ul style="list-style-type: none"> IS Management and Leadership Data and Information Management Systems Analysis & Design IS Project Management Enterprise Architecture User Experience Professional Issues in Information Systems
Foundational Knowledge Areas	
	<ul style="list-style-type: none"> Leadership and Communication Individual and Organizational Knowledge Work Capabilities
Domain-related Knowledge Areas	
	<ul style="list-style-type: none"> General models of the domain Key specializations within the domain Evaluation of performance within the domain

4 **Figure A4.1: Overview of the Information Systems Body of Knowledge**



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Figure A4.2a: Information Systems Specific Knowledge Areas, Part I



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Figure A4.2b: Information Systems Specific Knowledge Areas, Part II

APPENDIX 5 — REFERENCES FOR THE APPENDICES

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