Notification of Intent to Develop
New Program

Institution: New Mexico Highlands University

Contact Person: David West

Date: September 7, 2010

Degree Program Under Development: Master of Science in Software-driven Systems Design

Department Submitting Proposal: School of Business

Date of Proposal Submission to NMHED: September 2010

Desired Implementation Date: Fall, 2011

■■
Use one page to describe the following

Purpose of the Program:

To graduate individuals with the education necessary to use computer technology, (specifically the software that drives that technology), to creatively solve the complex problems faced by contemporary businesses and by governments, and societies. Graduates will be prepared to take on, and excel at, one of the estimated 1.4 million software development positions that the U.S. Labor department predicts will be unmet needs over the next five years.

Need:

According to U.S. Bureau of Labor Statistics projections for 2006-2016, "for the foreseeable future, **nearly 3 out of 4 new science or engineering jobs in the U.S. are going to be in computing!** By contrast, just 16% will be traditional engineering jobs, and even fewer will be in the sciences or mathematics.

1. The U.S. Bureau of Labor Statistics (USBLS) is projecting more than four times as many new jobs in computing as in all the other areas of engineering combined.
2. The number of new jobs per year is double number of computing graduates each year, creating a stupendous shortage.
3. Computing is the only STEM (Science, Technology, Engineering, Math) discipline in which demand for graduates exceeds supply.
4. 27% of the new STEM jobs (295,000) will be in "software engineering" - the focus of this program – a number that exceeds the number of jobs in all other areas of engineering combined (178,400).
5. Based on enrollment projections: In engineering, the physical sciences, and the life sciences, there are more graduates than there are jobs, but in computing there are almost 100,000 fewer projected graduates than jobs – per year, through 2018.

Institutional Commitment to the Program:

Along with being approved by the NMHU Academic Affairs Committee and the NMHU Board of Regents, the program has received letters of support from President Jim Fries, Vice President for Academic Affairs Gilbert Rivera and Associate Vice President for Academic Affairs Linda La Grange.

Proposal for the
Master of Science Degree in
Software-driven Systems Design
New Mexico Highlands University

Prepared and Submitted by
David West, Ph.D.
Professor of Management
Information Systems
September 2010

Proposal Table of Contents

Executive Summary

I. Program Description

a. Academic Purpose

The primary purpose of this program is to graduate professionals worthy of the title 'master,' with a portfolio of achievements, and extensive ties to the larger professional community of which they will be a part during their careers. Two corollary purposes guide the design and delivery of this program. One, using experience-based learning opportunities, in conjunction with working professionals as mentors and colleagues; and two, assuring that graduates have mastered, integrated, and applied a body of knowledge that includes the technical knowledge of computing and computing tools, systems knowledge, analytic and problem solving knowledge, design principles, and significant knowledge of at least one application domain (e.g., business). A third, general purpose of the program is assuring graduates have the knowledge, skills, and experience necessary to work as effective members and leaders of professional teams.

b. Academic Objectives

A. Student understanding of generative and complex adaptive systems and how to use that understanding to analyze and design solutions to contemporary problems in service of the enterprise, society, and humanity.
B. Student understanding of how to design, implement, and deploy software-computer solutions.
C. Increase the breadth, depth, and integration of student knowledge by embedding that knowledge in intensive and diverse experience.
D. Deep integration of discipline specific and technical knowledge with liberal arts based understanding, especially in the areas of philosophy, history, anthropology, and communication.
E. Graduate students who are acknowledged to be among the best in the world.

c. Curriculum

Total Credits Required – 40
  Required – 33
  Elective - 7

   SDA 590 – Development Project – Enterprise Focus (4)
   SDA 690 – Development Project – Mastery Focus (4)
   SDA 692 – Development Project – Research Focus (4)
   SDA 510 – Refereed Paper (1)
   SDA 610 – Monograph (1)
   BUS 505 - Proseminar – Aspects of the Enterprise I (3)
   BUS 506 - Proseminar _ Aspects of the Enterprise II (3)
   SDA 527 – Formal Solutions to Computational Problems I (3*)

SDA 629 – Formal Solutions to Computational Problems II (3*)
SDA 640 – Data Representation and Persistence (1)
SDA 642 – Data Representation and Visualization (1)
SDA 644 – Knowledge Management (1)
SDA 552 – Complex Systems (1)
SDA 646 – Enterprise Design (1)
SDA 644 – Dynamic/Emergent Systems Design (1)
SDA 650 – Ambient Computing (1)
SDA 655 - Topics (4)
Electives** (3)

Students without a Software, MIS, or Computer Science undergraduate degree will be required to take, prior to beginning graduate courses: (do not count for graduate credit) SDA 498 – Proseminar – Analysis, Design, and Implementation I (3); and, SDA 499 – Proseminar – Analysis, Design, and Implementation II (3).

II. Need for Program

a. Relationship to NMHU Mission

This effort directly supports every strategic objective in the published Mission Statement (with the possible exception of enhancing the physical campus environment).

b. Relationship to Other NMHU Programs

This effort will greatly enhance (and eventually replace) the MIS offerings in the School of Business. MIS has always suffered from a lack of integration with business offerings. This gap has translated into a professional world where MIS departments and the rest of the business enterprise are more adversaries than partners.

There is significant potential for cooperation with the Computer Science as well as (planned) cooperative efforts with the Media Arts program, and with several science departments (e.g., research and laboratory management and required information systems support).

c. Relationship to Other programs offered at other New Mexico Universities

There is some apparent overlap with existing programs in terms of topics – but there is no duplication in terms of the overall program, its curriculum, its structure, and its pedagogy.

d. Opportunities for Advanced Degrees

Graduates of this program will be qualified to enter Ph.D. programs in Computer Science, newer doctoral programs in Complexity Science, Ph.D. programs in Business, and exciting new inter-disciplinary programs like the Ph.D. in Computer Science-Design Studies at Stanford.

e. Opportunities for Employment

Employment opportunities are almost unlimited. More than 80% of the careers in the area loosely defined as computing and information technology are focused on software development and management of the software development process.

III. Resource Requirements

a. Existing Faculty

Three full time faculty members, currently in the School of Business, (one tenured) are available to support this degree. Existing School of Business faculty are available to develop and deliver the BUS Proseminar. Adjunct faculty members with Ph.D. and teaching experience have been identified to teach the mathematics derived courses.

Additional full-time faculty would be required – in a 1:20 full-time tenure-track faculty per FTE student.

b. Enrollment Projected # of Student Generated Credit Hours

	Year One	Year Two	Year Three	Year Four	Year Five
Enrollment Actual / FTE	20 / 12 [8x6 / 12x15]	28 / 20 [8x6 / 20x15]	40 / 30 [10x6 / 30x15]	70 / 50 [20x6 / 50x15]	100 / 70 [30x6 / 70x15]
Total Cr. Hrs.	392	696	1020	1740	2460

c. Institutional Readiness

All full time faculty required for program are in place, all adjunct faculty required have been identified. Space and infrastructure (local area network, dedicated servers, and student workstations) are in place. Library resources required are in place, including critical on-line database subscriptions. Some nominal budget amounts have been set aside for promotion and recruitment. All internal approvals have been obtained.

d. Projected Cost

Capital/Start-up costs:
Additional Faculty (none, first two years)	$ 0
Library (none first year)	$ 0
Space renovation / furniture	$ 5,000
Workstations / Servers	$25,000
Graduate Assistantship	$ 7,200
SUBTOTAL	$37,500

Annual costs

Category	Year one	Year two	Year three	Year four	Year five
FT Faculty[1, 2]	$ 40,000	$ 40,000	$ 80,000	$80,000	$ 150,000
PT/Adjunct Faculty[1]	$ 3,600	$ 14,400	$ 14,400	$ 28,800	$ 28,800
Library		$2,000	$ 2,000	$ 2,000	$ 2,000
Add'l Space			$ 5,000		$ 5,000
New equipment		$ 7,500	$ 12,000	$ 15,000	$ 18,000
Replacement equipment			$ 15,000		$ 10,000
Supplies	$ 2,000	$ 3,000	$ 4,000	$ 5,000	$ 5,000
Grad Asst. / Apprentice[3]	$ 96,000	$ 160,000	$ 320,000	$ 400,000	$ 560,000
Subtotal	$ 151,600	$ 243,900	$ 477,400	$ 560,800	$ 828,800
Less Externally Funded	$106,000	$ 175,000	$ 345,000	$ 430,000	$ 610,000
Net Annual Costs	$ 35,600	$ 53,900	$ 107,400	$ 100,800	$ 168,800

[1]Includes Benefits

[2] Reflects one-half salary (joint appointment with undergraduate program), except for the fifth year, when two full-time appointments, specifically for the graduate program, will be budgeted.

[3]Funded externally using software development contract and grant income. (See below.) These figures are directly proportional to expected enrollments – if enrollments are higher or lower these numbers will change accordingly.

a. Date of Implementation

August 2011, beginning of fall semester, is the hoped for start date.

b. Letters of Support

These are included in Appendix 4.

c. Accreditation

This program will be ready to participate in the general accreditation processes, both interim and long-term, except the 2011-2012 interim report.

APPROVAL PROCEDURE
ACADEMIC MAJORS/MINORS and CERTIFICATE PROGRAMS

NEW / (REVISED)   Date Submitted: 10/23/2009

Proposed Degree: **MS– Software-Driven Systems Design**

Discipline of: **MIS – Software Development**

College/School of: **Business**

Submitted by: **David West**, Program Representative

RECOMMENDATIONS:

Approve Deny _____ 4-6-10
                College or School Dean   Date

Approve Deny _____ 5/28/10
              Chair, Academic Affairs Committee   Date

Approve Deny _____ 7/26/'10
              Vice President, Academic Affairs   Date
****
Forwarded to President and Board of Regents for consideration on 7/26/'10
                                                                    Date

Action: Approved ___✓___ Denied _____   7/26/'10
                                                  Date

Proposal

A. Program Description and Purpose

The degree program being proposed is unique: in terms of the area of study, its structure, its pedagogy, its conscious focus on professional preparation, and its intentional engagement with the world outside of the university.

The focus of the program is evident in the name – Software-driven Systems Design – but the rationale for that focus merits a brief discussion. This program has deep roots in both traditional Computer Science (CS-the understanding of computers and how to write the software that drives them) and Management Information Systems (how to use computing technology in service of the enterprise). Despite those roots, the program offers a radical alternative to typical CS and MIS education. Specifically:

- CS and MIS focus their attention on the 'artifact,' the computer and the computer program, while this degree focuses on the 'system' in which that artifact is embedded and the effect of that artifact on the system.
- Both CS and Business are grounded in a systems view derived from 19th century Physics – the universe as a machine, a deterministic system that is formally described and manipulated. This program is grounded in the notion of "Complex Adaptive Systems" (CAS), non-deterministic, self-organizing, dynamic, and evolving. [Business recognized the utility of this alternative system concept two decades ago and has been trying to apply that understanding to contemporary business problems and solutions.]
- A long-standing divergence between academic theory and actual practice has created the situation that honors graduates from traditional CS and MIS degree programs are dramatically deficient in terms of the knowledge and skills required for 90% of the information systems, software development careers available. Hiring companies spend millions 'retraining' graduates to make them productive, and a significant amount of the knowledge required to succeed in a career is considered 'tacit' and is acquired on-the-job. This program makes a conscious commitment to providing students the education and the experience necessary to become a contributing member of a professional community; with slightly less emphasis on the preparation useful for entering the professoriate or for the 10% of the jobs that absolutely required the kind of formal education provided by a CS degree.
- Graduate education tends toward specialization and narrow focus. This program adheres to the notion that solving the 'wicked' problems confronting business, government, and society require far greater breadth of understanding and a far deeper integration of knowledge across disciplinary boundaries than is possible in traditional CS and MIS degree programs.
- CS and MIS programs are committed to teaching "computational thinking" the kind of formal, mathematical, analysis and conceptualization that is held to be typical of science. This program is more concerned with the a formal thinking processes usually associated with design, creativity, and innovation – the kind of thinking more often associated with Art than with Science. [An exemplar for this approach is the association between the d.school (design school) and the Computer Science department at Stanford.]

In addition to an alternative subject matter, the proposed program utilizes a very different structure, pedagogy, and practice: [A pilot of this approach was conducted, and proved extremely successful – garnering attention and accolades from professional groups and educators across the country – at the undergraduate level, three years ago.]

- A commitment to experiential learning. All students work on projects for paying customers (outside the university) alongside experienced professionals. All learning is immediately applied and integrated (and therefore retained) because it takes place in the experiential context. Students graduate with a transcript, but far more importantly, they graduate with a portfolio of work that demonstrates their mastery and accomplishments.
- The curriculum is competency-based, not course-based, with approximately one-hundred competencies defined at seven degrees of mastery (ranging from 'demonstrates competency under supervision' to 'makes an original contribution to the area of the competency.' And example of level seven (original contribution) is the publication of a refereed paper at a conference or in a journal. Half of the undergraduates in the one-year pilot program met this requirement.]
- Students commit a significant block of time each week to be "in-Studio." The Studio provides a "one-room-schoolhouse," where all students regardless of grade level meet and work collectively on projects. All education is provided in the Studio as well – creating an environment not unlike the bottega where Leonardo served his apprenticeship and mastered his craft.
- Active engagement with the larger professional community – which translates into professional networks that facilitate career advancement.
- The intent to graduate individuals ready to enter the workforce at the journeyman level, not entry-level.

The degree program, as proposed, can be a 'stand-alone' educational offering. Its real power, however, comes from the ability to be part of a cooperative venture (via the University's Research Park) with one or more private sector contract development companies. The private sector contracts work that is completed in the Studio using a mix of professional employees and our students. The students are simultaneously paid apprentices. (This helps offset the cost of their education.) This arrangement leads to the possibility that the entire program could be financially self-sufficient, job-creating, and an engine of economic development.

The degree is framed by three, sequential, project courses. Together with apprenticeship opportunities this assures student presence in the Studio for significant blocks of time each day and each week. Projects provide both the motivation for learning and the opportunity to apply (reinforce and retain learning) and integrate that learning. The Studio provides a rich environment of constant learning from peers, mentors, professionals, and faculty.

The spectrum of subject matter required is delivered in a highly incremental and accelerated manner via a set of one-credit courses. Each course is designed for on-line, self-paced, delivery with extensive self-assessment tools and a final objective exam. All course materials are available all the time. Each course is also "delivered" in the Studio by appropriate faculty – usually in an accelerated format and "on-demand." (On-demand means that a significant number of students, based on projects they are working on and their individual education plans, have an imminent need to demonstrate their mastery.)

Each educational module inverts the typical academic notion of pre-requisite knowledge. Students first confront advanced knowledge and practice and learn that essentially by rote in order to pass level-one mastery (demonstrates under supervision). They are then motivated to revisit the material in order to learn underlying principles and theory in order to demonstrate higher-level mastery (e.g. demonstrates independently, in a novel context, mentors others, makes contribution).

This is the right program at the right time for New Mexico. It will contribute to statewide economic development by providing a highly educated and experienced workforce that can support the hi-tech ambitions and polices of the State. It is unique in the State and the region, although we fully expect lots of schools to emulate the program as we rapidly demonstrate success.

This is the right program for New Mexico Highlands and for the School of Business Administration as both are actively engaged in efforts to promote innovative and inter-disciplinary educational offerings and to establish themselves as unduplicated alternative sources of higher education.

1. Primary Purpose

This program will graduate professionals with broad, interdisciplinary, theoretical and practical knowledge, experience, and a portfolio of accomplishments: professionals capable of creatively solving the "wicked" (complex and dynamic) problems facing business, government, and society.

This primary purpose directly supports the top five strategic goals incorporated into the NMHU Mission Statement: i.e., develop a learner-centered environment, engage the community, become a premier HSI, taking a leadership position in technology areas, and achieve competitive position vis-à-vis other State and regional institutions of higher education.

2. Secondary Purposes

1. To create the optimal learner-centric, learner-driven, educational setting possible.
2. To take full advantage of existing, but underutilized, scheduling and course design flexibility to address issues of knowledge comprehension, integration, and retention.
3. To build a community of students, integrated with the professional community outside the University.
4. To offer every student in the program the opportunity to offset the costs of their education via apprenticeships and assistantships.

3. Institutional Consistency

This program is consistent with NMHU policies and priorities that focus on innovation in educational offerings, seeking increased inter-departmental cooperation (including plans to combine several departments into a school of innovation and technology), exploiting the potential of the NMHU Research Park authorization, and the re-establishment of an undergraduate program with this same academic focus. The fact that the University also set aside budget specifically for this effort (and the associated changes in the MIS program) further indicates both consistency and priority.

4. Institutional Priority

The School of Business has set this program as its number one strategic priority and the University Administration has consistently shown its support by protecting the program from the current budget difficulties that might have derailed it as program with lower priority.

5. Curriculum

The program is framed and defined by the experiential learning offered by project courses. These courses, along with the time commitments ensuing from apprenticeships and assistantships provide a dedicated block of time and the opportunity to immediately apply and integrate (and thereby retain) the academic knowledge provided via the rest of the curriculum offering. The fact that students will be working side-by-side with experienced professionals assures the exchange of 'tacit' knowledge and skills that would normally be learned much later, and "on-the-job."

Part of being a member of a community is the obligation to make a contribution to that community. Students in the program will be **encouraged** to publish at least one refereed journal article or conference presentation and are **required** to complete a thesis (thesis committee to include outside reviewers and evaluation to include suitability for publication as a monograph).   Two courses and an ongoing practice of reader and writer workshops in the studio, will assure the ability to meet this expectation and requirement.

The most common domain of application for students graduating from this program is the enterprise (business). Accordingly, students are required to have a basic understanding of this domain and are provided with two business proseminar courses.

Prior art, from within the discipline or borrowed from others, provides a foundation for analyzing and solving problems. Mathematics is an important source of prior art. Students need to be able to recognize problems that are amenable to prior art solution and how to apply that prior art in the context of the problem. To this end students are required to take six hours of Formal Solutions for Computational Problems.

Data, information, and knowledge are fundamental to almost every system and students require advanced understanding of all three. Required courses in this area have been defined.

This degree mandates an understanding of the systems perspective and particularly of non-deterministic, non-mechanical, systems and how to affect and shape (design) such systems. Four courses provide this foundational knowledge.

Students are expected to develop a particular area of depth / expertise that is in part defined by a domain of application (e.g., IT Auditing from business) and in part by advanced understanding of a topic within the software/systems discipline (e.g,. problems of search, GIS application areas). Students will use electives to obtain this depth.

a. Courses

All courses and syllabi are included in Appendix 2.

b. Competencies

This program was designed on the basis of a set of knowledge and application "competencies" rather than a set of courses. At present, the number of discrete competencies

number around 100, but the final set is a work in progress that will be finalized upon program approval and inception. (We also expect the competencies to evolve over the life of the program to reflect new knowledge.) Appendix 3, provides more detail.

B. Justification for the Program

1. Need - Workforce

According to U.S. Bureau of Labor Statistics projections for 2006-2016, "for the foreseeable future, **nearly 3 out of 4 new science or engineering jobs in the U.S. are going to be in computing!** By contrast, just 16% will be traditional engineering jobs, and even fewer will be in the sciences or mathematics.

- The U.S. Bureau of Labor Statistics (USBLS) is projecting more than four times as many new jobs in computing as in all the other areas of engineering combined.
- The number of new jobs per year is double number of computing graduates each year, creating a stupendous shortage.
- Computing is the only STEM (Science, Technology, Engineering, Math) discipline in which demand for graduates exceeds supply.
- 27% of the new STEM jobs (295,000) will be in "software engineering" - the focus of this program – a number that exceeds the number of jobs in all other areas of engineering combined (178,400).
- Based on enrollment projections: In engineering, the physical sciences, and the life sciences, there are more graduates than there are jobs, but in computing there are almost 100,000 fewer projected graduates than jobs – per year, through 2018

In addition to these national numbers, the State is projecting a shortfall in graduates for positions in the software area. This demand is diminished at the moment because one of the largest potential employers is State and local government – all of which are dealing with severe budget concerns that, hopefully, might be resolved by the time we begin graduating students from this program.

Both of the National Laboratories and Intel have projected needs for graduates with software related skills – mostly in administration and research support areas, but as Sandia, in particular, re-orients is mission there will be more software research positions that need to be filled.

Healthcare, including regional health organizations, hospitals, and physicians are currently confronting immense IT challenges and this is generating a large demand for people capable of addressing this type of complex and dynamic problem – the specific type of graduates we intend to provide.

2. Duplication

Internal. There is some degree of duplication at the 'topic' level with existing computer science and mathematics offerings. Both this program and computer science might teach, for example, Java programming. This program will offer an accelerated module that focuses on syntax, libraries, and idioms with application of that knowledge in the context of a project.

The underlying theory of programming would be covered, in this program, via another modular course. There are opportunities for cross-listing and/or cooperative substitution, but these are nominal due to structural issues (one-credit versus three) and the inverted top-down approach to when general principles and 'fundamentals' are learned.

External. In the same way that there is internal duplication, the appearance of external duplication is possible – but it is appearance, not substance. All New Mexico Universities offer programs in Computer Science and in Management Information Systems. All 2-year institutions offer preparation in information technology. Those programs will necessarily offer some topics in some courses that are 'duplicative.' For the same reasons that this apparent duplication is not actual duplication internally, it is not duplicative externally.

The following communication was sent to the chairs of the four State schools that offer computer science masters programs (the programs most likely to find 'duplication') and, to date, have not generated any expressions of concern. The recipients were: Dr. Stephanie Forest at UNM, Dr. Enrico Pontelli at NMSU, Dr. Liebrock at NM Tech, and Dr. Burgess at WNMU.

This communication concerns a new masters program we want to offer at Highlands that is heading to the State HED for action and, hopefully, approval. The degree will be a "MS - Software-driven Systems Design." When the proposal is sent to HED they will forward to the Deans at the other State schools for comment, and I expect that the Deans will then forward to CS chairs. The purpose of this email is to provide a 'heads up' and to initiate any dialog that might be desirable that can answer any questions about the new degree program.

The MS degree will be an extension of the undergraduate Software Development Apprenticeship program I started at Highlands several years ago. Like that program, the focus is on the systems in which software is deployed, and not on the computer or computation as is the case in most Computer Science Programs. The degree is focused on "graduating students with the education and experience necessary to use computing technologies to solve the 'wicked' problems confronting business and society." The degree is intended to be professional more than academic.

The primary concern of the HED and the State is the extent to which this program will 'duplicate' existing offerings. Because the program involves the use of computers and the creation of software, there will be necessary overlap in terms of some specific topics (e.g. programming) but nothing that is not already 'duplicated' at every school in New Mexico.

The degree as a whole is far removed from the focus of any existing degree offered by a New Mexico school. The closest approximation is the inter-disciplinary (business and computer science) Masters degree at Western New Mexico University, and the software engineering concentration at UNM.

A second concern of HED and the State is the possibility of collaboration. This new degree is clearly focused on "practice" and application, while existing programs (excepting Western's) are focused on "theory." This simultaneously

limits and expands the possibility of collaboration. It limits in the sense that the goals of any research and course materials are significantly divergent. It expands, in the sense that joint projects, with one school focusing on making the theoretical advances while the other focuses on practical application of those advances, is a clear possibility.

If you or the other members of your department would like to know more about this degree proposal - before it hits your desk for comment to the HED - I would be happy to send you as much material as you might want (the HED proposal is about 70 pages). I can also answer any questions you might have, or even visit to talk with you and your faculty.

Please let me know.

Thank You,

dave west
professor
NMHU
dmwest@nmhu.edu
profwest@fastmail.fm
505-454-3322 - office
505-231-7233 - cell

3. Inter-Institutional Collaboration and Cooperation

There are some possibilities. For example, UNM offers a single course in Software Engineering (required) at the undergraduate level and a Software Engineering Track (optional) at the Master's level. The undergraduate course is most often taught by adjunct faculty and the graduate courses seldom offered at all because of a lack of tenured/tenure-track faculty interested in this area. There are obvious opportunities to allow their graduate students, desirous of an MS instead of a Ph.D. and who have an interest in the software engineering area to take this program (in some manner, and on their campus(es)) as an alternative.

There are also possibilities for student research in areas outside the interests of existing faculty at other institutions, as the program at Highlands will provide opportunities far wider, albeit "applied," than are typically found at research universities.

One other possibility is in the area of technology transfer – with the research university focusing on the theoretical advancements and Highlands addressing some of the practical and application oriented aspects of the research with the aim of providing either or both institutions technology transfer apparatus with a commercialization-ready product.

C. Clientele and Expected Enrollment

1. Clientele

We will recruit from the very large pool of aspiring professionals who are disenchanted with the career knowledge offered by traditional CS degree programs and who find the MIS to be insufficient preparation (because it is a concentration). We also expect to draw heavily from the pool of individuals who have started but failed to complete a traditional CS degree. Thirdly, we expect to recruit heavily from the pool of graduates of 2-year institutions as these students have already indicated their focus on career-oriented education.

The apprenticeship aspect of the program will provide funding – akin to graduate assistantships – that will make the program highly attractive to international students. The primary focus of the program will be serving New Mexicans, with an emphasis on the northern portion of the state, but a diverse international student body will provide enrollment numbers while enhancing the learning environment for all.

Based on our experience with the undergraduate pilot program, plus the enrollments in our graduate MBA-MIS Concentration program, we expect fully 50% of our students to be female – the largest under-represented group in STEM disciplines. By virtue of Highlands' role as an HSI and significant recruitment efforts addressing the Black community (both local and international), we expect close to 70% minority representation.

The program will establish no barriers to entry. Anyone with any kind of undergraduate degree will be accepted into the program. Those with zero or nominal computing related coursework will be required to complete a two-semester (six-credit) proseminar prior to beginning graduate work.

2. Projected Enrollment

	Year One	Year Two	Year Three	Year Four	Year Five
PT/ FT	[8x6 / 12x15]	[8x6 / 20x15]	[10x6 / 30x15]	[20x6 / 50x15]	[30x6 / 70x15]
Total Cr. Hrs.	228	348	510	870	1230

These numbers are based on the following information
1. Enrollments (actual and projected) in the undergraduate program in software development at Highlands. Growing from 20 in year one to 60 in year five, with the expectation that at least half of those students will continue for the master's degree. These enrollments will be felt starting as early as year two of the masters program, as we already have undergraduates close to completing their degree.
2. Enrollments and enrollment trends in graduate software development programs (e.g., the Graduate Programs in Software at the University of St. Thomas – the world's largest) as published by the Council of Graduate Schools.
3. Enrollments (actual and projected) in the Highlands MBA-MIS concentration program. We expect the majority of these students to transfer to the MS degree because it more accurately reflects their career aspirations than the concentration.

4. Bachelor degrees in computer science and business-MIS as reported in the 2009 PEP report of the Council of University Presidents.
5. An informal survey of students currently enrolled in computer science masters programs, at Highlands and at UNM, as to their interest in a software focused masters degree program.
6. Enrollment trends in computer science, MIS, and software engineering as reported by Joel Adams, a professor of computer science at Calvin College in Michigan entitled 'Market for Computing Careers.'

Combining numbers from these sources suggest that the annual pool of potential graduate students over the next five years will rise from 200 in year one to 280 in year five. We project that Highlands will be able to attract at least 5% of that pool in the first year and at least 25% by the fifth year as we are able to both market the program and demonstrate its value.

D. Institutional Readiness

1. Teaching Faculty

Three full-time faculty members are available to support this program (one tenured, two tenure eligible). Adjunct faculty members are available and have been identified. The program also relies extensively on mentoring by working professionals, recruited to lead and take responsibility for projects. These mentors have also been identified and their willingness to participate (at less than market rates) has been ascertained.

2. Library

The library already has most of the books and the electronic subscriptions that will be required to support this program.

The program and its courses do not rely on textbooks. Instead we have identified a "Professional Library" of books that students are expected to acquire, assimilate, keep, and use throughout their careers. It would be useful to have the Library possess this same library – and objective that will be accomplished with a budget of around $1,000-1,500 per year. (Many of the books in the professional library are already in the University collection.)

3. Facilities

This program utilizes a unique, but proven, concept of a "one-room schoolhouse," where all activities, academic and project, take place in a single studio housing up to 30 students. This means that space requirements are minimal – one studio per 30 FTE students. Space to accommodate the program has been identified, both now and for the next five years.

Infrastructure is also minimized by the nature and structure of the program – all students work in pairs, so the number of workstations required equal ½ the number of students enrolled. These needs have also been identified and budgeted for.

4. Equipment

No special equipment, other than the workstations and infrastructure noted above are required for this program. Software utilized will almost always be open source and hence low or no cost. In those cases where proprietary software is required it is covered by existing institutional licenses.

5. Other Operating Resources

The program is designed to be a partnership between the public institution, NMHU, and one or more private sector software development companies. The latter will solicit and deliver software to other private sector companies and will generate revenues that will pay for all anticipated operational costs for the program – primarily apprenticeship and assistantship costs and student travel costs to professional conferences.

E. Projected Costs

1. New Costs

Capital/Start-up costs:

Additional Faculty (none, first two years)	$ 0
Library (none first year)	$ 0
Space renovation / furniture	$ 5,000
Workstations / Servers	$25,000
Graduate Assistantship	$ 7,200
SUBTOTAL	$37,500

Annual costs

Category	Year one	Year two	Year three	Year four	Year five
FT Faculty[1,2]	$ 40,000	$ 40,000	$ 80,000	$80,000	$ 150,000
PT/Adjunct Faculty[1]	$ 3,600	$ 14,400	$ 14,400	$ 28,800	$ 28,800
Library		$2,000	$ 2,000	$ 2,000	$ 2,000
Add'l Space			$ 5,000		$ 5,000
New equipment		$ 7,500	$ 12,000	$ 15,000	$ 18,000
Replacement equipment			$ 15,000		$ 10,000
Supplies	$ 2,000	$ 3,000	$ 4,000	$ 5,000	$ 5,000
Grad Asst. / Apprentice[3]	$ 96,000	$ 160,000	$ 320,000	$ 400,000	$ 560,000
Subtotal	$ 151,600	$ 243,900	$ 477,400	$ 560,800	$ 828,800
Less Externally Funded	$106,000	$ 175,000	$ 345,000	$ 430,000	$ 610,000
Net Annual Costs	$ 35,600	$ 53,900	$ 107,400	$ 100,800	$ 168,800

[1]Includes Benefits

[2] Reflects one-half salary (joint appointment with undergraduate program), except for the fifth year, when two full-time appointments, specifically for the graduate program, will be budgeted.

[3]Funded externally using software development contract and grant income. (See below.) These figures are directly proportional to expected enrollments – if enrollments are higher or lower these numbers will change accordingly.

2. State Support

State support is for new enrollments only. No additional support is required. The current total cost-rate per credit hour for the Computer Science-graduate in Tier 2 is $873.81.23. Projections of student credit hour production support from state provided I and G dollars, consistent with the projected new student enrollment credit hours, with a one year delay are shown below.

	Year One	Year Two	Year Three	Year Four	Year Five
PT/ FT	[8x6 / 12x15]	[8x6 / 20x15]	[10x6 / 30x15]	[20x6 / 50x15]	[30x6 / 70x15]
Total Cr. Hrs.	228	348	510	870	1230
Tier 2 Grad Rate	873.81	873.81	873.81	873.81	873.81
Total I&G	$199,229	$304,086	$445,643	$760,215	$1,074,786

3. Other Support

This program is based on a public-private cooperative agreement. When first offered at the undergraduate level, this was accomplished via a contract with a single, for-profit, entity, but this time it will be a similar contract, but with one or more private sector entities and under the umbrella of the University Research Park authorization.

The private sector entity contracts with other enterprises to perform software development work for a fee – assuming all liability for delivery of the software. The private sector entity offers all students the chance to work on those projects alongside employees of the private sector entity. The private sector entity transfers to the University the monies necessary to pay the students (who would have work-study / assistantship appointments) plus an administration fee. The private sector entity would also pay (directly, not via the University) all costs associated with student travel and registration for professional conferences, or any other costs generated by the actual project work.

In order to assure that students are exposed to, and have the opportunity to complete, the full range of competencies expected; total reliance on projects defined and funded by external private sector opportunities is infeasible. To assure students have the opportunity to perform cutting edge research and state-of-the-art application software projects; we will actively solicit grant funding. That grant funding would then be used, in large part, to cover student earnings and student travel expenses (when attending professional conferences).

F. Quality of the Program

1. NMHED 5.3.12 NMAC Compliance

This proposal follows the protocol described in the 5 NMAC 5 guidelines.

2. Quality Evaluations

a- **Curriculum.** Although the curriculum, structure, and pedagogy are non-traditional, they have been demonstrated to be effective at the undergraduate level and at the graduate level via existing MIS concentrations in the MBA program.

b- **Faculty.** All full-time faculty members identified for this program have terminal degrees, years of teaching experience in the areas of MIS and software development. One faculty member helped grow the world's largest graduate software program (at the University of St. Thomas in Minnesota – over 900 students) and has been involved in the creation of new programs at three New Mexico Universities.

c- **Admissions.** This program is deliberately made available to anyone with an accredited undergraduate degree. This is in keeping with the Mission of the University, accommodates those who wish to (or have been forced to) change careers. Students who are deemed to lack appropriate preparation are required to take a two-semester course sequence to provide an adequate foundation. The program is designed to ensure success without regard to prior preparation. The ability to do this has been demonstrated.

d- **Current technology**. Every aspect of this program is grounded on state-of-the-art and state-of-the-practice technology. Every available avenue of Web-based communication and instruction are utilized in the delivery of the curriculum. Web-based resources are utilized in place of traditional textbooks, (supplemented by a professional library of 'timeless' material).

e- **Work opportunities**. The program is an active apprenticeship – students will work on real world commercial software as well as research applications, will work alongside professional developers who will mentor and validate student accomplishments. Students will graduate with an experience-derived portfolio that will qualify them for journeyman level entry into the workforce.

f- **Support services**. In addition to the services provided by the University to all students, this program is deeply concerned with the formation of an extended community. Students will have access to extensive mentoring, peer support, social support, and active and ongoing connections to those already working as professionals in this area.

g- **Integration.** There is no "final" experience – the entire program is constantly integrating knowledge as it is applied in the creation of production-ready software.

h- **External evaluation.** This program and curriculum has been reviewed by educators, professionals, and members of professional organizations (the same organizations that would provide the equivalent of specialty accreditation). The support had been unanimous. The program will also utilize an external "Board of Advisors" to assure ongoing quality. The undergraduate program, on which this proposal was based,

generated a multitude of letters to the then President of the University and the Governor protesting the termination of the program and asserting its value and importance. Those same individuals, and associations, would provide letters of support if asked.

i- **HLC Accreditation**. This program will be included in all interim and long term accreditation actions, excepting the 2011-2012, interim year report.

j- **Specialized Accreditation**. There is no specialty accreditation entity for this domain, but there is a rough equivalent offered by the ACM/IEEE. This program will seek that endorsement / acknowledgement of consistency with ACM/IEEE model curricula no later than the third year of operation.

Perhaps the most significant indication of the quality of this program comes from the expectations set for our graduates. These are stated in Appendix 3. Our definition of "mastery" includes two very important measures: a broad record of demonstrated achievement, measured by the depth of the student portfolio; and, a demonstrated ability to make professional-level contributions, evidenced by achieving completing at least 10% of all defined competencies that define an individual profile at level seven.

Our goal is to graduate masters of the profession, not have them achieve that status 5-10 years into their careers.

G. Assessment of Operations and Impact

This program is designed to be iterative and incremental at all levels, from the completion of specific development tasks, to project cycles, to learning cycles. Each cycle begins with a "planning" session and ends with a "retrospective." During every cycle (of whatever type) a series of "big visible charts" that plot progress to planned goals are updated daily. Electronic versions of these charts are being developed as part of a University-wide project to create a comprehensive outcomes assessment tool.

Beginning with student level data, every day you will be able to see:
- How many students have demonstrated level (one-to-seven) mastery of the 100+ competencies that define a student profile.
- How many students have advanced from novice level to master level, (a function of the number of level-competencies demonstrated to date.
- Progress Velocity – a sustained level of competencies per unit of time each student is achieving.
- Average scores on tests or other assessments
- Items in the student's portfolio along with assessments of peers, mentors (professionals), and faculty.
- Professional contributions (usually whitepapers, but sometimes software tools and techniques), including submissions and acceptances to refereed conferences or journals.
- Sponsorships (equivalent of internships) and job offers.

The Board of Advisors, faculty, and any interested HED or other party, will be able to see, also on a daily basis, aggregates of student performance and status data, evaluations as to the

preparedness of our students from sponsoring and hiring companies, and evaluations of the quality of the work produced 'for-hire' by our students.

As mentioned, every cycle – be it an arbitrary boundary like a semester, or a natural completion of a learning or development cycle – is concluded with an extensive retrospective where everyone involved assess what was done, what was good and should be done more, and what was negative and should be done less. Retrospectives are also structured to introduce potential innovations and alternative approaches to be tried and evaluated in the next cycle. Part of the input to a retrospective are comments from a big visible chart called a "Temperature Wall" – comments made about experiences, posted as they happen, that are positive, negative, and puzzling.

H. Administrative Responsibility and Institutional Commitment

The program will be housed in the School of Business Administration (SOBA). SOBA is itself in the process of transitioning from a traditional business school to a "school of professional studies" that will include Media Arts and, potentially, Computer Science. The goal is to create a highly interdisciplinary, pre-professional, environment for collaborative research and education.

Perhaps the largest indication of institutional commitment is the simple fact that this is the only new program being undertaken in these uncertain and severe financial times, and that it has received funding support from the University and from the Office of Research and Graduate Studies.

Appendices

1. Program Approval Documentation

APPROVAL PROCEDURE
ACADEMIC MAJORS/MINORS and CERTIFICATE PROGRAMS

NEW / (REVISED)   Date Submitted: **10/23/2009**

Proposed Degree: **MS– Software-Driven Systems Design**

Discipline of: **MIS – Software Development**

College/School of: **Business**

Submitted by: **David West**, Program Representative

RECOMMENDATIONS:

Approve Deny _____ _____
                 College or School Dean   Date

Approve Deny _____ _____
              Chair, Academic Affairs Committee   Date

Approve Deny _____ _____
            Vice President, Academic Affairs   Date
****
Forwarded to President and Board of Regents for consideration on _____
                                                     Date

Action: Approved _____ Denied _____ _____
                                                 Date

I Program Description

  A. Academic Purpose

Technology, especially computer technology defines every aspect of our professions, our lives, our economy, even our worldview and value systems. This is a cliché, but nevertheless absolutely true. Those charged with harnessing this technology for the benefit (or, all to often, to the detriment) of the rest of us require a depth and breadth of preparation that exceeds anything being offered today. Equally important is a need for a radical reorientation from the traditional focus on artifacts a deep understanding of systems.

Computer Science (CS), and the disciplines of Software Engineering (SE) and Management Information Systems that derived from it, are firmly grounded in the intellectual tradition of 19th century physics. They are formalist in orientation and very well suited to the understanding and construction of deterministic, mechanical, systems.

Computers and programs are machines (programs are virtual machines) and, as such, are the proper purview of CS and SE. But CS and SE do not provide the proper foundations for the study of how those machines are used by the enterprise (and other socio-cultural organizations) as a tool for solving problems and creating capabilities. MIS has, for decades, been separate from CS and closely associated with Business for precisely this reason.

The proposed MS degree has a dual academic purpose: 1) to redefine, restructure, expand and enhance a curriculum to replace the existing but obsolete MIS offering in order to reflect contemporary knowledge and practice; and, 2) to provide a unique learning environment and process that will allow students to increase the breadth of their knowledge and the depth of their specialization while deeply embedding their knowledge in experience.

B. Objectives
Specific objectives for this degree include:
- Student understanding of generative and complex adaptive systems and how to use that understanding to analyze and design solutions to contemporary problems in service of the enterprise, society, and humanity.
- Student understanding of how to design, implement, and deploy software-computer solutions.
- Increase the breadth, depth, and integration of student knowledge by embedding that knowledge in intensive and diverse experience.
- Deep integration of discipline specific and technical knowledge with liberal arts based understanding, especially in the areas of philosophy, history, anthropology, and communication.
- Graduate students that are acknowledged to be among the best in the world.

C. Outcomes Assessment
Student assessment will incorporate traditional measures, like exam scores, that are internationally normed – for example, certification exams – wherever possible. We seek to have all graduates score above the 85th percentile on such exams. More importantly, students will create a portfolio of achievements that not only demonstrates their ability to apply that knowledge but to integrate and extend that knowledge innovative and creative ways. Constant self- and peer-assessment practices will be augmented by equally constant mentor and faculty feedback – all of which will be incorporated into the student portfolio.

A seven level scale of achievement will be used to assess individual progress and results.
1. Understanding of concepts and applications, evidenced by objective testing.

2. Ability to apply knowledge under supervision, evidenced by self-assessments plus peer, mentor, and faculty feedback.
3. Ability to apply knowledge independently, evidenced in the same way as (2).
4. Ability to apply knowledge in novel contexts, evidenced in the same way as (2).
5. Ability to mentor others, evidenced by faculty feedback.
6. Ability to innovate and extend or enhance knowledge and practice, evidenced via the student portfolio.
7. Ability to advance knowledge and communicate that knowledge via refereed papers and a refereed monograph (thesis).

Program Assessment will rely on traditional measures, like placement rates and starting salaries. We expect 100% placement at a level, at minimum, of one step above typical entry level job titles. We also expect initial salaries to be at least 10% above the U.S. national average as reported by the Labor Department.

We will indirectly measure the reputation of the program and the quality of our graduates by the number of published papers in refereed journals, refereed conferences, and published monographs/books.

A third measure will be the number and quality of students we attract and the funding (grant and project monies) we obtain.

II Curriculum – All new courses

Total Credits Required – 40
    Required – 33
    Elective - 7

The program is framed and defined by the experiential learning offered by project courses. Three (4 credit) project courses are required to graduate.
    SDA 590 – Development Project – Enterprise Focus (4)
    SDA 690 – Development Project – Mastery Focus (4)
    SDA 692 – Development Project – Research Focus (4)

Graduates are **encouraged** to publish at least one refereed journal article or conference presentation and are **required** to complete a thesis (thesis committee to include outside reviewers and evaluation to include suitability for publication as a monograph). In support of this requirement two courses are required.
    SDA 510 – Refereed Paper (1)
    SDA 610 – Monograph (1)

The most common domain of application for students graduating from this program is the enterprise (business systems). Accordingly, students are required to have a basic understanding of this domain – provided via:
    BUS 505 - Proseminar – Aspects of the Enterprise I (3)
    BUS 506 - Proseminar _ Aspects of the Enterprise II (3)

Prior art, from within the discipline or borrowed from others, provides a foundation for analyzing and solving problems. Mathematics is an important source of prior art. Students

need to be able to recognize problems that are amenable to prior art solution and how to apply that prior art in the context of the problem (e.g. what data is available? what formulae or algorithms apply?). To this end students are required to take six hours of Formal Solutions for Computational Problems, three at the 500-level and three at the 600-level. *The formal solutions course is a one-credit course and students must take three occurrences of this course. Like a topics course – the specific content varies with each offering.*

    SDA 527 – Formal Solutions to Computational Problems I (3*)
    SDA 629 – Formal Solutions to Computational Problems II (3*)

       SDA 527 and SDA 629 are one credit courses that must be taken three times each, with each occurrence covering different subject matter.

Data, information, and knowledge are fundamental to almost every system and students require advanced understanding of all three. Required courses in this area:

    SDA 640 – Data Representation and Persistence (1)
    SDA 642 – Data Representation and Visualization (1)
    SDA 644 – Knowledge Management (1)

This degree mandates an understandings of the systems perspective and particularly of non-deterministic, non-mechanical, systems and how to affect and shape (design) such systems. Four courses provide this foundational knowledge.

    SDA 552 – Complex Systems (1)
    SDA 646 – Enterprise Design (1)
    SDA 644 – Dynamic/Emergent Systems Design (1)
    SDA 650 – Ambient Computing (1)

Students are expected to develop a particular area of depth / expertise that is in part defined by a domain of application (e.g. IT Auditing from business) and in part by advanced understanding of a topic within the software/systems discipline (e.g. problems of search, GIS application areas). Students will use electives to obtain this depth. **At least four of the seven elective credits must be at the 600 level.**

    SDA 655 Topics (4)
    Electives** (3)

    **Electives are usually other SDA courses (especially topics courses) but may be relevant and appropriate graduate offerings from any department. Electives are chosen in consultation with a graduate advisor in the SDA program.

    Important Note:
    Students without a Software, MIS, or Computer Science undergraduate degree will be required to take, prior to beginning graduate courses: (do not count for graduate credit) SDA 498 – Proseminar – Analysis, Design, and Implementation I (3); and, SDA 499 – Proseminar – Analysis, Design, and Implementation II (3).

III Need for Program
A. Relationship to NMHU Mission
This effort directly supports every strategic objective in the published Mission Statement (with the possible exception of enhancing the physical campus environment). Specifically:

Strategic Goal A: Learning-centered environment. This program provides an immersive learning environment – the Studio – that facilitates instructor led learning, peer-to-peer learning, and tacit learning provided by working professionals. It also creates a social environment that supports learning within and without the degree specialization.

Strategic Goal B: Engagement community and regional partnerships. The project-centric nature of this program opens the doors to a variety of partnerships, e.g. developing software and providing services to local communities, governments and businesses. Past projects (in the undergraduate program) included work for the Las Vegas Public Schools, Office of the State Engineer, a Mora and San Miguel county non-profit, and several small businesses.

Strategic Goal C: Premier Hispanic Serving Institution. Highlands is an HIS, and this program offers the kind of advanced, unique, and "premier" kind of education envisioned in this strategic goal.

Strategic Goal D: Alignment with leading edge technology for education. This program is designed to take full advantage of technology, in its focus, its delivery, and by finding the optimal mix of technology-based and traditional pedagogy. The entire program will have a permanent and accessible on-line presence and provide a virtual community that will serve students during the program and after graduation.

Strategic Goal E: Competitive position in target areas. Highlands is in the midst of an effort to focus our mission vis-à-vis technology and pre-professional programs. The program proposed here is a key component of that plan along with redefinition of the focus of computer science, enhancements to the Media Arts program, and restructuring of the business program.

Strategic Goal F: Physical environment. No contribution.

Strategic Goal G: Efficient and effective academic and administrative processes. This program will provide a detailed template for comprehensive outcomes assessment and will involve the design and development of tools for such assessment. We also anticipate taking on projects that facilitate other administrative and academic work.

Strategic Goal H: Communicate the image and reputation of the University. Our goal with this program is to produce graduates that are an order of magnitude more knowledgeable, better prepared, and with appropriate experience in software development and systems design than any other university. The unofficial logo for this program includes a symbol for ten times average – acknowledgement of the empirical finding that some developers are at least ten times better (quality and productivity) than others and setting that as the performance bar for our students.

B.   Relationship to other NMHU Programs

This effort will greatly enhance the MIS offerings in the School of Business. MIS has always suffered from a lack of integration with business offerings. This gap has translated into a

professional world where MIS departments and the rest of the business enterprise are more adversaries than partners. The new offerings will assure that business majors have a better understanding of the technology upon which the enterprise is dependent (and their role in shaping that technology) and the MIS specialists will better understand the business system of which they are a part.

There is significant potential for cooperation with the Computer Science programs, allowing them to focus on computing and delegating applications of that technology to this program or using this offering to extend their ability to serve CS students. A similar cross-over potential exists with the Mathematics department.

C.   Relationship to other Programs offered at other NM Universities
No other university or college in New Mexico – with the exception of the almost invisible Western Governor's University – offers a degree program with this focus. UNM, for example, has a single course in its undergraduate computer science program that focuses on software. Regionally there are a few graduate programs with a software focus and world-wide there are numerous graduate programs in this area.

D.   Opportunities for Advanced Degrees
The MS is an advanced degree, but students wishing to pursue doctoral level work will find opportunities for both Ph.D. and Doctoral degrees, both in the U.S. and internationally.

E.   Opportunities for Employment
Employment opportunities are almost unlimited. More than 80% of the careers in the area loosely defined as computing and information technology are focused on software development and management of the software development process. Entry level positions – what most graduates of most universities are qualified for – are subject to being off-shored as commodity jobs. Our graduates, in contrast, will graduate with a breadth of knowledge and a proven track-record of achievements that will qualify them for "journeyman" level placement.

IV Resource Requirements
A. Existing Faculty
Three full time faculty, currently in the School of Business, (one tenured) are available to support this degree. Existing School of Business faculty are available to develop and deliver the BUS Proseminar. Adjunct faculty with Ph.D. and teaching experience have been identified to teach the mathematics derived courses.
B. New Faculty
Additional full-time faculty would be required – in a 1:20 full-time tenure-track faculty per FTE student.

C. Library
Students in this program are expected to acquire a professional library that they keep even after graduation. The library should also have the set of books in this library – probably an acquisition of around 10 new books per year. Excepting the books, existing library resources are adequate for this program.
D. Equipment
Students in this program are expected to provide their own professional grade laptop

computer. University provided equipment will include: desktop computers in the ratio of 1 per 3 enrolled students, three servers, a networked color laser printer, a local area network (with both wired and wireless capability), and an Internet connection. Custom tables and rolling chairs, plus wall-to-wall whiteboards in the Studio are the other capital equipment required.

E. Budget

Capital/Start-up costs:

Space renovation / furniture	$25,000	
Equipment	$15,000	
Promotion / marketing	$5,000	
SUBTOTAL		$45,000

Annual costs:

Full-time Faculty / year (includes benefits)	$60,000	
Equipment maintenance/replacement	$5,000	
Supplies / Misc	$2,000	
(Travel – Student*	$25,000)	
(Travel – Faculty*	$10,000)	
SUBTOTAL		$67,000
TOTAL		$112,000

* Travel costs are expected to be offset by income from project contracts and grant funds. They are noted for informational purposes but not included in the annual cost total.

F. Other

This program requires a dedicated "studio" environment, but will share that environment with the existing (but to be revised) undergraduate program.

V Other

A. Enrollment Projections

Two different studies were made of the potential market (one when a similar program was first offered at Highlands and a second as part of an effort at the College of Santa Fe. The potential market: graduate students (national and international market) 10-20,000 / year and we would reasonably expect to capture up to 1-2% of that market with a realistic potential to capture 2-5%. Our projections for graduate enrollment are 10-15 the first year of the program, 40-50 the second year, and adding a minimum of 20 per year until we reach whatever enrollment cap that might be set. According to Carnegie Mellon's Software Engineering Institute, masters degree programs in the US average around 200 FTE students. At the University of St. Thomas (my previous school) we had 900 FTE with about half of them international students.

B. Implementation Date

August 2010 (may be delayed to January 2011 depending on external approval process)

2. Course Approval Documentation

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA - 498**
B. Course Title: **Proseminar: Analysis, Design, and Implementation I**
C. Hours Credit: **3**
D. Total Contact Hours: (Lecture: **3** Lab: **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
> **This course provides the technical and programming foundation for students entering the graduate software program from non-computing, MIS, or IT undergraduate majors. It is not offered for graduate credit.**

G. Course(s) to be discontinued or revised if this course is approved: **none**

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
> **Provides the minimal level of software development knowledge required for the graduate program.**

J. Check all that apply to the proposed course:
   Other: X   (this course addresses deficiencies in undergraduate preparation)

K. Resource requirements
> **No new requirements.**

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                        School/College Dean

Approval _____ Denial _____ _____
                                                        Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                    Vice President for Academic Affairs

SDA - 498 Syllabus

Catalog Description
See proposal submission form.

Prerequisites: none.

Rationale / Objectives
Students will be attracted to a software development graduate program from many other disciplines, with a concomitant lack of preparation in the technical aspects of software development. This, and the companion proseminar course, will provide the basic fundamentals and act as a leveling course students lacking sufficient undergraduate preparation.

Students completing these two courses will be prepared to succeed in the MS degree or the MIS graduate concentration.

Topics
1. Systems Theory.
2. Automated system components.
3. The nature of software.
4. Systems analysis and decomposition.
5. Specification and modeling.
6. Method and process.

Structure
This course will be highly compressed with substantial didactic material available on-line. Students will be expected pass objective exams in each topical area as well as participate in extensive class discussions.

Evaluation / Assessment
Students will be required to pass objective examinations (a 70% threshold will be required) and participate in the class discussions. Student ability to use what is learned will be separately, and constantly, evaluated in the project courses – students will actually have to demonstrate their understanding on an ongoing basis.

Assessment of the utility and effectiveness of this course will be based on the ability of students to write effective, efficient, and elegant programs.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA - 499**
B. Course Title: **Proseminar: Analysis, Design, and Implementation II**
C. Hours Credit: **3**
D. Total Contact Hours: (Lecture: **3** Lab: **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
  This course provides the technical and programming foundation for students entering the graduate software program from non-computing, MIS, or IT undergraduate majors. It is not offered for graduate credit. Prerequisite: SDA 498.

G. Course(s) to be discontinued or revised if this course is approved: **none**

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
  Provides the minimal level of software development knowledge required for the graduate program.

J. Check all that apply to the proposed course:
  Other: X   (this course addresses deficiencies in undergraduate preparation)

K. Resource requirements
  No new requirements.

RECOMMENDATION:
Approval _____ Denial _____ _____
                                        School/College Dean

Approval _____ Denial _____ _____
                                        Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                        Vice President for Academic Affairs

SDA - 499 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: SDA 498.

Rationale / Objectives

Students will be attracted to a software development graduate program from many other disciplines, with a concomitant lack of preparation in the technical aspects of software development. This, and the companion proseminar course, will provide the basic fundamentals and act as a leveling course students lacking sufficient undergraduate preparation.

Students completing these two courses will be prepared to undertake graduate work in software development.

Topics

7. Programming.
8. Programming languages.
9. Programming practice.
10. Patterns and architectures.
11. Traditional and agile approaches.
12. Project management and leadership.

Structure

This course will be highly compressed with substantial didactic material available on-line. Students will be expected pass objective exams in each topical area as well as participate in extensive class discussions.

Evaluation / Assessment

Students will be required to pass objective examinations (a 70% threshold will be required) and participate in the class discussions. Student ability to use what is learned will be separately, and constantly, evaluated in the project courses – students will actually have to demonstrate their understanding on an ongoing basis.

Assessment of the utility and effectiveness of this course will be based on the ability of students to write effective, efficient, and elegant programs.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 510**
B. Course Title: **Refereed Paper**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
> **This course covers the production, revision, and presentation of technical papers to refereed professional journals or conferences. Students completing the course will be prepared to succeed with their expected submissions.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**
> **Discrete topics in this course may duplicate topics in existing courses, but because of structure (1 credit) and format of delivery, it cannot be said to duplicate any existing course. (Because of the potential topic overlap, another department will be offered the opportunity to develop and deliver the course if they have the desire and resources. If not, qualified faculty/adjunct faculty in the SDA program have been identified to do so.)**

I. Explain briefly how the course content impacts the program objective.
> **Students are required to publish/present a refereed paper before graduating.**

J. Check all that apply to the proposed course:
> Major Requirement: X

K. Resource requirements
> **SDA Studio and existing Library holdings**

RECOMMENDATION:
Approval _____ Denial _____ _____
<div align="center">School/College Dean</div>

Approval _____ Denial _____ _____
<div align="center">Academic Affairs Committee</div>

ACTION:
_____Approval _____Denial _____
<div align="center">Vice President for Academic Affairs</div>

SDA-510 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: none.

Rationale / Objectives

Undergraduate students will be encouraged to publish at least one refereed paper (at a conference or in a professional journal) prior to graduation and graduate students will be required to do so. (It is expected that almost all undergraduates will in fact publish such a paper but it is not an absolute mandate.) This course will prepare them for success in such an effort.

Students will learn about their target audience, how to recognize a publication worthy contribution, how to complete supporting research, how to write, and the form and format of a technical publication.

Topics

1. Audience.
2. What can/should I write about.
3. Research – where does my contribution fit?.
4. Refereed conference proceedings and presentation.
5. Professional journals.
6. Required style.

Structure

This course will consist of some on-line resources, but will primarily take the form of a writer's workshop where papers are presented and constantly revised until deemed suitable for submission. Rejected papers will return to the writer's workshop for shepherding.

Evaluation / Assessment

Students will be required to participate in the writer's workshop exercises until they have an accepted paper.

Assessment will be based on a 100% success rate for graduates and a 90% success rate for undergraduates.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 520**
B. Course Title: **Organizational Culture and Technology**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:

> **This course uses an extensive set of case studies to analyze the ways in which the introduction of a technology changes – often in profound and unexpected ways – the receiving cultural system. Deep inter-dependencies are explored in order to best determine when and how to introduce a technology such that the negative impacts are minimized and the benefits are maximized. How to avoid traps and surprises arising from an imperfect understanding of the target culture is also covered.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

> **Supports student need to understand the larger system into which their software will be deployed.**

J. Check all that apply to the proposed course:
Elective: X

K. Resource requirements

> **SDA Studio and existing Library holdings**

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                         School/College Dean

Approval _____ Denial _____ _____
                                                         Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                                  Vice President for Academic Affairs

SDA-520 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: none.

Rationale / Objectives

The reciprocal relationships between culture and technology that was generally explored at the undergraduate level is refined and focused for this course. The culture involved in the "organizational culture" and the concerns are how this culture inhibits or enhances an organizations ability to adopt and adapt technological innovation. How to anticipate cultural changes that accrue from technological innovations, how to manage the cultural change process, and how to create a culture of innovation and adaptability (grounded in technology) are also explored.

Students will learn the nature of corporate culture and how to produce an ethnography of that culture. They will learn, from case studies, how technology disrupts and changes culture, and how the culture can inhibit the adoption of a technology. Lastly they will learn how to "design" and implement an organizational culture supportive of change and innovation.

Topics

1. Organizational culture and behavior.
2. Innovation and adaptation.
3. Rites of passage – managing change.
4. Innovation culture supported by technology.
5. Case studies.

Structure

This course will consist of some on-line resources, but will primarily take the form of a reader's / writer's workshop where case study preparations are presented, discussed, and used as the foundation for further work

Evaluation / Assessment

Students will be evaluated on their participation in the structured discussions – evaluation dimensions include preparation, articulation of a position, ability to listen and constructively contribute to the development of ideas of others. Student ability to manage the implementation phase of their projects will provide confirmation of mastery of this course.

Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge to solve problems in their project courses.

REQUEST COURSE CHANGE

REVISED

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 527**

B. Course Title**: Formal Solutions to Computational Problems I**

C. Hours Credit: **1**

D. Total Contact Hours: (Lecture: **variable** Lab: **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

This course will introduce students to a wide range of "formal" – mathematical, logical, algorithmic – solutions to commonly encountered computational problems.   Between fifteen and thirty specific patterns (identified as intermediate level) will comprise the content of each course instance. Each pattern will identify a problem in context, the forces shaping potential solutions, and known formal solutions. How each solution can be implemented in a computer program is also covered.

This course must be repeated a minimum of three times, and may be taken for elective credit additional times – as long as the content (the selection of patterns studied) is not duplicative across course instances.

G. Course(s) to be discontinued or revised if this course is approved: **none**

H. Does this course duplicate or approximate any current course(s) in the Catalog? **No**

I. Explain briefly how the course content impacts the program objective.

Students will frequently encounter problems that are amenable to known formally defined (e.g. algorithmic or mathematical) solutions. Students need to recognize such problems, understand what makes the problem amenable to a formal solution, see why a given solution is appropriate, and see how to implement the formal solution in computer program code. Graduates of the program must be familiar with a repertoire of formal solution patterns, but that repertoire may vary from student to student depending on their areas of specialization.

J. Check all that apply to the proposed course:

Degree Requirement: X   Elective: X

K. Resource requirements

SDA Studio and FSPL.

RECOMMENDATION:

Approval _____ Denial _____ _____

<div align="center">School/College Dean</div>

Approval _____ Denial _____ _____

<div align="center">Academic Affairs Committee</div>

ACTION:

_____Approval _____Denial _____

<div align="center">Vice President for Academic Affairs</div>

SDA-527 Syllabus

Catalog Description

 See proposal submission form.

Prerequisites: none.

Rationale / Objectives

 Software developers frequently encounter problems that have known solutions or that have known frameworks (patterns) of solution. Unfortunately, any given developer may be unaware of the existence of such solutions. Several different approaches have been taken to resolve this issue – the most notable of which (at least in the software world) is the Patterns Movement. Numerous books and thousands of patterns are available to deal with commonly encountered software problems.

 In may cases the solutions (the patterns) originate outside of software development – most notably in the areas of mathematics, logic, and algorithms (computer science). These patterns are formal – i.e. rigorously defined and "proven." Software developers must be familiar with, possess a repertoire of, formal solution patterns as well as the heuristic programming solutions and solution frameworks. This course provides students with the opportunity to acquire such a repertoire.

 This course does not attempt to replicate a typical mathematics course. The set of patterns presented in any given instance of this course may represent several different mathematical subjects, or a subset of the topics that might be offered in a traditional course. The intent is not to teach mathematics, but to help the student understand that (paraphrasing an I-phone commercial) "there's a math for that."

Topics

 The actual topics covered in each instance of this class will vary. Students taking the course (a minimum of six different times) will select, with the advise and consent of the faculty and mentors, a specific set of patterns from the Formal Solutions Patterns Library (FSPL) to be mastered during that instance of the course. Each topic will be presented as a "pattern," which means it will have the following structure and contents:

  <u>Pattern name</u> – selected to remind the student of the pattern and enable rapid selection from the repertoire of patterns known to the student.

  <u>Problem in context</u> – a description of the problem (e.g. modeling linked queues with probabilistic distribution of time-in-queue) and the context(s) in which it is encountered (e.g. establishing subway or train schedules).

  <u>Formal solution</u> – description and explanation of the formula or algorithm – with emphasis on concepts implicit in the solution, connection to available data or measurement protocols, and implementation of the solution in one or more programming languages.

  <u>Variations</u> – description and explanation of relationships to other patterns or other formal (e.g. mathematical) concepts.

Examples – multiple examples, showing how the problem was deconstructed and the solution made possible – with discussion

Self-test problems – essentially a series of 'story problems' that the student can use to determine mastery of the pattern and as preparation for the course final examination.

Note: The FSPL is under development – the group leading the development of this library is noted in the supplemental information submitted with this proposal. of patterns. All patterns will be delivered in a Web accessible format with opportunity for both self-study and distance learning.

Structure

This course will be highly compressed with substantial didactic material available on-line. Much of the course will be self-study, much like the introductory mathematics courses taught at Highlands. Students will pass this course as a stand-alone unit, but will be constantly referred back to the course material whenever they encounter an appropriate problem in their project courses.

Evaluation / Assessment

Students will be required to pass objective examinations on the teaching material (a 70% correct threshold will be required to pass the course). Student ability to use what is learned will be separately, and constantly, evaluated in the project courses – students will actually have to demonstrate their understanding on an ongoing basis.

Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their mathematical knowledge so solve problems.

REQUEST COURSE CHANGE

REVISED

Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA-535**
B. Course Title: **Special Topics**
C. Hours Credit: **variable 1-3**
D. Total Contact Hours: (variable -- Lecture: **1-3** Lab: **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:

    This course provides an opportunity to respond to student interest and developing topics in the area of software development including new domains, new tools, and new methods.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

    Allows the program to remain current.

J. Check all that apply to the proposed course:
    Elective: X

K. Resource requirements
    No new requirements.

RECOMMENDATION:
Approval _____ Denial _____ _____
                                       School/College Dean

Approval _____ Denial _____ _____
                                    Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                 Vice President for Academic Affairs

SDA-535 Syllabus

Catalog Description
   See proposal submission form.

Prerequisites: none.

Rationale / Objectives
   Software development is a rapidly changing field and there is a constant need to
   integrate new areas of study and application. Students will often desire the ability to
   customize their education to provide a foundation for post-graduate specialization.

Topics
   Will vary according to the particular instance of the course.

Structure
   Topics courses will be offered in a Structured Seminar format – with specified
   reading and writing assignments that will be reviewed, critiqued, evaluated and
   revised in a reader's / writer's workshop setting.

Evaluation / Assessment
Student evaluations will be based on participation, completion and improvement of
writing assignments and preparation based on completion of reading assignments.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 548**
B. Course Title: **Multi-cultural Technology Design**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
> **The need for technology, especially software, to operate in any setting in the World presents significant challenges. This course will explore the issues raised by the need to design across cultures and contexts and will present known solutions and design heuristics.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
> **Students are expected to operate in today's "flat" World.**

J. Check all that apply to the proposed course:
> Elective: X

K. Resource requirements
> **SDA Studio and existing Library holdings**

RECOMMENDATION:
Approval _____ Denial _____ _____
<div align="center">School/College Dean</div>

Approval _____ Denial _____ _____
<div align="center">Academic Affairs Committee</div>

ACTION:
_____Approval _____Denial _____
<div align="center">Vice President for Academic Affairs</div>

SDA-548 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: none.

Rationale / Objectives

All markets are global. Any technological innovation, from artifact, to interface, to process or method, will be utilized across national and cultural boundaries. The process of designing and implementing a technological innovation will likely involve participants from multiple cultural backgrounds. Multi-cultural sensitivity and understanding is essential knowledge for technological innovation and software development.

Students will learn how different cultures approach design thinking, how cultural imposes design constraints, and how different cultures make different sense of common phenomenon. Numerous case studies will be used to provide examples of success and failure and to illustrate common threads.

Topics

1. Language, culture, and thought.
2. Multi-cultural artifact design.
3. Multi-cultural interface design.
4. Multi-cultural process and method design.
5. Cross-cultural "theory building."
6. Design constraints – cultural to legal.

Structure

This course will be highly compressed with substantial didactic material available on-line. Students will complete case study assignments that involve analyzing examples of information visualization and creating analyses that will then be reviewed in a writer's workshop setting.

Evaluation / Assessment

Students will be evaluated based on their participation in the writer's workshops and their completion of case study assignments.

Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge so solve problems in their project work.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 550**
B. Course Title: **Ambient Computing**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
> **We are rapidly moving to a world that is a computer – almost everything in the world will have some form of computing capability. This course covers the question of how you can design that kind of environment and how people will be able to interact with it.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
> **This is the kind of software environments that our students will be asked to build upon graduation.**

J. Check all that apply to the proposed course:
   Major Requirement: X   Elective: X

K. Resource requirements
   SDA Studio and existing Library holdings

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                  School/College Dean

Approval _____ Denial _____ _____
                                                  Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                      Vice President for Academic Affairs

SDA-550 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: none.

Rationale / Objectives

Ambient and ubiquitous computing are closely related topics – both dealing with the rapid "computerization" of the world around us. Ambient computing focuses on two primary issues: how we can take advantage of an environment where every aspect has some degree of computational power; and, how human beings can interface with such a world.

Students in this course will learn the extent to which miniaturization and dense wireless networking is creating an environment were toasters, light fixtures, door locks, walls and even our bodies are taking on computational capabilities – where data an information about the state of things can be communicated to every other thing in the world. They will learn to conceive new applications that can exploit this capability and how to design new methods for human-computer interaction.

Topics

1. Everything is a computer.
2. Everything is networked.
3. Intersection of virtual and physical worlds.
4. User interfaces.
5. Smart matter and how to use it.

Structure

This course will be highly compressed with substantial didactic material available on-line. This course will require substantial individual research, creativity, and creative expression (usually in the form of papers, but often in the form of software prototypes) that will be reviewed, critiqued, and improved in a writer's workshop setting.

Evaluation / Assessment

Students will be evaluated based on their participation in the writer's workshops and their completion of study assignments.

Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge so solve problems in their project work.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 590**

B. Course Title: **Mini-Project**

C. Hours Credit: **2**

D. Total Contact Hours: (Lecture: **variable** Lab **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

> **This course is like all other project courses except that it is scaled to be suitable for certificate programs.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

> **Certificate students require a shorter duration and smaller scaled project to provide the framework for the limited course content of a typical certificate.**

J. Check all that apply to the proposed course:

> Other: X   (will be used in conjunction with deficiency courses and future certificate courses)

K. Resource requirements

> **SDA Studio and existing Library holdings**

RECOMMENDATION:

Approval _____ Denial _____ _____

<div align="center">School/College Dean</div>

Approval _____ Denial _____ _____

<div align="center">Academic Affairs Committee</div>

ACTION:

_____Approval _____Denial _____

<div align="center">Vice President for Academic Affairs</div>

SDA-590 Syllabus

Catalog Description

    See proposal submission form.

Prerequisites: none.

Rationale / Objectives

    The overall philosophy of this program is grounded in the critical nature of experiential learning. "*We are sure only of that which we build,*" Giambattistaco. We also strongly believe that students learn more, learn faster, and retain longer when topical knowledge is acquired in a context where that knowledge can be motivated and immediately applied.

Topics

    Project courses do not have separate topical foci – they are the context for such learning, and provide opportunities to cement learning in experience.

Structure

    Projects have a pre-specified duration and focus, creating automated components for an enterprise or investigatory system. Students may assume multiple roles during the duration of a project – ranging from basic programming to design to management.

    Depending on the nature of the project, the domain of application, the student role, and the problem feature being addressed by the student in her role – specific topical courses (the one and two-credit subject matter courses) will be required. These subject matter courses will be offered in the project studio in a time-frame and format most appropriate to the student(s) requiring that subject matter.

Evaluation / Assessment

    Student work results (from specific assignments in specific roles) will be accumulated in an "Experience Portfolio" along with peer, instructor, and professional feedback and evaluation results. Published papers, theses, certifications, and other significant achievements will also be included in the portfolio.

    Additionally, student work evaluations will be compiled into a "Professional Profile" along with subject matter test results. This profile will show student performance along with average peer performance and average national peer performance on each element of the profile.

    The efficacy of the project-based experiential learning approach will be evaluated with the same measures that establish the national peer averages, with the goal of our student average consistently being higher than the national averages.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 591**

B. Course Title: **Project – Enterprise Focus I**

C. Hours Credit: **4**

D. Total Contact Hours: (Lecture: **4** Lab: **16**)

E. Semester(s) Course to be offered: **every semester and summer**

F. Proposed Course Description for Catalog:

> **Projects frame and motivate the topical learning while providing opportunities to apply the knowledge so gained. Projects provide the opportunities for mentoring, teamwork, and acquisition of the intangible "oral traditions" essential to mastery of the software development discipline. Introductory projects are distinguished by the scope of the project (small, short term) and the expected role of the student (working under supervision in multiple contexts).**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

> **Projects are the framework for the entire program, provide the experience and the context for all other learning.**

J. Check all that apply to the proposed course:

   Major Requirement: X   Elective: X

K. Resource requirements

> **SDA Studio and existing Library holdings**

RECOMMENDATION:

Approval _____ Denial _____ _____

School/College Dean

Approval _____ Denial _____ _____

Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

Vice President for Academic Affairs

SDA-591 Syllabus

Catalog Description

　　See proposal submission form.

Prerequisites: none.

Rationale / Objectives

　　The overall philosophy of this program is grounded in the critical nature of experiential learning. "*We are sure only of that which we build,*" Giambattista Vico. We also strongly believe that students learn more, learn faster, and retain longer when topical knowledge is acquired in a context where that knowledge can be motivated and immediately applied.

Topics

　　Project courses do not have separate topical foci – they are the context for such learning, and provide opportunities to cement learning in experience.

Structure

　　Projects have a pre-specified duration and focus, creating automated components for an enterprise or investigatory system. Students may assume multiple roles during the duration of a project – ranging from basic programming to design to management.

　　Depending on the nature of the project, the domain of application, the student role, and the problem feature being addressed by the student in her role – specific topical courses (the one and two-credit subject matter courses) will be required. These subject matter courses will be offered in the project studio in a time-frame and format most appropriate to the student(s) requiring that subject matter.

Evaluation / Assessment

　　Student work results (from specific assignments in specific roles) will be accumulated in an "Experience Portfolio" along with peer, instructor, and professional feedback and evaluation results. Published papers, theses, certifications, and other significant achievements will also be included in the portfolio.

　　Additionally, student work evaluations will be compiled into a "Professional Profile" along with subject matter test results. This profile will show student performance along with average peer performance and average national peer performance on each element of the profile.

　　The efficacy of the project-based experiential learning approach will be evaluated with the same measures that establish the national peer averages, with the goal of our student average consistently being higher than the national averages.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 610**
B. Course Title: **Monograph**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab: **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
   Students must complete a monograph that is similar in scale and substance to a thesis. This course will provide the knowledge and skills necessary to complete that graduation requirement.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
   A monograph is a graduation requirement.

J. Check all that apply to the proposed course:
   Major Requirement: X   Elective: X

K. Resource requirements
   SDA Studio and existing Library holdings

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                                  School/College Dean

Approval _____ Denial _____ _____
                                                                  Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                                  Vice President for Academic Affairs

SDA-610 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: none.

Rationale / Objectives

Completing a monograph is a graduation requirement – demonstrating that our students are indeed ready and able contribute to their profession. A monograph is a thesis with the added requirement that it be deemed publishable by a panel of peers outside of Highlands. As a thesis it must be grounded in research and must be deemed to advance or extend knowledge in its area of focus.

Due to the vagaries of the publication market – actual commercial publication will not be required – an acceptable option is a peer review committee and "publication" to the library as with theses in other disciplines.

Students will learn about their target audience, how to recognize a publication worthy contribution, how to complete supporting research, how to write, and the form and format of a technical mongraph.

Topics

1. Audience.
2. What can/should I write about.
3. Research – where does my contribution fit?.
4. Publication process and its equivalents.
5. Derivative work (conference and journal articles).
6. Required style.

Structure

This course will consist of some on-line resources, but will primarily take the form of a writer's workshop where theses are presented and constantly revised until deemed suitable for submission. Rejected papers will return to the writer's workshop for shepherding.

Evaluation / Assessment

Students will be required to participate in the writer's workshop exercises until they have an accepted paper.

Assessment will be based on a 100% success rate for graduate students.

REQUEST COURSE CHANGE

REVISED

Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 629**
B. Course Title**: Formal Solutions to Computational Problems II**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab: **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
    This course will introduce students to a wide range of "formal" – mathematical, logical, algorithmic – solutions to commonly encountered computational problems.   Between fifteen and thirty specific patterns (identified as advanced level) will comprise the content of each course instance. Each pattern will identify a problem in context, the forces shaping potential solutions, and known formal solutions. How each solution can be implemented in a computer program is also covered.

    This course must be repeated a minimum of three times, and may be taken for elective credit additional times – as long as the content (the selection of patterns studied) is not duplicative across course instances.

G. Course(s) to be discontinued or revised if this course is approved: **none**

H. Does this course duplicate or approximate any current course(s) in the Catalog? **No**

I. Explain briefly how the course content impacts the program objective.
    Students will frequently encounter problems that are amenable to known formally defined (e.g. algorithmic or mathematical) solutions. Students need to recognize such problems, understand what makes the problem amenable to a formal solution, see why a given solution is appropriate, and see how to implement the formal solution in computer program code. Graduates of the program must be familiar with a repertoire of formal solution patterns, but that repertoire may vary from student to student depending on their areas of specialization.

J. Check all that apply to the proposed course:
    Degree Requirement: X   Elective: X

K. Resource requirements
    SDA Studio and a 'catalog' of formal solution pattern modules.

RECOMMENDATION:
Approval _____ Denial _____ _____
                                 School/College Dean

Approval _____ Denial _____ _____
                               Academic Affairs Committee
ACTION:
_____Approval _____Denial _____

Vice President for Academic Affairs

SDA-629 Syllabus

Catalog Description
    See proposal submission form.

Prerequisites: none.

Rationale / Objectives
    Software developers frequently encounter problems that have known solutions or that
    have known frameworks (patterns) of solution. Unfortunately, any given developer
    may be unaware of the existence of such solutions. Several different approaches have
    been taken to resolve this issue – the most notable of which (at least in the software
    world) is the Patterns Movement. Numerous books and thousands of patterns are
    available to deal with commonly encountered software problems.

    In may cases the solutions (the patterns) originate outside of software development –
    most notably in the areas of mathematics, logic, and algorithms (computer science).
    These patterns are formal – i.e. rigorously defined and "proven." Software
    developers must be familiar with, possess a repertoire of, formal solution patterns as
    well as the heuristic programming solutions and solution frameworks. This course
    provides students with the opportunity to acquire such a repertoire.

    This course does not attempt to replicate a typical mathematics course. The set of
    patterns presented in any given instance of this course may represent several different
    mathematical subjects, or a subset of the topics that might be offered in a traditional
    course. The intent is not to teach mathematics, but to help the student understand that
    (paraphrasing an I-phone commercial) "there's a math for that."

Topics
    The actual topics covered in each instance of this class will vary. A partial list of
    potential patterns from which content would be selected is attached. Each topic will
    be presented as a "pattern," which means it will have the following structure and
    contents:
        Pattern name – selected to remind the student of the pattern and enable rapid
            selection from the repertoire of patterns known to the student.
        Problem in context – a description of the problem (e.g. modeling linked queues
            with probabilistic distribution of time-in-queue) and the context(s) in which it is
            encountered (e.g. establishing subway or train schedules).
        Formal solution – description and explanation of the formula or algorithm – with
            emphasis on concepts implicit in the solution, connection to available data or
            measurement protocols, and implementation of the solution in one or more
            programming languages.
        Variations – description and explanation of relationships to other patterns or other
            formal (e.g. mathematical) concepts.
        Examples – multiple examples, showing how the problem was deconstructed and
            the solution made possible – with discussion

<u>Self-test problems</u> – essentially a series of 'story problems' that the student can use to determine mastery of the pattern and as preparation for the course final examination.

Note: The FSPL is under development – the group leading the development of this library is noted in the supplemental information submitted with this proposal. of patterns. All patterns will be delivered in a Web accessible format with opportunity for both self-study and distance learning.

Structure

This course will be highly compressed with substantial didactic material available on-line. Much of the course will be self-study, much like the introductory mathematics courses taught at Highlands. Students will pass this course as a stand-alone unit, but will be constantly referred back to the course material whenever they encounter an appropriate problem in their project courses.

Evaluation / Assessment

Students will be required to pass objective examinations on the teaching material (a 70% correct threshold will be required to pass the course). Student ability to use what is learned will be separately, and constantly, evaluated in the project courses – students will actually have to demonstrate their understanding on an ongoing basis.

Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their mathematical knowledge so solve problems.

REQUEST COURSE CHANGE

REVISED

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA-635**

B. Course Title: **Special Topics**

C. Hours Credit: **variable 1-3**

D. Total Contact Hours: (variable -- Lecture: **1-3** Lab: **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

> **This course provides an opportunity to respond to student interest and developing topics in the area of software development including new domains, new tools, and new methods.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

> **Allows the program to remain current.**

J. Check all that apply to the proposed course:

> Elective: X

K. Resource requirements

> **No new requirements.**

RECOMMENDATION:

Approval _____ Denial _____ _____

School/College Dean

Approval _____ Denial _____ _____

Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

Vice President for Academic Affairs

SDA-635 Syllabus

Catalog Description
    See proposal submission form.

Prerequisites: none.

Rationale / Objectives
    Software development is a rapidly changing field and there is a constant need to integrate new areas of study and application. Students will often desire the ability to customize their education to provide a foundation for post-graduate specialization.

Topics
    Will vary according to the particular instance of the course.

Structure
    Topics courses will be offered in a Structured Seminar format – with specified reading and writing assignments that will be reviewed, critiqued, evaluated and revised in a reader's / writer's workshop setting.

Evaluation / Assessment
    Student evaluations will be based on participation, completion and improvement of writing assignments and preparation based on completion of reading assignments.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 640**

B. Course Title: **Data Representation and Persistence**

C. Hours Credit: **1**

D. Total Contact Hours: (Lecture: **variable** Lab **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

This course presents and analyzes the various approaches to dealing with data representation and persistence in large-scale, distributed, and multi-media applications. Performance criteria, efficacy of approach, and heuristics for designing custom – application specific – solutions are covered. Advanced database (object, sparse, multimedia, intelligent) concepts are also covered.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

Traditional data and persistence systems are 50 year old technology – this course allows students to master contemporary technology and knowledge.

J. Check all that apply to the proposed course:

Major Requirement: X   Elective: X

K. Resource requirements

SDA Studio and existing Library holdings

RECOMMENDATION:

Approval _____ Denial _____ _____

School/College Dean

Approval _____ Denial _____ _____

Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

Vice President for Academic Affairs

SDA-640 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: none.

Rationale / Objectives

Digitization and the Web have combined to collect vast amounts of information – more information than all the libraries in all the ages combined. The information is there – but gaining access is a very non-trivial problem. Search is the term used as an umbrella for the tightly related problems of digital representation, categorization, indexing, key word semantics, and search algorithms.

Students will become familiar with the challenges associated with indexing and categorization and how these define what is searchable. They will understand the issues on non-textual information storage and retrieval. They will understand how to measure efficiency of search algorithms for extremely large data sets, and the possibility of specialized algorithms for different data sets.

Topics

1. Dimensions of Search.
2. Categories, indices, and the meaning of terms in context.
3. Indexing non-textual information resources.
4. One man's meaning in another woman's nonsense.
5. Searching dense data sets.
6. Searching sparse data sets.
7. Special purpose search.

Structure

This course will be highly compressed with substantial didactic material available on-line. Students will pass this course as a stand-alone unit, but will be constantly referred back to the course material whenever they encounter an appropriate problem in their project courses. This course will most often be taken in the context of a research oritented project or an enterprise project with an emphasis search applied to internal data sets.

Evaluation / Assessment

Students will be required to pass objective examinations on the teaching material (a 70% correct threshold will be required to pass the course). Student ability to use what is learned will be separately, and constantly, evaluated in the project courses – students will actually have to demonstrate their understanding on an ongoing basis.

Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their mathematical knowledge so solve problems.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 642**
B. Course Title: **Data Representation / Visualization**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
   This course explores the techniques and principles involved in presenting – visualizing – complex, multivariate, and dynamic data sets. Applications include scientific visualization (nuclear bomb explosions, cosmological or quantum phenomenon) as well as how to avoid distortion of information arising from its visual representation.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
   Directly supports advance simulation programming projects.

J. Check all that apply to the proposed course:
   Major Requirement: X

K. Resource requirements
   SDA Studio and existing Library holdings

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                          School/College Dean

Approval _____ Denial _____ _____
                                                          Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                          Vice President for Academic Affairs

SDA-642 Syllabus

Catalog Description

    See proposal submission form.

Prerequisites: none.

Rationale / Objectives

    Everyone must confront massive amounts of information, every day. If this information was presented in raw form its sheer volume would make it impossible to comprehend and assimilate. Vast data sets must be represented and presented in a form amenable to human consumption and utilization. This course deals with the visualization (without distortion and bias) of quantitative and qualitative information, presentation of multivariate and dynamic data sets, and the aesthetics of presentation. Using the power of computer-based presentation tools will also be covered.

Topics

1. Tufte and other pioneers.
2. Envisioning information.
3. Simulations and scientific visualization.
4. Dynamic data sets.
5. Case studies.

Structure

    This course will be highly compressed with substantial didactic material available on-line. Students will complete case study assignments that involve analyzing examples of information visualization and creating analyses that will then be reviewed in a writer's workshop setting.

Evaluation / Assessment

    Students will be evaluated based on their participation in the writer's workshops and their completion of case study assignments.

    Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge so solve problems in their project work.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 644**
B. Course Title: **Knowledge Management**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
> **Knowledge is generally assumed to be located in the heads of people and is integrated with their experience. This means that knowledge is not amenable to the same technologies as data and information. Yet it is an asset that needs to be maintained and utilized. This course will explore and apply contemporary knowledge management applications and theories.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
> **Provides the knowledge necessary to build this kind of leading edge application.**

J. Check all that apply to the proposed course:
   Major Requirement: X   Elective: X

K. Resource requirements
   SDA Studio and existing Library holdings

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                                School/College Dean

Approval _____ Denial _____ _____
                                                                Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                            Vice President for Academic Affairs

SDA-644 Syllabus

Catalog Description

    See proposal submission form.

Prerequisites: none.

Rationale / Objectives

    To a large extent, data and information can be captured in digital form and stored, manipulated, and retrieved using computer based systems. To a much lesser extent, knowledge is amenable to this kind of treatment (expert systems, artificial intelligence). Knowledge, to a very large extent, exists in the minds of people, which presents some interesting challenges for knowledge management. At the same time knowledge is recognized as an individual and organizational asset worthy of some protection but subject to some exploitation.

    In this course, students will learn the nature and essence of knowledge, the degree to which it can be made manifest in a manipulable form, and how to "manage" information that exists only in the minds of human beings.

Topics

1. Knowledge = information + experience?.
2. The role of context.
3. Externalizing and representing knowledge.
4. Dealing with the ineffable and inexpressible.
5. Case studies.

Structure

    This course will be highly compressed with substantial didactic material available on-line. Students will complete case study assignments that involve analyzing examples of knowledge and knowledge management and creating analyses that will then be reviewed in a writer's workshop setting.

Evaluation / Assessment

    Students will be evaluated based on their participation in the writer's workshops and their completion of case study assignments.

    Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge so solve problems in their project work.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 645**

B. Course Title: **Dynamic / Emergent Systems Design**

C. Hours Credit: **1**

D. Total Contact Hours: (Lecture: **variable** Lab: **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

> **This course covers the theory of non-deterministic systems design (how to design that which cannot be known in advance – an apparent paradox). The use of agent-based, cellular-automata, and genetic algorithms as possible mechanisms for emergent system design are covered.**

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

> **This course supports the research requirements of the program.**

J. Check all that apply to the proposed course:

Major Requirement: X   Elective: X

K. Resource requirements

> **SDA Studio and existing Library holdings**

RECOMMENDATION:

Approval _____ Denial _____ _____

School/College Dean

Approval _____ Denial _____ _____

Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

Vice President for Academic Affairs

SDA-645 Syllabus

Catalog Description

    See proposal submission form.

Prerequisites: none.

Rationale / Objectives

    Like the enterprise design course, this course is a place and time to synthesize the various knowledge themes from other courses and apply them to the design and modification of a large-scale system. The enterprise is not the only CAS system that will be of interest to software developers. This course will focus on the problems of design that are common in all CAS systems. Also like the enterprise design course, this course returns to some of the most primal ideas in the curriculum – a focus on complex adaptive systems and the fact that software development is an act of system change – not artifact construction.

    In this course the student will learn how to visualize and/or model a CAS. They will learn how to isolate elements of this system – individual components or relationships or subsystems. They will learn how to introduce a change in an isolated element and evaluate its effect on the system as a whole. Finally they will learn how to apply design thinking to craft new elements or revise existing ones in order to evolve and adapt the whole system in a way that supports system goals.

Topics

1. CAS.
2. Essential and accidental elements.
3. Applying design thinking to system optimization / adaptation.
4. Altering the alterable.
5. Assessing results.
6. Living systems.

Structure

    This course will be highly compressed with substantial didactic material available on-line. A number of "case studies" – particular instances of a CAS that can be supported with software (e.g. evolutionary development) – will be analyzed to distill common elements and frame potential solutions. This course is substantially focused on research not direct development. Structured discussions (writer's workshops) will be used to stimulate and assess student participation.

Evaluation / Assessment

    Students will be evaluated based on their participation in the writer's workshops and their completion of case study assignments.

    Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge so solve problems in their project work.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 646**
B. Course Title: **Enterprise Design**
C. Hours Credit: **1**
D. Total Contact Hours: (Lecture: **variable** Lab **0**)
E. Semester(s) Course to be Offered: **as needed**
F. Proposed Course Description for Catalog:
   The integration of IT and the Enterprise is a driving need. Satisfying that need results in a single system – the Enterprise – with some of its components and relationships among those components being embedded in software. How to configure the Enterprise to best achieve its goals is enterprise design and defines the contents of this course.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
   Directly supports the larger goal of this program and of the MIS concentration option.

J. Check all that apply to the proposed course:
   Major Requirement: X

K. Resource requirements
   SDA Studio and existing Library holdings

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                              School/College Dean

Approval _____ Denial _____ _____
                                                              Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                                       Vice President for Academic Affairs

SDA-646 Syllabus

Catalog Description
    See proposal submission form.

Prerequisites: none.

Rationale / Objectives
    In many ways this course is a capstone – a place and time to synthesize the various knowledge themes from other courses and apply them in an enterprise level development project. It is culminating in another way as well – it returns to some of the most primal ideas in the curriculum – the enterprise as a complex adaptive system and the fact that software development is an act of system change – not artifact construction.

    In this course the student will learn how to visualize and/or model the enterprise as a complex adaptive system. They will learn how to isolate elements of this system – individual components or relationships or subsystems. They will learn how to introduce a change in an isolated element and evaluate its effect on the system as a whole. Finally they will learn how to apply design thinking to craft new elements or revise existing ones in order to evolve and adapt the whole system in a way that supports enterprise goals.

Topics
1. Enterprise as a CAS, reprise.
2. Essential and accidental elements.
3. Applying design thinking to system optimization / adaptation.
4. Altering the alterable.
5. Assessing results.
6. Living organizations.

Structure
    This course will be highly compressed with substantial didactic material available on-line. Students will complete case study assignments that involve analyzing examples of information visualization and creating analyses that will then be reviewed in a writer's workshop setting.

Evaluation / Assessment
    Students will be evaluated based on their participation in the writer's workshops and their completion of case study assignments.

    Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge so solve problems in their project work.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 650**

B. Course Title: **Ubiquitous Computing**

C. Hours Credit: **1**

D. Total Contact Hours: (Lecture: **variable** Lab: **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

This course is closely related to, but the flip side of, ambient computing. Ubiquitous computing focuses on the design and development of highly distributed, densely networked, and mobile computational objects – the creation of the environment assumed by ambient computing.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

Also supports the research requirement of the program.

J. Check all that apply to the proposed course:

Major Requirement: X   Elective: X

K. Resource requirements

SDA Studio and existing Library holdings

RECOMMENDATION:

Approval _____ Denial _____ _____

School/College Dean

Approval _____ Denial _____ _____

Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

Vice President for Academic Affairs

SDA-650 Syllabus

Catalog Description

See proposal submission form.

Prerequisites: none.

Rationale / Objectives

Ambient and ubiquitous computing are closely related topics – both dealing with the rapid "computerization" of the world around us. Ubiquitous computing deals with how to "computerize" the world around us – from designing intelligent HVAC systems to constructing networks using skin conductivity of human beings.

Students in this course will learn how computational capability can be specialized and miniaturized to make almost any piece of the natural world "intelligent." They will learn how scale (the U.S. smart power grid – to nano-computers) constrains design. Students will learn a "new" collaborative computing paradigm that will affect how software is developed to empower billions of "computers" communicating with each other via pervasive networks.

Topics

1. Mirror Worlds.
2. Embedded software.
3. Managing communication traffic.
4. Security and privacy.
5. Unexpected consequences.

Structure

This course will be highly compressed with substantial didactic material available on-line. This course will require substantial individual research, creativity, and creative expression (usually in the form of papers, but often in the form of software prototypes) that will be reviewed, critiqued, and improved in a writer's workshop setting.

Evaluation / Assessment

Students will be evaluated based on the completion of written assignments and on their participation in class discussions. Both written assignments and discussion participation will be grounded in journal and other on-line and library research.

Assessment of the utility and effectiveness of this course will be based on the ability of students to apply their knowledge so solve problems in their project work.

REQUEST COURSE CHANGE

NEW
Date Submitted **10/23/2009**   Date Received **10/28/2009**
Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 690**
B. Course Title: **Project – Mastery Focus**
C. Hours Credit: **4**
D. Total Contact Hours: (Lecture: **4** Lab: **16**)
E. Semester(s) Course to be Offered: **every semester and summer**
F. Proposed Course Description for Catalog:
    Projects frame and motivate the topical learning while providing opportunities to apply the knowledge so gained. Projects provide the opportunities for mentoring, teamwork, and acquisition of the intangible "oral traditions" essential to mastery of the software development discipline. Advanced projects are distinguished by the scope of the project and the expected role of the student (working independently as team leader and mentor in multiple contexts).

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.
    Projects are the frameworks and context for the rest of the academic program.

J. Check all that apply to the proposed course:
    Major Requirement: X   Elective: X

K. Resource requirements
    SDA Studio and existing Library holdings

RECOMMENDATION:
Approval _____ Denial _____ _____
                                                  School/College Dean

Approval _____ Denial _____ _____
                                              Academic Affairs Committee

ACTION:
_____Approval _____Denial _____
                                      Vice President for Academic Affairs

SDA-690 Syllabus

Catalog Description

　　See proposal submission form.

Prerequisites: none.

Rationale / Objectives

　　The overall philosophy of this program is grounded in the critical nature of experiential learning. "*We are sure only of that which we build,*" Giambattista Vico. We also strongly believe that students learn more, learn faster, and retain longer when topical knowledge is acquired in a context where that knowledge can be motivated and immediately applied.

Topics

　　Project courses do not have separate topical foci – they are the context for such learning, and provide opportunities to cement learning in experience.

Structure

　　Projects have a pre-specified duration and focus, creating automated components for an enterprise or investigatory system. Students may assume multiple roles during the duration of a project – ranging from basic programming to design to management.

　　Depending on the nature of the project, the domain of application, the student role, and the problem feature being addressed by the student in her role – specific topical courses (the one and two-credit subject matter courses) will be required. These subject matter courses will be offered in the project studio in a time-frame and format most appropriate to the student(s) requiring that subject matter.

Evaluation / Assessment

　　Student work results (from specific assignments in specific roles) will be accumulated in an "Experience Portfolio" along with peer, instructor, and professional feedback and evaluation results. Published papers, theses, certifications, and other significant achievements will also be included in the portfolio.

　　Additionally, student work evaluations will be compiled into a "Professional Profile" along with subject matter test results. This profile will show student performance along with average peer performance and average national peer performance on each element of the profile.

　　The efficacy of the project-based experiential learning approach will be evaluated with the same measures that establish the national peer averages, with the goal of our student average consistently being higher than the national averages.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **SDA- 692**

B. Course Title: **Project – Research Focus**

C. Hours Credit: **4**

D. Total Contact Hours: (Lecture: **4** Lab: **16**)

E. Semester(s) Course to be Offered: **every semester and summer**

F. Proposed Course Description for Catalog:

Projects frame and motivate the topical learning while providing opportunities to apply the knowledge so gained. Projects provide the opportunities for mentoring, teamwork, and acquisition of the intangible "oral traditions" essential to mastery of the software development discipline. Advanced projects are distinguished by the scope of the project and the expected role of the student (working independently as team leader and mentor in multiple contexts).

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

Framework and context for rest of program.

J. Check all that apply to the proposed course:

   Major Requirement: X   Elective: X

K. Resource requirements

   SDA Studio and existing Library holdings

RECOMMENDATION:

Approval _____ Denial _____ _____

                                                                School/College Dean

Approval _____ Denial _____ _____

                                                                Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

                                                   Vice President for Academic Affairs

SDA-692 Syllabus

Catalog Description
> See proposal submission form.

Prerequisites: none.

Rationale / Objectives
> The overall philosophy of this program is grounded in the critical nature of experiential learning. "*We are sure only of that which we build*," Giambattista Vico. We also strongly believe that students learn more, learn faster, and retain longer when topical knowledge is acquired in a context where that knowledge can be motivated and immediately applied.

Topics
> Project courses do not have separate topical foci – they are the context for such learning, and provide opportunities to cement learning in experience.

Structure
> Projects have a pre-specified duration and focus, creating automated components for an enterprise or investigatory system. Students may assume multiple roles during the duration of a project – ranging from basic programming to design to management.
>
> Depending on the nature of the project, the domain of application, the student role, and the problem feature being addressed by the student in her role – specific topical courses (the one and two-credit subject matter courses) will be required. These subject matter courses will be offered in the project studio in a time-frame and format most appropriate to the student(s) requiring that subject matter.

Evaluation / Assessment
> Student work results (from specific assignments in specific roles) will be accumulated in an "Experience Portfolio" along with peer, instructor, and professional feedback and evaluation results. Published papers, theses, certifications, and other significant achievements will also be included in the portfolio.
>
> Additionally, student work evaluations will be compiled into a "Professional Profile" along with subject matter test results. This profile will show student performance along with average peer performance and average national peer performance on each element of the profile.
>
> The efficacy of the project-based experiential learning approach will be evaluated with the same measures that establish the national peer averages, with the goal of our student average consistently being higher than the national averages.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **BUS - 505**

B. Course Title: **Proseminar: The Enterprise I**

C. Hours Credit: **3**

D. Total Contact Hours: (Lecture: **3** Lab: **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

This course provides the basic business foundation required by software developers who do most of their work for business organizations. It is a foundation and a leveling course. Each of the typical MBA subject areas is introduced and the essential knowledge of that area is summarized.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

Provides the minimal level of business knowledge required for software developers.

J. Check all that apply to the proposed course:

Major Requirement: X

K. Resource requirements

No new requirements.

RECOMMENDATION:

Approval _____ Denial _____ _____

School/College Dean

Approval _____ Denial _____ _____

Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

Vice President for Academic Affairs

BUS 505 Syllabus

Catalog Description
   See proposal submission form.

Prerequisites: none.

Rationale / Objectives
   Students in the software development graduate program will inevitably do much of
   their work in support of business enterprises. A major challenge for software systems
   developers is to keep their work integrated with and supportive of the business
   enterprise and to satisfy the expectations of business management in terms of results
   and return on investment. It is essential that software developers possess a
   comprehensive, but basic, understanding of the business view of the world.

   Students completing these two courses will be prepared to work cooperatively with
   domain specialists and enterprise management.

Topics
   1. The Firm.
   2. MBA curriculum and its rationale.
   3. Strategy and Tactics.
   4. Operations.
   5. Management - Leadership.
   6. Middle, operational, and team management.
   7. Accounting – keeping score.
   8. Accounting – state of the enterprise

Structure
   This course will be highly compressed with substantial didactic material available on-
   line. Students will be expected pass objective exams in each topical area as well as
   participate in extensive class discussions.

Evaluation / Assessment
   Students will be required to pass objective examinations (a 70% threshold will be
   required) and participate in the class discussions. Student ability to use what is
   learned will be separately, and constantly, evaluated in the project courses – students
   will actually have to demonstrate their understanding on an ongoing basis.

   Assessment of the utility and effectiveness of this course will be based on the ability
   of students to write effective, efficient, and elegant programs.

REQUEST COURSE CHANGE

NEW

Date Submitted **10/23/2009**   Date Received **10/28/2009**

Submitted by: **David West**, Program Representative

A. Proposed Discipline and Course Number: **BUS - 506**

B. Course Title: **Proseminar: The Enterprise II**

C. Hours Credit: **3**

D. Total Contact Hours: (Lecture: **3** Lab: **0**)

E. Semester(s) Course to be Offered: **as needed**

F. Proposed Course Description for Catalog:

This course provides the basic business foundation required by software developers who do most of their work for business organizations. It is a foundation and a leveling course. Each of the typical MBA subject areas is introduced and the essential knowledge of that area is summarized.

G. Course(s) to be discontinued or revised if this course is approved:

H. Does this course duplicate or approximate any current course(s) in the Catalog? **NO**

I. Explain briefly how the course content impacts the program objective.

Provides the minimal level of business knowledge required for software developers.

J. Check all that apply to the proposed course:
   Major Requirement: X

K. Resource requirements
   No new requirements.

RECOMMENDATION:

Approval _____ Denial _____ _____

School/College Dean

Approval _____ Denial _____ _____

Academic Affairs Committee

ACTION:

_____Approval _____Denial _____

Vice President for Academic Affairs

BUS 506 Syllabus

Catalog Description
    See proposal submission form.

Prerequisites: none.

Rationale / Objectives
    Students in the software development graduate program will inevitably do much of their work in support of business enterprises. A major challenge for software systems developers is to keep their work integrated with and supportive of the business enterprise and to satisfy the expectations of business management in terms of results and return on investment. It is essential that software developers possess a comprehensive, but basic, understanding of the business view of the world.

    Students completing these two courses will be prepared to work cooperatively with domain specialists and enterprise management.

Topics
9. Financing the Enterprise.
10. Marketing.
11. Human Assets.
12. Constraints – legal and other.
13. Understanding and exploiting technology.
14. The world is flat.
15. Green enterprise.
16. Living enterprise.

Structure
    This course will be highly compressed with substantial didactic material available on-line. Students will be expected pass objective exams in each topical area as well as participate in extensive class discussions.

Evaluation / Assessment
    Students will be required to pass objective examinations (a 70% threshold will be required) and participate in the class discussions. Student ability to use what is learned will be separately, and constantly, evaluated in the project courses – students will actually have to demonstrate their understanding on an ongoing basis.

Assessment of the utility and effectiveness of this course will be based on the ability of students to write effective, efficient, and elegant programs.

3. Student Outcome Assessment

The proposal notes that this program is ultimately a competency-based rather than a course-based program. Courses are defined and will be offered in a traditional fashion, mostly for the purpose of rationalizing administration, registration, and transcripts. Behind the scenes, every student will have a profile of demonstrated competencies that directly reflects what they have learned, experienced, and applied.

At present (this is a work in progress and will evolve as the program evolves) there are approximately 100 competencies defined. Each competency has seven levels of demonstrated achievement:

1- Understanding of concepts and applications, evidenced by objective testing.
2- Ability to apply knowledge under supervision, evidenced by self-assessments plus peer, mentor, and faculty feedback.
3- Ability to apply knowledge independently, evidenced in the same way as (2).
4- Ability to apply knowledge in novel contexts, evidenced in the same way as (2).
5- Ability to mentor others, evidenced by faculty feedback.
6- Ability to innovate and extend or enhance knowledge and practice, evidenced via the student portfolio.
7- Ability to advance knowledge and communicate that knowledge, i.e. has made an original contribution to the understanding/practice of the competency, by creating a new tool, writing a white paper, publishing a paper in trade journal, an accepted paper in a refereed journal, or delivering a presentation at a refereed conference.

Students are classified based on their profiles.

- A Novice has completed 0-49% of the defined competencies to level 3.
- A Senior has completed 50-99% of the defined competencies to level 3.
- A Practioner has completed 100% of the defined competencies to level 4, AND has 10 or more items in his/her portfolio.
- A Mentor has completed at least 40% of the defined competencies to level 5, AND has 20 or more items in his/her portfolio
- A Master has completed at least 10% of the defined competencies to level 7, AND has 50 or more items in his/her portfolio

4. Letters of Support

New Mexico

HIGHLANDS University

Box 9000
Las Vegas, New Mexico 87701

Tel: 505-425-7511   www.nmhu.edu

November 3, 2010

Dr. Viola Florez, Secretary
New Mexico Higher Education Department
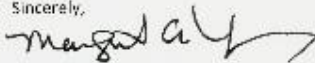2048 Galisteo Street
Santa Fe, NM 87505-2100

Dear Dr. Florez:

We ask that you seriously consider approval of New Mexico Highlands University's application for a new Master's Degree in Software Driven Systems Design. This degree would be unique among state universities in New Mexico. Futhermore, this is a program that we believe in here at Highlands, and we support it. We believe that the Master's degree in Software Driven Systems Design will fill a unique need for highly skilled technical labor here in New Mexico.

Dr. David West, our lead faculty in this effort and the person championing this program, comes from a large and successful program in Minnesota, and he understands the management issues associated with starting this program. He was hired for the sole purpose of developing this program but we also have other faculty who can support it. In addition to supporting faculty in this area, we have dedicated space and technology resources to support our efforts.

Our long term goal is to support and enhance technology education here in New Mexico. We feel that the Master's Degree in Software Driven Systems Design is a step in the right direction. Please give our program application your most serious consideration.

Sincerely,

Margaret A. Young, Dean
School of Business Administration
New Mexico Highlands University

NEW MEXICO HIGHLANDS UNIVERSITY

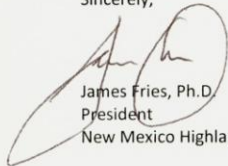*A Place for Individual Excellence*

October 19, 2010

Dr. Viola Florez, Secretary
New Mexico Higher Education Department
2048 Galisteo Streeet
Santa Fe, NM 87505-2100

Dear Dr. Florez:

According to a CNBC special technology report New Mexico ranks 38th in technology and innovation infrastructure, and 44th in technology education in the US. To enhance the State's competitive position and foster sustained economic development, educational programs that respond to emerging needs and broaden the technological expertise available to employers within the state of New Mexico are critical. This is especially true given the continuing demand for technology workers from both Sandia and Los Alamos National Laboratories.

The Master's Degree in Software Driven Systems Design proposed by New Mexico Highlands University, does not duplicate any program currently offered in New Mexico. This program is intended to prepare modern "polymaths" (individuals that have integrated multiple disciplinary perspectives) capable of using computers and computing technology to comprehend and solve the complex and dynamic problems confronting business, society, and the global community. This program will contribute in practical ways to the technology infrastructure and educated workforce available in New Mexico. NM Highlands University is requesting approval of this unique and distinctive program. Thank you for your consideration.

Sincerely,

James Fries, Ph.D.
President
New Mexico Highlands University

LAS VEGAS, NEW MEXICO 87701   OFFICE OF THE PRESIDENT   TELEPHONE   505-454-3269