

2014-2015 LONG SIGNATURE SHEET



Proposal Number: SIS-10-27-14

Proposal Title: ITIS 6530/8530^{ve} Systems Dynamics

Originating Department: Software and Information Systems (ITIS)

TYPE OF PROPOSAL: UNDERGRADUATE _____ GRADUATE X UNDERGRADUATE & GRADUATE _____
 (Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
8/25/2014	8/26/2014	8/26/2014	Approved	<u>DEPARTMENT CHAIR</u> [Mary Lou Maher]
8/26/2014	9/3/2014	9/3/2014	Approved	<u>COLLEGE CURRICULUM COMMITTEE CHAIR</u> [Yuliang Zheng]
10/25/2014	11/4/2014	11/4/2014	Approved	<u>COLLEGE FACULTY CHAIR (if applicable)</u> [Srinivas Akella]
11/5/2014	11/5/2014	11/5/2014	Approved	<u>COLLEGE DEAN</u> [Yi Deng]
			Approved	<u>GENERAL EDUCATION</u> (if applicable; for General Education courses) [N/A]
			Approved	<u>UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR</u> (for undergraduate courses only)
11-16-14	1-6-15	2-25-15	Approved	<u>GRADUATE COUNCIL CHAIR</u> (for graduate courses only) ALAN R. FREITAG
				<u>FACULTY GOVERNANCE ASSISTANT</u> (Faculty Council approval on Consent Calendar)
				<u>FACULTY EXECUTIVE COMMITTEE</u> (if decision is appealed)



UNC CHARLOTTE

LONG FORM COURSE AND CURRICULUM PROPOSAL

*To: Graduate Council Chair

From: Software and Information Systems Department

Date: October 27, 2014

Re: IT IS 6530/8530: Systems Dynamics

The Long Form is used for major curriculum changes. Examples of major changes can include: creation of a new major, creation of a new minor, creation of a new area of concentration, or significant changes (more than 50%) to an existing program (Note: changing the name of an academic department does not automatically change the name(s) of the degree(s). The requests must be approved separately by the Board of Governors.)

Submission of this Long Form indicates review and assessment of the proposed curriculum changes at the department and collegiate level either separately or as part of ongoing assessment efforts.

*Proposals for undergraduate courses should be sent to the Undergraduate Course and Curriculum Committee Chair. Proposals related to both undergraduate and graduate courses, (e.g., courses co-listed at both levels) must be sent to both the Undergraduate Course and Curriculum Committee and the Graduate Council.

University of North Carolina at Charlotte
New Graduate Course and Curriculum Proposal from: Department of
Software and Information Systems

Title: Systems Dynamics

A. PROPOSAL SUMMARY.

1. SUMMARY

The Department of Software and Information Systems proposes to add a new course, ITIS 6530/8530 Systems Dynamics, designed to provide graduate students with a comprehensive look at the systems dynamics tools for understanding dynamic complexity of natural and man-made systems. This course is intended for SIS majors at the MS and PhD level.

B. JUSTIFICATION

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

The scientific study of dynamical systems; including environment, business organizations, governmental policies, biological systems, health problems, and social issues; has received an enormous amount of interest in the past twenty years. Issues like sustainability, resilience, globalization, pandemics, terrorism, cyber attacks, and global financial crises have demonstrated that the world is getting increasingly more connected. In order to deal with the complexity of this connectedness, organizations need a new breed of tools that will allow them to both understand the issue at hand and plan a set of contingencies for dealing with the uncertainty introduced by the multitudes of the interconnected factors.

The field of Systems Dynamics offers a well-defined methodology for both modeling and simulating complex relationships of a dynamical system that helps the designer both map and set in motion the Web of interconnected variables that determine the eventual outcome of the system. This methodology is a combination of graphical representation, mathematical expression, and network connectivity that yields important insights into the operation of a business, flows in a biological network, or a possible outcome of a new strategic plan.

Subjects covered in this course include elements of complex systems, properties of system dynamics, structure and behavior of dynamic systems, tools for systems thinking, dynamics of growth, instability and oscillation, and model design and evaluation. They will allow students to define, understand, and analyze dynamical systems at the appropriate level of abstraction and inquiry.

2. Discuss prerequisites/corequisites for course(s) including class-standing.

There are no prerequisites for this course. The students only need to have graduate standing.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

The course is intended for graduate students interested in the analysis of dynamical systems. It is usually taken in conjunction with the courses on Complex Adaptive Systems and Network Science. These courses can be taken in any sequence. The PhD students will have a separate definition of the project, requiring them to do a more comprehensive analysis of the selected network.

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

This course will be one of the three courses that form a well-defined sequence on Complex Systems: Complex Adaptive Systems, Network Science, and Systems Dynamics.

- C. IMPACT.** Changes to courses and curricula often have impacts both within the proposing department as well as campus-wide. What effect will this proposal have on existing courses and curricula, students, and other departments/units? Submit an Impact Statement that fully addresses how you have assessed potential impacts and what the impacts of this proposal might be. Consider the following:

1. What group(s) of students will be served by this proposal? (Undergraduate and/or graduate; majors and/or non-majors, others? Explain). Describe how you determine which students will be served.

The course is designed to serve the needs of the SIS MS and PhD students.

2. What effect will this proposal have on existing courses and curricula?
 - a. When and how often will added course(s) be taught?

ITIS 6530/8530 will be taught on demand.

- b. How will the content and/or frequency of offering of other courses be affected?

There should be no impact on the content or frequency of offering of other courses.

- c. What is the anticipated enrollment in course(s) added (for credit and auditors)?

The anticipated enrollment is approximately 10-15 students per class.

- d. How will enrollment in other courses be affected? How did you determine this?

This course may increase the demand for the Complex Adaptive Systems and Network Science courses, and vice versa.

- e. Identify other areas of catalog copy that would be affected, including within other departments and colleges (e.g., curriculum outlines, requirements for the degree, prerequisites, articulation agreements, etc.)

There are no other anticipated changes in the catalog.

III. RESOURCES REQUIRED TO SUPPORT PROPOSAL.

When added resources are not required, indicate "none". For items which require "none" explain how this determination was made.

- A. **PERSONNEL.** Specify requirements for new faculty, part-time teaching, student assistants and/or increased load on present faculty. List by name qualified faculty members interested in teaching the course(s).

No new or part-time faculty is required in order to offer these courses; nor will these courses introduce an increased teaching load on present faculty. Mirsad Hadzikadic will teach this course.

- B. **PHYSICAL FACILITY.** Is adequate space available for this course?

The College of Computing and Informatics (CCI) has adequate space and basic hardware and software infrastructure needed to cover this course.

- C. **EQUIPMENT AND SUPPLIES:** Has funding been allocated for any special equipment or supplies needed?

No additional equipment or supplies are needed for the proposed course.

- D. **COMPUTER.** Specify any computer usage (beyond Moodle) required by students and/or faculty, and include an assessment of the adequacy of software/computing resources by available for the course(s).

Any computer laboratory on campus and personal computers of students will suffice as a computational platform for this course.

- E. **AUDIO-VISUAL.** If there are requirements for audio-visual facilities beyond the standard classroom podiums, please list those here.

Current facilities are adequate to support this course.

- F. OTHER RESOURCES.** Specify and estimate cost of other new/added resources required, e.g., travel, communication, printing and binding.

None needed.

- G. SOURCE OF FUNDING.** Indicate source(s) of funding for new/additional resources required to support this proposal.

None needed.

IV. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS

- A. LIBRARY CONSULTATION.** Indicate written consultation with the Library Reference Staff at the departmental level to ensure that library holdings are adequate to support the proposal prior to its leaving the department. (Attach copy of Consultation on Library Holdings).

Consultation was completed on 04-03-2014 (see Attachment 2).

- B. CONSULTATION WITH OTHER DEPARTMENTS OR UNITS.** List departments/units consulted in writing regarding all elements outlined in IIC: Impact Statement, including dates consulted. Summarize results of consultation and attach correspondence. Provide information on voting and dissenting opinions (if applicable).

Consultations with the Departments of Computer Science, Bioinformatics and Genomics, and Systems Engineering and Engineering management were completed by September 26, 2014. (See Attachment 2)

V. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

- A. ORIGINATING UNIT.** Briefly summarize action on the proposal in the originating unit including information on voting and dissenting opinions.

Approved by the Department of Software and Information Systems on 8/26/2014, unanimously and with no dissenting opinions.

- B. CREDIT HOUR. (Mandatory if new and/or revised course in proposal)**

Review statement and check box once completed:

- The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a credit hour.

C. ATTACHMENTS.

1. CONSULTATION: Attach relevant documentation of consultations with other units.
 - *Consultation on Library Holdings attached in Appendix 2*

2. COURSE OUTLINE/SYLLABUS: For undergraduate courses attach course outline(s) including basic topics to be covered and suggested textbooks and reference materials with dates of publication. For Graduate Courses attach a course syllabus. Please see Boiler Plate for Syllabi for New/Revised Graduate Courses.
 - *Course syllabus attached in Appendix 1*

3. PROPOSED CATALOG COPY: Copy should be provided for all courses in the proposal. Include current subject prefixes and course numbers, full titles, credit hours, prerequisites and/or corequisites, concise descriptions, and an indication of when the courses are to be offered as to semesters and day/evening/weekend. Copy and paste the current catalog copy and use the Microsoft Word "track changes" feature (or use red text with "strikethrough" formatting for text to be deleted, and adding blue text with "underline" formatting for text to be added).

a. For a new course or revisions to an existing course, check all the statements that apply:

- _____ This course will be cross listed with another course.
- _____ There are prerequisites for this course.
- _____ There are corequisites for this course.
- _____ This course is repeatable for credit.
- _____ This course will increase/decrease the number of credits hours currently offered by its program.
- _____ This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

For all items checked above, applicable statements and content must be reflected in the proposed catalog copy.

- *Proposed catalog copy attached in Appendix 3*

b. If overall proposal is for a new degree program that requires approval from General Administration, please contact the facultygovernance@uncc.edu for consultation on catalog copy.

4. ACADEMIC PLAN OF STUDY (UNDERGRADUATE ONLY): Does the proposed change impact an existing Academic Plan of Study?
 - Yes. If yes, please provide updated Academic Plan of Study in template format.

No.

5. STUDENT LEARNING OUTCOMES (UNDERGRADUATE & GRADUATE):
Does this course or curricular change require a change in Student Learning Outcomes (SLOs) or assessment for the degree program?

Yes. If yes, please provide updated SLOs in template format.

No.

6. TEXTBOOK COSTS: It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

Yes. Briefly explain below.

There is no electronic version of the textbooks available yet. Textbook rentals or the buyback program should be available through the bookstore.

No. Briefly explain below.

IMPORTANT NOTE: A Microsoft Word version of the final course and curriculum proposal should be sent to facultygovernance@uncc.edu upon approval by the Undergraduate Course and Curriculum Committee and/or Graduate Council chair.

Attachment 1

ITIS 6530/8530 Course Objectives, Outline, Textbooks, and Evaluations Course Objectives

This course will offer a system dynamics approach to understanding and modeling complex systems. The course will clearly identify when dynamical systems modeling is favorable to agent-based modeling. It will also draw parallels, similarities, and differences between the two techniques. After taking this course, students will be able to explain, model, and predict outcome in systems defined as “dynamical.” They will also be able to use one of the existing commercial tools to address problems often found in real life.

Course Outline

1. Introduction to Complex Systems
2. System Dynamics in Action
 - a. Applications
 - b. Principles for Successful Use of Systems Dynamics
3. The Modeling Process
 - a. Purpose
 - b. The Client and the Modeler
 - c. Steps of Modeling Process
 - d. Model Iteration
 - e. Overview of the Modeling Process
4. Structure and Behavior of Dynamic Systems
 - a. Fundamental Modes of Dynamic Behavior
 - b. Interactions of the Fundamental Modes
 - c. Other Modes of Behavior
5. Tools for Systems Thinking
 - a. Causal Loop Diagrams
 - b. Stocks and Flows
 - c. Dynamics of Stocks and Flows
 - d. Dynamics of Simple Structures
6. The Dynamics of Growth
 - a. S-Shaped Growth: Epidemics, Innovation Diffusion, and the Growth of New Products
 - b. Path Dependence and Positive Feedback
7. Tools for Modeling Dynamic Systems
 - a. Delays
 - b. Co-flows and Aging Chains
 - c. Modeling Decision Making
 - d. Formulating Nonlinear Relationships
 - e. Modeling Human Behavior: Bounded Rationality or Rational Expectations?
 - f. Forecasts and Fudge Factors: Modeling Expectation Formation
8. Instability and Oscillation

- a. Supply Chains and the Origin of Oscillations
 - b. The Manufacturing Supply Chain
 - c. The Labor Supply Chain and the Origin of Business Cycles
 - d. The Invisible Hand Sometimes Shakes: Commodity Cycles
9. Model Testing
 10. Challenges for the Future

Suggested Textbooks

“Business Dynamics: Systems Thinking and Modeling for a Complex World,” John D. Sterman, McGraw-Hill Inc., 2000.

The textbook is expensive, so we will find a mechanism that will allow students to share the book without violating authors’ copyrights.

Course Requirements and Grading Policy

The class will be taught as a sequence of lectures, with students being expected to read appropriate chapters from the textbook before each class. The classes will mainly be constructed as a discussion of the material that students already read. The class includes a project. Each student is responsible for suggesting a project topic, to be approved by the instructor. Each project will include the following phases: design, modeling, evaluation, and report.

Allocation of points:

Project:	40%
Midterm Exam:	20%
Final Exam:	40%

Grading:

90-100 points	A
80-89	B
70-79	C
69 and below	U

Attachment 2: Library and Departmental Consultations



J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Mirsad Hadzikadic
 From: Dr. Melanie Sorrell
 Date: 4/7/2014
 Subject: ITIS 6530/8530 Systems Dynamics

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell Date: 4/7/2014

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate x
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

This is a proposal for a new graduate course. Library holdings should be adequate to support student research for this program (see list of items held by subject heading below). Students will have access to relevant databases including INSPEC, Science Direct, Business Source Complete, Compendex, IEEE Xplore, ACM Digital Library, and the Wiley Online Library.

LC Subject Heading	Total items held
System theory	215 monographs
Systems analysis	160 monographs
Management information systems	723 monographs
Industrial management	2,148 monographs
Business logistics	333 monographs
Dynamical systems -- mathematical models	31 monographs
Systems research and behavioral science	Journal title

Melanie Sorrell

 Evaluator's Signature

4/7/2014

 Date

Lawrence Mays Ph. D.

To: Mirsad Hadzikadic <mirsad@uncc.edu>

Re: Systems Dynamics course

April 12, 2014 3:33 PM

[Hide Details](#)

1

Dear Mirsad,

The Bioinformatics and Genomics Department enthusiastically endorses the new Systems Dynamics course.

Larry Mays

[See More](#) from Hadzikadic, Mirsad

From: "Ozelkan, Ertunga" <Ertunga.Ozelkan@uncc.edu>
Subject: RE: Systems Dynamics Course
Date: September 26, 2014 at 1:44:01 PM EDT
To: "Hadzikadic, Mirsad" <mirsad@uncc.edu>

Mirsad,

We do not have any issues with the proposed course.
I believe it may serve as a good elective for some of our graduate students.
Best wishes,

Ertunga

Dr. Ertunga C. Ozelkan, Ph.D. | Interim Chair & Associate Professor,
Systems Engineering and Engineering Management ☞ Associate Director,
Center for Lean Logistics and Engineered Systems ☞ UNC Charlotte | Room:
Cameron 236 (Moved Due to Renovation)
9201 University City Blvd. | Charlotte, NC 28223
Phone: 704-687-1952 | Fax: 704-687-0968 | ecozelka@uncc.edu
<http://coefs.uncc.edu/ecozelka> | <http://seem.uncc.edu> |
<http://www.uncc.edu>

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From: "Cukic, Bojan" <bcukic@uncc.edu>
Subject: RE: Systems Dynamics course
Date: September 28, 2014 at 12:21:13 PM EDT
To: "Hadzikadic, Mirsad" <mirsad@uncc.edu>

Dear Mirsad,

I am pleased to see your request to introduce System Dynamics Course to the students in our College. With the growing complexity of today's computational processes and their implementation, resilience, coordination, adaptivity and complex interactions are becoming essential requirements. Deeper understanding of dynamical systems and their role in computation is essential. I note that our current courses do not offer the breadth and depth of the topic. Therefore, I enthusiastically support the introduction of the new course. I am sure computer Science students will find it equally interesting as will the students in your Department.

Please let me know if you have any additional questions.

Regards,

Bojan

Bojan Cukic
Professor and Chair
Department of Computer Science
University of North Carolina at Charlotte

Attachment 3: Proposed Catalog Copy

ITIS 6530/8530 Systems Dynamics (3) Prerequisite: Full graduate standing or department approval. Systems Dynamics introduces students to systems thinking and the systems dynamics world view, tools for eliciting and mapping the structure and dynamics of complex systems, tools for modeling and simulation of complex systems, and procedures for testing and improving models. The course helps students outline and evaluate dynamic relationships and factors that influence organizations' performance, market position, decision-making, and policy evaluations. The course integrates concepts across information systems, computer science, business, engineering, economics, and social sciences. The course is based on 3-hour weekly lectures and hands-on project assignment. (On demand)