ITEM # 13AA

Biomedical Engineering

http://ecs.utdallas.edu/BME/

Faculty

Professors: John H. L. Hansen, Philipos Loizou, Raimund Ober, Mathukumalli Vidyasagar, Li Zhang
Associate Professors: Dinesh Bhatia, Jinming Gao
Assistant Professors: Leonidas Bleris, Walter Hu, Hyun-Joo Nam

Adjunct Faculty (UT Southwestern and UT Dallas)
List joint-assignments here

Comment [SRK1]: As seen in UTA's catalog: http://www.uta.edu/gradcatalog/2010/biomedical_engineering

Objectives

The Biomedical Engineering Program is jointly offered by The University of Texas at Dallas, The University of Texas at Arlington, and The University of Texas Southwestern Medical Center at Dallas. The program coordinates research and teaching activities of many departments on all three campuses.

Comment [SRK2]:

The objective of the Ph.D. Program in Biomedical Engineering is to train exceptional persons to become leaders in the field through high quality original research work, supplemented as appropriate by a broad range of interdisciplinary courses. The new generation of biomedical engineers will address fundamental scientific questions, provide answers to critical problems and develop novel applications with commercial potential. The opportunities for interdisciplinary research and course work in several branches of engineering coupled with the life sciences will allow the graduates of this program to tackle complex life sciences-related problems in novel ways and to create solutions for the future.

Comment [SRK3]: Modified from UTSW's catalog: http://www.utsouthwestern.edu/vgn/images/portal/cit_56417/27/51/343404Bio_Eng.pdf

The objective of the MS degree program in Biomedical Engineering is to produce BME graduates who will be capable of undertaking challenging BME-related projects. The primary educational objective of the M.S. program is to expose students to the latest developments in biomedicine and to provide them with the appropriate tools to understand and contribute further to these developments. The M.S. degree program will provide the necessary education and immediately applicable skills that will enable both recent baccalaureate graduates and experienced biomedical engineers to develop new life science related technologies and applications.

Facilities

The Engineering and Computer Science Building and the new Natural Science and Engineering Research Laboratory provide extensive wet lab, fabrication, instrumentation, and high performance computing facilities to foster biomedical engineering and nano-technology research. A Class 10000 microelectronics clean room facility, including e-beam lithography, sputter deposition, PECVD, LPCVD, etch, ash and evaporation, is available for student projects and research. In addition to the facilities on campus, students in this program will also have an opportunity to work closely with researchers in the UT Southwestern Medical School.

Master of Science in Biomedical Engineering

Admission Requirements

The University's general admission requirements are discussed here.

~~The Joint Graduate Studies Committee in Biomedical Engineering (UT Southwestern/UT Arlington/UT Dallas) constitutes the admissions committee for the program.~~

A student lacking undergraduate prerequisites for graduate courses in biomedical engineering must complete these prerequisites or receive approval from the graduate adviser and the course instructor. An entrance examination may be required. Specific admission requirements follow.

The student entering the M.S.B.M.E. program should meet the following guidelines:

- An undergraduate preparation equivalent to a baccalaureate in a field of engineering or the sciences,
- A grade point average in upper-division quantitative course work of 3.0 or better on a 4-point scale, and
- GRE scores of 500, 700 and 4 for the verbal, quantitative and analytical writing components, respectively, are advisable based on our experience with student success in the program.

Applicants must submit three letters of recommendation from individuals who are able to judge the candidate's probability of success in pursuing a program of study leading to the master's degree. Applicants must also submit an essay outlining the candidate's background, education and professional goals.

Degree Requirements

The University's general degree requirements are discussed here.
The M.S.B.M.E. requires the completion of a minimum of 33 semester hours.
All students must have an academic advisor and an approved degree plan.
For the M.S.B.M.E program, all students must pass the following courses with a grade of B- or better:

- BMEN 6376 Lecture Course in Biomedical Engineering Applications
- BMEN 6373 Anatomy and Human Physiology for Engineers
- BMEN 6374 Genes, Proteins and Cell Biology for Engineers

The M.S.B.M.E. program has both a thesis and a non-thesis option. All part-time M.S.B.M.E. students will be assigned initially to the non-thesis option. Those wishing to elect the thesis option may do so by obtaining the approval of a faculty thesis supervisor. Research and thesis hours cannot be counted in a M.S.B.M.E. degree plan unless a thesis is written and successfully defended.
Students must achieve an overall GPA of 3.0 or better, a GPA of 3.0 or better in their core MSBME classes, and a grade of B- or better in all their core MSBME classes in order to satisfy their degree requirements.
All full-time, supported students are required to participate in the thesis option.

Doctor of Philosophy in Biomedical Engineering

Admission Requirements

The University's general admission requirements are discussed here.
The Ph.D. in Biomedical Engineering is awarded primarily to acknowledge the student's success in an original research project, the description of which is a significant contribution to the literature of the discipline. Applicants for the doctoral program are therefore selected by the Biomedical Engineering Program Graduate Committee on the basis of research aptitude, as well as academic record. Applications for the doctoral program are considered on an individual basis.

The following are guidelines for admission to the Ph.D. program in Biomedical Engineering:

- A master's degree in engineering or one of the sciences from an accredited U.S. institution, or from an acceptable foreign university. Consideration will be given to highly qualified students wishing to pursue the doctorate without satisfying all of the requirements for a master's degree.
- A grade point average in graduate course work of 3.5 or better on a 4-point scale.
- GRE scores of 500, 700 and 4 for the verbal, quantitative and analytical writing components, respectively, are advisable based on our experience with student success in the program.

Applicants must submit three letters of recommendation on official school or business letterhead or the UTD Letter of Recommendation Form from individuals who are familiar with the student's record and able to judge the candidate's probability of success in pursuing doctoral study in biomedical engineering.
Applicants must also submit a narrative describing their motivation for doctoral study and how it relates to their professional goals.
For students who are interested in a Ph.D. but are unable to attend school full-time, there is a part-time option. The guidelines for admission to the program and the degree requirements are the same as for full-time Ph.D. students.
All students must have an academic adviser and an approved plan of study.

Degree Requirements

The University's general degree requirements are discussed here.

Each program for doctoral study is individually tailored to the student's background and research objectives by the student's supervisory committee. The program will require a minimum of 75 semester credit hours beyond the baccalaureate degree. These credits must include at least 18 semester hours of graduate level courses beyond the baccalaureate level in the major concentration. All PhD students must demonstrate competence in the Master's level core courses in their research area. All students must have an academic advisor and an approved plan of study.

Also required are:

- A research oriented oral qualifying examination (QE) demonstrating competence in the Ph.D. candidate's research area. A student must make an oral presentation based on a review of 2 to 4 papers followed by a question-answer session. A student entering the Ph.D. program with a M.S.B.M.E. must pass this exam within 3 long semesters, and a student entering without an M.S.B.M.E. must pass this exam within 4 long semesters. A student has at most two attempts at this qualifying exam. The exam will be given during the fall and spring semesters.
- A comprehensive exam consisting of: a written dissertation proposal, a public seminar, and a private oral examination conducted by the Ph.D. candidate's supervising committee.
- Completion of a major research project culminating in a dissertation demonstrating an original contribution to scientific knowledge and engineering practice. The dissertation will be defended publicly. The rules for this defense are specified by the Office of the Dean of Graduate Studies. Neither a foreign language nor a minor is required for the Ph.D. However, the student's supervisory committee may impose these or other requirements that it feels are necessary and appropriate to the student's degree program.

Note: In degree plan descriptions, course numbers followed by a D are offered at U.T. Southwestern.

Biomedical Engineering Course Descriptions

BMEN 6373 Anatomy and Human Physiology for Engineers (3 semester hours) This course provides an introduction to anatomy and human physiology for engineers and other non-life-scientists. Topics include nervous system, muscle and cardiac function, digestive system, immune system. (3-0) Y
BMEN 6374 Genes, Proteins and Cell Biology for Engineers (3 semester hours) This course provides an introduction to principles of modern molecular and cellular biology for engineers and other non-life-scientists. Topics include genes, protein structure and function, organization of cells and cellular trafficking. (3-0) Y
BMEN 6375 Techniques in Cell and Molecular Biology (3 semester hours) Introduction to various cell and molecular laboratory techniques including DNA recombinant technology, protein biochemistry, structural biology, and molecular biology. Intended for engineers and other non-life-scientists. Prerequisite: BMEN 6374 or instructor permission. (3-0) Y.
BMEN 6376 Lecture Course in Biomedical Engineering (3 semester hours) This course provides an introduction to different areas of biomedical engineering. A special emphasis will be placed on research topics that are actively pursued at UTD. (3-0) Y
BMEN 6377 Introduction to Protein Engineering (3 semester hours) Development of proteins with practical utility will be discussed using examples and case studies taken from the current literature. Prerequisites: BMEN 6374 or by instructor permission. (3-0) Y.
BMEN 6380 Introduction to Cellular Microscopy (3 semester hours) Image formation, diffraction, labeling techniques, fluorescence and image processing techniques will be introduced. (3-0) Y
BMEN 6381 Advanced Concepts in Microscopy (3 semester hours) Continuation of BMEN 6380, with emphasis on advanced approaches such as vectorial diffraction, stochastic aspects of image formation and analysis. Prerequisites: BMEN 6380 or by instructor permission. (3-0) Y.
BMEN 6382 Systems Biology (3 semester hours) An interdisciplinary approach to biology. It explores experimental, theoretical, and computational approaches from mathematics, physics, and engineering for the understanding and analysis of biological problems. Prerequisites: BMEN 6374 or instructor permission. (3-0) Y.
BMEN 6383 Biological Networks (3 semester hours) This course will examine the fundamental principles and associated structure of a range of biological networks at the molecular, cellular, and population levels. Prerequisites: BMEN 6374 or instructor permission. (3-0) Y.
BMEN 6384 Stochastic Methods in Biomedical Engineering (3 semester hours) This course will examine stochastic approaches to several problems in genomics and proteomics, such as sequence similarity detection, gene and protein classification, and structure prediction. Techniques such as Markov and hidden Markov models will be introduced in the course and applied to these problems. (3-0) Y.
BMEN 6V70 Research In Biomedical Engineering (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) R
BMEN 6V71 Seminars In Biomedical Engineering (1-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([1-9]-0) R
BMEN 6V87 Special Topics in Biomedical Engineering (1-9 semester hours) (May be repeated for credit.) ([1-9]-0) S
BMEN 6V40 Individual Instruction in Biomedical Engineering (1-9 semester hours) (May be repeated for credit.) ([1-9]-0) R
BMEN 6V99 Dissertation (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S
BMEN 7390 Works in Progress (1 semester hours) Presentation of research results obtained during dissertation research. (May be repeated for credit.) (2-0) Y.
BMEN 7391 Journal Club (2 semester hours) Presentation and discussion of scientific literature in biomedical engineering. (May be repeated for credit.) (2-0) Y.
BMEN 7V87 Special Topics in Biomedical Engineering (1-9 semester hours) (May be repeated for credit) ([1-9]-0) S
BMEN 7V88 Seminars In Biomedical Engineering (1-9 semester hours) (May be repeated for credit.) ([1-9]-0) R

BMEN 8V40 Individual Instruction in Biomedical Engineering (1-9 semester hours) (May be repeated for credit.) ([1-9]-0) R
BMEN 8V70 Research In Biomedical Engineering (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) R
BMEN 8V99 Dissertation (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S

Item #13NNN

New Program Request Form for Bachelor's and Master's Degrees

Directions: An institution shall use this form to propose a new bachelor's or master's degree program. In completing the form, the institution should refer to the document *Standards for Bachelor's and Master's Programs,* which prescribes specific requirements for new degree programs. Note: This form requires signatures of (1) the Chief Executive Officer, certifying adequacy of funding for the new program; (2) a member of the Board of Regents (or designee), certifying Board approval, and (3) if applicable, a member of the Board of Regents or (designee), certifying that criteria have been met for staff-level approval. Note: An institution which does not have preliminary authority for the proposed program shall submit a separate request for preliminary authority. That request shall address criteria set in Coordinating Board rules Section 5.24 (a).

Information: Contact the Division of Academic Affairs and Research at 512/427-6200 for more information.

Administrative Information

1. Institution: **The University of Texas at Dallas**

2. Program Name – Show how the program would appear on the Coordinating Board's program inventory (*e.g., Bachelor of Business Administration degree with a major in Accounting*):

Master of Science in Systems Engineering & Management

3. Proposed CIP Code: 14.2701, Systems Engineering

4. Brief Program Description – Describe the program and the educational objectives:

The current business environment requires that engineers in industry and government be trained to be good managers and leaders, and to be good stewards of corporate or government resources. Conversely, managers in industry need a better appreciation and understanding of technology and how to manage large and complex engineering projects. They are all also expected to be cognizant of the broader impact of their management and engineering activities on their companies and the society at large.

Traditional areas of study in engineering have involved the study of "small" systems – micro-, nano-, info-, and bio- systems. However, there has over the years been a large and growing unmet need, as evidenced by discussions with our industry partners at Texas Instruments, Raytheon, EDS-HP, Rockwell and others, as well as, presentations at conferences, such as those organized by the MIT Enterprise Systems Division, June 15th 2009, for formalized education in engineering and management of increasingly complex "macro" systems with a large number of inter-dependent parts that have a very significant organizational or societal impact. These

areas are at the intersection of the traditionally separate disciplines of engineering and management.

According to the National Center for Education Statistics, which defines the national Classification of Instructional Programs (CIP) codes, Systems Engineering is a "program that prepares individuals to apply mathematical and scientific principles to the design, development and operational evaluation of total systems solutions to a wide variety of engineering problems, including the integration of human, physical, energy, communications, management, and information requirements as needed, and the application of requisite analytical methods to specific situations."[1] The International Council on Systems Engineering (INCOSE) provides further detail on the difference between systems engineering and traditional specialty engineering: "Systems engineering is concerned with the overall process of defining, developing, operating, maintaining, and ultimately replacing quality systems. Where other engineering disciplines concentrate on the details of individual aspects of a system (electronics, mechanics, ergonometric, aerodynamics, software, etc.), systems engineering is concerned with the integration of all of these aspects into a coherent and effective system. Systems engineers concentrate their efforts on the aspects of the engineering process (requirements definition, top-level functional designs, project management, life cycle cost analysis...) that serve to organize and coordinate other engineering activities. The systems engineer is the primary interface between management, customers, suppliers, and specialty engineers in the systems development process."[2]

The need for systems engineers has come to the attention of the national press. A 2008 article on the aging systems engineering workforce commented that systems engineering involves "accurately assessing at the outset whether the technological goals are attainable and affordable, then managing the engineering to ensure that hardware and software are properly designed, tested and integrated", and goes on to say, "Without [systems engineering], projects can turn into chaotic, costly failures."[3]

The objective of the UT Dallas Master of Science degree program in Systems Engineering & Management (MS in SEM) is to produce graduates who will be capable of undertaking challenging projects that will encompass wide ranging scientific, engineering and management disciplines. In other words, the objective of the program is to develop an "integrated systems engineering and systems management" skill set among the students who go through this program.

This program is targeted towards engineers with a number of years of industry experience, as well as towards graduates with a fresh bachelor's degree.

The MS in SEM degree will require a total of 36 credit hours consisting of 12 courses in the non-thesis option or 10 courses plus 6 hours of thesis credit for the thesis option.

[1] National Center for Education Statistics, http://nces.ed.gov/ipeds/cipcode/cipdetail.aspx?y=55&cip=14.2701

[2] International Council on Systems Engineering, http:// www.incose.org/educationcareers/careersinsystemseng.aspx

[3] Philip Taubman, "Top Engineers Shun Military; Concern Grows," New York Times, June 25, 2008.

The program being proposed here has enough flexibility built into it to accommodate different backgrounds among incoming students, allowing students to pick up areas in which they are deficient, while still guaranteeing core competency in systems engineering and engineering management.

Course Requirements (see Table 3 page 8)

Required Courses: Students will be required to take at least 4 courses (a total of 12 credit hours) from an offered set of 8 courses in Systems Engineering (SYSM). Two of the courses must be from IA and two from IB in Table 3. Thus the 4 required courses contribute a total of 12 credit hours towards the MS degree.

Prescribed Elective Courses will consist of an additional 4 distinct courses (a total of 12 credit hours) from a core set of 20 courses (Table 3), which have not already been taken towards the required 4 courses. At least two of these courses must be chosen from either IA or IIA in Table 3.

Free Elective Courses: For the free electives students will be able to take any 4 additional and distinct courses of the remaining 12 core courses that have not already been taken as required courses or prescribed elective courses. Students will also be able to take additional free elective courses that are already being offered in management or in engineering that will allow "concentration" or "specialization" in specific industry sectors.

5. Administrative Unit – Identify where the program would fit within the organizational structure of the university (e.g., The Department of Electrical Engineering within the College of Engineering):

A joint program between

The Erik Jonsson School of Engineering and Computer Science (ECS), and

The School of Management (SOM)

6. Proposed Implementation Date – Report the first semester and year that students would enter the program:

Fall Semester 2010

7. Contact Person(s) – Provide contact information for the person who can answer specific questions about the program:

Name: Dr. Mark W. Spong
Title: Dean, ECS
E-mail: mspong@utdallas.edu
Phone: 972-883-2974

Dr. Hasan Pirkul
Dean, SOM
hpirkul@utdallas.edu
972-883-6813

Program Information

I. Need

Note: Complete I.A and I.B only if preliminary authority for the program was granted more than four years ago. This includes programs for which the institution was granted broad preliminary authority for the discipline.

A. Job Market Need – Provide short- and long-term evidence of the need for graduates in the job market.

Systems Engineering & Management (SEM) is an interdisciplinary field between Engineering and Management that focuses on the engineering & management of complex engineering projects. For large, complex projects, SEM deals with issues such as automatic control of machinery, logistics and the coordination of different teams, work processes and tools to handle such projects. It overlaps with both technical and human centered disciplines, such as Control Engineering and Project Management.

Data compiled by the Greater Dallas Chamber of Commerce (GDC), and the Texas Workforce Commission (TxWFC) in 2007 across various High-tech Sectors that are relevant to SEM, excluding the Defense, Energy and Healthcare Sectors, indicates an engineering population in the DFW Metroplex well in excess of 200,000. Even if 5 % of these engineers are conservatively assumed to be Systems Engineers that translates to about 10,000. Again, if we were to conservatively assume that these 10,000 professionals renew their skills every 10 years, which creates a potential Total Available Market (TAM) of 1000 engineers and managers every year that would need SEM training every year in the DFW area alone. Of this population of engineers, the MS SEM Program is targeted towards engineers with 4 to 5 years of experience.

Again, using the GDC and TxWFC data, DFW area represents about 40 % of the state's high-tech population, not including the defense, energy and healthcare sectors, significantly larger than any other city in the state. DFW area is already the 4th largest in the country by population and GDP. It is also home to the headquarters of about 25 large corporations, and also home to major divisions of a large number of companies not head-quartered in the region. Cumulative job growth, as well as population growth in the DFW area, over the next 10 years, is expected to be twice the national average.

Also according to the Bureau of Labor Statistics (BLS) and the American Electronics Association (AeA) – "Contrary to the hype about rampant outsourcing, high-tech has many job openings, as demonstrated by the BLS's 2.5 % unemployment rate for computer scientists and under 2% for engineers."[1]

While interests in this new discipline have been verified in discussions with local companies – TI, EDS-HP, Raytheon, Rockwell and others – along with an initial interest in potential commitment of employees to send through this program, specific hard numbers to indicate potential future job market for this discipline are provided above.

[1] *William T. Archey, President& CEO, American Electronics Association (AeA), April 24, 2007, Cyberstates 2007.*

Because the field of Systems Engineering & Management comprises a wide range of engineering disciplines, it potentially represents a large portion of the engineering population. The graduates of the UT Dallas SEM program will be employed by large corporations in various industries, and to mention just a few examples – defense, aerospace, and space systems; transportation; telecom and computers networks and systems integration and services; semiconductors and electronics; healthcare systems; sustainable and intelligent energy systems; etc.

B. Student Demand – Provide short- and long-term evidence of demand for the program.

The American Society for Engineering Education reports that the Master's enrollment in industrial and manufacturing engineering grew steadily from around 5,000 in 1999 to more than 6,300 in 2008.[4] Based upon the assumption that many industrial engineering students have a systems focus, student demand for systems engineering and closely related fields is growing at a slower rate than will probably be necessary for replacement of engineers who are now nearing retirement age. However, student demand is a trailing, not a leading, indicator of perceived job opportunities.

Several local industry representatives have been contacted and subsequently confirmed their interest in this program. Sample letters of support from some of those representatives are included in Appendix 1.

Also, over the last several years, SMU and other local universities began offering engineering-only focused courses. SMU offers an MS in Systems Engineering. No programs in the North Texas Region exist that combine systems engineering and systems management, leveraging the strengths of both the School of Engineering and the School of Management, except perhaps a dual-track program in MS Engineering Systems (MSES) and MBA launched in May 2009 by the University of North Texas (UNT) or the UNT MS in Engineering Systems program that has a 15-hour management curriculum offered at their home campus and at the Collin Higher Education Center in McKinney; however, this program is a traditional engineering technology program. Similarly, the Systems Engineering programs offered by SMU and UT Austin are offered only through their engineering schools and do not provide any business education.

A summary chart of data from the Coordinating Board's PREP online database comparing programs from other Texas schools that could even remotely be considered similar to the proposed UTD Program is provided below, showing significant interest in this general area.

				Declared Majors				Degrees Awarded		
	Institution	**Program Name**	**CIP Code**	**2005**	**2006**	**2007**	**2008**	**05-'06**	**06-'07**	**07-'08**
1	Tx A&M	Industrial Engineering	14350100	441	548	621	755	42	42	57
2	Tx Tech	Engineering Management	14999901	32	27	48	58	11	18	12
3	UT Arlington	Engineering Management	14999901	28	29	33	31	10	9	12
4	UT Austin	Engineering Management	14999901	-	-	-	-	33	20	34
5	UT Pan Am	Engineering Management	14999901	-	-	10	14	-	1	2

[4] *Profiles of Engineering Colleges*, American Society for Engineering Education, 2009

6	Lamar U	Engineering Management	14999901	5	8	2	1	1	3	1
7	U of H	Ops Mgmt & Supervision	52020500	211	209	226	282	121	75	86
8	UNT	Engineering Technology	15000000	53	34	38	32	7	9	7

The highly popular program at Texas A&M is in the area of Industrial Engineering, which might be thought of as a subset of the Systems Engineering & Management Program being proposed by UTD. The Texas A&M program, while highly popular, is offered only out of the engineering school and does not include any management disciplines that are so crucial in the mid- to upper- management of large projects.

The same is true of the Engineering Management degrees offered by Texas Tech, UT Arlington, UT Pan American and Lamar University – all offered entirely out of schools of engineering. This is true also of the traditional Engineering Technology program offered by the University of North Texas. The degree offered by UT Austin, is out of the Engineering School also, but does incorporate some business oriented courses.

The degree offered by the University of Houston is in the area of Operations Management and Supervision, which again could be thought of as a subset of the broad area of Systems Engineering and Management. Also, the program is offered entirely out of the Business School, with no engineering involvement.

The UTD proposed program will be unique in that, both advanced engineering and advanced management education will be provided together in MS in SEM, leveraging the strengths of two very quantitatively strong and highly ranked programs in the Schools of Management and Engineering. Students will not be required to pursue an MBA to get the complementary business education. The program is unique in that it is a true 50/50 collaboration between the two schools.

C. Enrollment Projections – Use this table to show the estimated cumulative headcount and full-time student equivalent (FTSE) enrollment for the first five years of the program. (*Include majors only and consider attrition and graduation*.)
Based upon strong interests expressed by a number of area companies such as Texas Instruments, Rockwell, Raytheon, EDS-HP and other members of the SOM and ECS Advisory Boards, we expect to have a commitment from these companies to send students through the program at any given point in time. These discussions suggest the following progression for enrollment:.

Table - 1(#)

Year	1	2	3	4	5
Headcount	20	45	55	65	75
FTSE	15	30	45	55	60

(#) Table-1 assumes, students graduating in 2 years and attrition rate of 10 %. This attrition is anticipated to be primarily due to industry participants in the program

moving elsewhere, since these are expected to be senior, as well high-performing people in member companies.

II. Quality

A. **Degree Requirements** – Use this table to show the degree requirements of the program. *(Modify the table as needed; if necessary replicate the table for more than one option.)*

1. **Course Requirements:** The MS in SEM degree (non-thesis option) will require a total of *12 courses for a total of 36 credit hours*.

Table – 2 SEM Non-Thesis Option Degree Requirements

Category	Semester Credit Hours	Clock Hours
General Education Core Curriculum *(bachelor's degree only)*	N/A	
Required Courses	12	
Prescribed Electives	12	
Free Electives	12	
Other *(Specify, e.g., internships, clinical work)*	(if not included above)	
TOTAL	36	

2. **Thesis Option:** An alternative to 36 credit hours required for the MS SEM degree, would be to take 30 credit hours of courses and, in addition, write a Master's Thesis, in lieu of the remaining 6 credit hours.

B. **Curriculum** – Use these tables to identify the required courses and prescribed electives of the program. Note with an asterisk (*) courses that would be added if the program is approved. *(Add and delete rows as needed. If applicable, replicate the tables for different tracks/options.)*

Again, the program being proposed here has enough flexibility built into it to accommodate different backgrounds among incoming students, allowing students to choose areas in which they are deficient, rather than having them all go through a prescribed set of courses.

The Core Curriculum will consist of 20 Courses **(Table - 3)**.

1. All Courses listed below are 3 credit hours each

2. Courses with (*) are new courses
3. All non-asterisked courses already exist and are being offered under other prefixes.
4. Students who have taken other existing courses with other prefixes will be allowed to transfer to this program.

Table - 3

Prefix & Number	Core Curriculum	Credit
IA		
SYSM6301	Systems Engineering Architecture & Design (*)	3
SYSM6302	Quantitative Risk, Probability, Stochastic Processes	3
SYSM6303	Systems Engineering Risk & Decision Analysis	3
SYSM6304	Dynamic Systems Modeling & Analysis (*)	3
IB		
SYSM6305	Systems Project Management	3
SYSM6306	Engineering Economics	3
SYSM6307	Human Factors in Complex Organizations	3
SYSM6308	Manufacturing and Service Systems Planning and Analysis	3
IIA		
SYSM6309	Dynamics of Complex Structures	3
SYSM6310	Systems and Control Theory	3
SYSM6311	Software Maintenance, Evolution and Re-engineering	3
SYSM6312	Advanced Requirements Engineering	3
SYSM6313	Software Testing, Validation, Verification	3
SYSM6314	Modeling and Simulation of Engineering Systems	3
IIB		
SYSM6315	Entrepreneurship	3
SYSM6316	Innovation within the Corporation	3
SYSM6317	The Management of High Tech Products (*)	3
SYSM6318	Marketing Management, Marketing Systems Analysis	3
SYSM6319	Business Economics	3
SYSM6320	Strategic Management	3

a) ***Required Courses*****:** Students will be required to take at least 2 courses from Group IA and at least 2 courses from Group IB (a total of 6 credit hours) out of an offered set of 4 courses from Groups IA and IB**.** Thus the 4 required courses contribute a total of 12 credit hours towards an MS degree.

b) ***Prescribed Elective Courses*** will consist of an additional 4 distinct courses (a total of 12 credit hours) from the core curriculum of 20 courses, which have not already been taken towards the required 4 courses. At least two of these prescribed elective courses must be in Group IA or IIA.

c) ***Free Elective Courses*:** For the free electives, students will be able to take any 4 additional and distinct courses of the remaining 12 core courses that have not already been taken as required courses or prescribed elective courses. They may also take additional free elective courses that are already being offered in engineering or in management that will allow "concentration" or "specialization" in specific industry sectors.

Total Semester Credit Hours:
12 (Required) +12 (Prescribed Electives) +12 (Free Electives) = 36

d) ***Thesis Option:*** Alternatively, students who choose the thesis option will be able to substitute 6 hours of free electives with a written thesis in addition to the 12 required credit hours and 12 prescribed elective credit hours.

C. **Academic Council** – Due to the unique nature of this program and the 50/50 joint collaboration between Engineering and Management Schools, academic leadership and oversight for this program will be provided by a committee consisting 4 faculty from each school and more specifically by the Co – Program Heads of this program, one from each school **(Table-4).**

Table - 4

	Faculty Name	School
1	Dr. Milind Dawande, *Program Co-Head*	SOM
2	Dr. Mathukumalli Vidyasagar, *Program Co-Head*	ECS
3	Dr. Alain Bensoussan	SOM
4	Dr. Duncan MacFarlane	ECS
5	Dr. Ozalp Ozer	SOM
6	Dr. Rajiv R. Shah	SOM
7	Dr. Lakshman Tamil	ECS
8	Dr. Bhavani Thuraisingham	ECS

D. Faculty – Use these tables to provide information about Core and Support faculty. Add an asterisk (*) before the name of the individual who will have direct administrative responsibilities for the program. *(Add and delete rows as needed.)*

Table - 5

Name of Core Faculty and Faculty Rank	Highest Degree and Awarding Institution	Courses Assigned in Program	% Time Assigned To Program
Dr. Farokh Bastani	Ph.D. In Computer Science	SYSM6313	25%

Professor	UC Berkeley		
Dr. Alain Bensoussan Distinguished Research Professor	Ph.D. in Mathematics University of Paris, France	SYSM6303	25%
Dr. Cy Cantrell Professor	Ph.D. in Physics Princeton University	SYSM6314	25%
Dr. Huseyin Cavusoglu Assistant Professor	Ph.D. in MIS UT Dallas	SYSM6330	25%
Dr. R. Chandrasekaran Ashbel Smith Professor	Ph.D. in Operations Research UC Berkeley	SYSM6309	25%
Dr. Kendra Cooper Associate Professor	Ph.D. In Electrical and Computer Engineering, U of British Columbia	SYSM6301	25%
Dr. Milind Dawande Professor	Ph.D. in Algorithms Carnegie Mellon University	SYSM6308	50%
Dr. Greg Dess Professor	Ph.D. in Organizational Behavior U of Washington	SYSM6314	25%
Dr. Nick Gans Assistant Professor	Ph.D. in Systems & Entrepreneurial Engineering, U of Illinois	SYSM6304	25%
Dr. R. Henderson Assistant Professor	Ph.D. in Electrical Engineering U of Michigan	SYSM6312	25%
Dr. Kamran Kiasaleh Professor	Ph.D. in Electrical Engineering USC	SYSM6310	25%
Dr. Robert Kieschnick Associate Professor	Ph.D. in Finance UT Austin	SYSM6306	25%
Dr. Nanda Kumar Associate Professor	Ph.D. in Marketing U of Chicago	SYSM6312	25%
Dr. Duncan MacFarlane Professor	Ph.D. In Electrical Engineering Brown University	SYSM6317	50%
Dr. Mathukumalli Vidyasagar, *Program Co-Head*	Ph.D. in Electrical Engineering University of Wisconsin	SYSM 6304	50%

Table - 6

Name of Support Faculty and Faculty Rank	**Highest Degree and Awarding Institution**	**Courses Assigned in Program**	**% Time Assigned To Program**
Dr. Peter Lewin Clinical Professor	Ph.D. in Economics University of Chicago	SYSM6313	25%

Dr. Shun-Chin Niu Professor	Ph.D. in Operations Research UC Berkeley	SYSM6302	25%
Dr. Ozalp Ozer Associate Professor	Ph.D. in Operations Research Columbia University	SYSM6305	25%
Dr. S. Ragunathan Professor	Ph.D. in Operations Research U of Pittsburgh	SYSM6308	25%
Mr. Bob Robb Senior Lecturer	MS in Biology University of Utah	SYSM6309	25%
Dr. Rajiv R. Shah Clinical Professor	Ph.D. in Electrical Engineering Rice University	SYSM6310	50%
Dr. I-ling Yen Associate Professor	Ph.D. in Computer Science U of Houston	SYSM6312	25%
Dr. R. Zalila-Wenkstern Associate Professor	Ph.D. in Computer Science U of Ottawa	SYSM6313	25%
Dr. Kang Zhang Professor	Ph.D. in Computer Science University of Brighton, UK	SYSM6311	25%
Dr. Laurie Ziegler Senior Lecturer	Ph.D. in Business Administration UT Arlington	SYSM6307	25%

Note – In both tables, Table-5 and Table-6, some faculty are shown assigned at 25 % and some are shown assigned at 50 %. This is due to the differences in their anticipated involvement in not only academic but also with program management and support responsibilities.

D. Students – Describe general recruitment efforts and admission requirements. Describe plans to recruit and admit students from under-represented groups for the program.

This program will participate in the general recruitment efforts of the School of Management (SOM) and the School of Engineering and Computer Science (ECS), and will have the same admission requirements as the Master's programs of these two schools.

In addition, the two schools jointly will promote this SEM program to local industry and corporations and will recruit heavily from these corporations –high performers in these companies with five to ten years of work experience in addition to their bachelor's and other masters degrees.

The two schools will also make every effort to recruit and retain underrepresented students into this program. Such efforts will include, but will not be limited to, advertising the program widely to communities and organizations with underrepresented populations; open houses, providing needed advising to such students on their academic work; and helping them on their career path. In addition, the two schools will also work with corporate partners to recruit members of under-represented communities from these companies.

E. Library – Provide the library director's assessment of library resources necessary for the program. Describe plans to build the library holdings to support the program.

The journal collection at the University of Texas at Dallas compares favorably with the collections at UT Arlington, UT Austin, and MIT. UT Dallas should add 2 additional titles during the next 3 years at the cost of $900. .

During the analysis of the book collection at the University of Texas at Dallas, the results indicated that the Library needed to increase the number of the titles available as compared to UT Austin and MIT. The Library immediately purchased 40 new titles at a cost of $5,062.

	Number of titles
UT Dallas	152+40 new titles (192)
UT Arlington	110
UT Austin	326
MIT	334

Given the shortage of book materials, the Library will need to increase spending by approximately 30 titles per year at a cost of $4,000 annually. Most of the new book titles will be purchased in electronic format using established procedures. Purchasing electronic books enables multiple customers to use the titles at one time and supports distance learning initiatives.

In summary, the graduate degree in systems engineering and management will cost the Libraries approximately $4,900 annually, plus inflation.

F. Facilities and Equipment – Describe the availability and adequacy of facilities and equipment to support the program. Describe plans for facility and equipment improvements/additions.

Current facilities are adequate to support the program. The School of Management and the School of Engineering and Computer Science buildings are both newly constructed, with cutting edge computing and other teaching facilities and technologies. Both buildings offer adequate facilities and equipment, in terms of office and classroom spaces, computing, research and teaching resources to accommodate the proposed program.

The School of Engineering and Computer Science also has extensive computer labs and facilities that can be used for this program and are considered adequate to support the program.

G. Accreditation – If the discipline has a national accrediting body, describe plans to obtain accreditation or provide a rationale for not pursuing accreditation.

Currently, the American Assembly of Collegiate Schools of Business (AACSB) is the accreditation body that accredits business school programs. Their standards for a business school can be found at http://www.aacsb.edu/accreditation/standards.asp. The School of Management was accredited by the AACSB in 2002 and will be accredited again in 2011. The management portion of the proposed MS in SEM degree program utilizes existing courses (as a part of our current MS and MBA degree programs) which meet the stated standards.

UT Dallas undergoes its standard SACS accreditation process and the new program will be integrated as part of the regular review and assessment procedures associated with this activity.

III. Costs and Funding

Five-Year Costs and Funding Sources - Use this table to show five-year costs and sources of funding for the program.

Table - 7

Five-Year Costs		**Five-Year Funding**	
Personnel[1]	$1, 800,000	Reallocated Funds	$ 1,800,000
Facilities and Equipment	$0	Anticipated New Formula Funding[3]	$ 650,000
Library, Supplies, and Materials	$25,000	Special Item Funding	$ 0
Other[2]	$0	Other[4]	$ 95,000
Total Costs	**$1, 825,000**	**Total Funding**	**$2,545,000**

Notes:
(1 The costs include the costs of faculty teaching these courses for the designated % time allocated to this program. So although no new faculty are being hired at this time, a portion of the existing faculties salaries have been accounted for in the costs as well as the reallocated funds for this particular program.
(3)Formula funding calculations: 62.19 x 18 credit hours x 5.525 (averaged SOM and ECS rate) x new students for years 3, 4, and 5.
(4) Designated tuition fee rate: 18 credit hours x $50 (averaged SOM and ECS fee) x new students for years 3, 4, and 5

Signature Page

1. Adequacy of Funding – The chief executive officer shall sign the following statement:

   I certify that the institution has adequate funds to cover the costs of the new program. Furthermore, the new program will not reduce the effectiveness or quality of existing programs at the institution.

   _____

   Chief Executive Officer Date

2. Board of Regents or Designee Approval – A member of the Board of Regents or designee shall sign the following statement:

   On behalf of the Board of Regents, I approve the program.

   _____

   Board of Regents (Designee) Date of Approval

3. Board of Regents Certification of Criteria for Commissioner of Assistant Commissioner Approval –

   For a program to be approved by the Commissioner or the Assistant Commissioner for Academic Affairs and Research, the Board of Regents or designee must certify that the new program meets the eight criteria under TAC Section 5.50 (b): The criteria stipulate that the program shall:

   (1) be within the institution's current Table of Programs;
   (2) have a curriculum, faculty, resources, support services, and other components of a degree program that are comparable to those of high quality programs in the same or similar disciplines at other institutions;
   (3) have sufficient clinical or in-service sites, if applicable, to support the program;
   (4) be consistent with the standards of the Commission of Colleges of the Southern Association of Colleges and Schools and, if applicable, with the standards or discipline-specific accrediting agencies and licensing agencies;
   (5) attract students on a long-term basis and produce graduates who would have opportunities for employment; or the program is appropriate for the development of a well-rounded array of basic baccalaureate degree programs at the institution;
   (6) not unnecessarily duplicate existing programs at other institutions;
   (7) not be dependent on future Special Item funding
   (8) have new five-year costs that would not exceed $2 million.

   On behalf of the Board of Regents, I certify that the new program meets the criteria specified under TAC Section 5.50 (b).

   _____

   Board of Regents (Designee) Date

Appendix 1 Confirmation of Support

Local industry representatives that have been contacted and who have confirmed their interest, and a potential commitment to send 15 to 20 students through this program at any given point in time are –

1.	Mr. Steve Lyle	s-lyle@ti.com
2.	Mr. Martin Izard	izzard@ti.com
3.	Mr. Alan Gatherer	gatherer@ti.com
4.	Mr. Tom Hill	tom.hill@eds.com
5.	Mr. John McDonald	John_T_McDonald@raytheon.com
6.	Ms Lynn Mortnesen	lmortensen@raytheon.com
7.	Mr. Paul Klocek	p-klocek@raytheon.com
8.	Mr. Alan Caslavka	accaslav@rockwellcollins.com

We have also included four formal letters of support.

Item #13NNN

Thomas L. Hill
Fellow

To: Coordinating Board

From: Thomas L. Hill, Director HP Enterprise Services Fellows and Distinguished Engineering

Date: September 29, 2009

Subject: Strong Support for The University of Texas at Dallas Systems Engineering and Management Program

HP Enterprise Services is excited to participate in the Systems Engineering and Management Program proposed by The University of Texas at Dallas.
We have worked closely with the curriculum development team to ensure that the course content is relevant to our industry.

The current North Texas business environment requires that engineers also be adept managers and leaders with the ability to supervise large, complex engineering projects. Unlike other degree programs in Texas, this program is the first to address this particular need as it integrates disciplines, focusing on both systems engineering and systems management.

The Systems Engineering and Management degree program is ideal for candidates with five or more years of experience, and as a result, graduates will be uniquely positioned to join large engineering management or government organizations at mid- to upper- management levels. Additionally, graduates of this program, trained to manage large systems with many interdependent parts, will provide a competitive advantage of particular interest to HP Enterprise Services.

Most importantly, the flexibility of the program provides industry partners the opportunity to tailor the degree to address current business needs, while the adaptable, interdisciplinary curriculum also allows students to gain the specific skills they require to successfully oversee complex projects. Thank you for your consideration of this proposed degree program— it will certainly be of interest to organizations in North Texas. I will make sure our organization and other organizations are ready to enroll when the program begins.

Sincerely,

Thomas L. Hill
HP Enterprise Services
H4-GF-20
5400 Legacy Drive
Plano, Texas 75924

Item #13NNN

Technology for better business outcomes.

Item #13NNN

September 25, 2009

Dr. Rajiv Shah
School of Management
The University of Texas at Dallas
800 West Campbell Road SM 43
Richardson, Texas 75080-3021

Dear Dr. Shah,

This letter is offered in strong support for The School of Management and The Erik Jonsson School of Engineering and Computer Science's proposed degree program, Systems Engineering and Management. Currently there is an industry need for trained leadership with experience in both engineering and management. This degree program, using an interdisciplinary approach, focuses on the engineering and management of complex engineering projects, such as the automatic control of machinery; logistics and the coordination of different teams; and implementing work processes and tools to handle such projects.

The degree program addresses both the technical and human centered disciplines by covering issues such as control engineering and project management. This unique program is both innovative and flexible, allowing students to concentrate on a host of disciplines ranging from healthcare and defense, both of particular interest to ELCAN, to macro-economic and financial services. The adaptability of the program allows companies the opportunity to target specific needs within their corporation by training future leaders in that area.

In my view, the ideal candidates for this degree program would have five to ten years of industry experience and the desire to transcend their discipline while enhancing their engineering skill-set. As the program becomes established, I anticipate that ELCAN would encourage and support enrollment in this degree program as part of our ongoing talent development activities. Beyond ELCAN, I believe this program aligns well with the interests of the large number of high-tech organizations in the North Texas region.

Sincerely,

Paul Klocek
General Manager
ELCAN Optical Technologies
a Raytheon Company

Item #13NNN

Texas Instruments Incorporated

September 30, 2009

Dr. Rajiv Shah
School of Management
The University of Texas at Dallas
800 West Campbell Road SM 43
Richardson, Texas 75080-3021

Dear Dr. Shah,

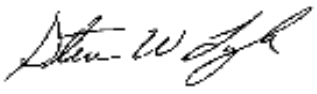
As an industry partner, you know that I have had the opportunity to work closely with both The School of Management and The Erik Jonsson School of Engineering and Computer Science to establish the proposed interdisciplinary degree program, Systems Engineering and Management. Today I write in strong support of this program which satisfies a growing industry need for trained business leaders with formalized education in both engineering and management.

By focusing on a candidate's specific needs, this unique program's flexible curriculum provides experienced candidates the necessary tools to manage complex "macro" systems. Graduates of the program will be equipped to oversee these challenging projects that require knowledge of scientific, engineering, and management disciplines.

As the program becomes established, I anticipate that Texas Instruments would encourage and support enrollment in this degree program as part of our ongoing talent development activities.

Please keep us advised of your progress in the development and implementation of this exciting new program.

Sincerely,



Steve Lyle
Manager
Education, Workforce Development & Diversity

Item #13NNN

September 29, 2009

Dr. Rajiv Shah
School of Management
The University of Texas at Dallas
800 West Campbell Road SM 43
Richardson, Texas 75080-3021

Dear Dr. Shah,

I am writing to express my support for the Systems Engineering and Management joint degree program collaboratively created by The School of Management and The Erik Jonsson School of Engineering and Computer Science. Successful management of large, complex engineering projects is critical for Raytheon, and in our industry, there is a need to formally educate leaders who can oversee these multifaceted projects.

This unique program leverages the strengths of both the Schools of Management and Engineering to train students based on their areas of need regarding systems engineering and systems management. In this way, experienced engineers and managers can focus on learning applicable skills that will enable them to architect, research, develop, engineer, manage, execute, and deliver complex systems programs while managing large teams and budgets.

Raytheon Intelligence & Information Systems, as well as other businesses in the North Texas region, will certainly take advantage of this program in terms of talent development and hiring of graduates. The Systems Engineering and Management degree program provides future business leaders the opportunity to pursue an interdisciplinary course of study critical for the continued success and growth of high-tech organizations.

Sincerely,

John T. McDonald
Chief Engineer/Chief Architect
RTN IIS Engineering
972.205.7360 (office)
214.244.2691 (BB)
RTN Six Sigma Expert
Raytheon Certified Architect

Proposed Academic Certificates Program

Title: *Certificates in Systems Engineering & Management (SEM)*
School: *School of Management (SOM) and*
The Jonsson School of Engineering & Computer Science (ECS)

Contacts: *SOM – Dr. Rajiv R. Shah; ECS – Dr. Duncan MacFarlane*
Rajiv.shah@utdallas.edu; Duncan.macfarlane@utdallas.edu

Implementation Date: *Spring 2010*

Introduction/Description: Traditional state-of-the-art areas of study in engineering and associated management in the last few decades have involved the study of small or "tiny" systems – micro-, nano-, info-, and bio- systems. However, there has been a large, growing "unmet" need for formalized education in engineering, management, as well as in other areas of more and more complex, larger and larger "macro" systems that involve a large number of interconnected components and have a very significant societal impact. These areas are at the intersection or overlap of traditionally "silo'd" disciplines of study not only in engineering and management, but also include – natural sciences, social sciences, as well as arts and humanities.

Academic Focus of the 2 Certificates: *What follows is an overarching description that addresses 2 separate and distinct certificates, 12 credit hours each, with each certificate to be taken in at most 1 academic year. The names of the 2 Certificates will be –*

(1) Certificate in Systems Engineering
(2) Certificate in Systems Management

Academically, the certificates will focus on educating industry sponsored corporate employees in the disciplines of – Systems Engineering and Systems Management. It will employ rigorous quantitative, as well as qualitative methods, leveraging the best faculty in two of the largest and most-quantitatively oriented schools on campus – SOM and ECS, as well as appropriate guest faculty in the local region who are leaders in their respective fields. The Program will also offer concentrations from a "systems" perspective in several areas, driven by market demand from local companies, and will invite appropriate faculty from other schools on campus, as well as experts in the field to teach these "non-core" specialty courses as part of the certificates program.

***Job Market Need* for the 2 Certificates:**

The target customers for this program will be local and regional industry in various sectors that architect, develop, engineer, manufacture, manage, plan or research all aspects – engineering, as well as financial, human resources or project or program management - of large and complex systems.

The target vertical sectors could, therefore, be fairly wide-ranging – aerospace, defense and space systems; transportation systems; information and communications technology (ICT) systems; information assurance and cyber-security systems; healthcare systems; energy, environment and infrastructure systems; complex biological systems; macro-economic and financial systems; etc. The choice of specific certificates in the "non-core" areas of specialization will be driven by market demand from specific industry sectors and companies willing to sponsor employees through this program.

Systems Engineering & Management comprises of a wide range of areas – traditional industrial engineering, traditional engineering management, as well as **segments** of traditional - electrical engineering, computer science and engineering, hardware and software engineering, mechanical engineering, biomedical engineering, aerospace engineering, transportation engineering, operations research and others. As such, the field of Systems Engineering & Management potentially represents a large portion of the engineering population.

Data compiled by the Greater Dallas Chamber of Commerce (GDC), and the Texas Workforce Commission (TxWFC) in 2007 across various High-tech Sectors that might be relevant to SE&M, but not including the Defense, Energy and Healthcare Sectors, indicates an engineering population in the DFW Metroplex well in excess of 200, 000. Even if 5 % of these very conservatively are assumed to be Systems Engineers and Managers, that translates to about 10, 000. Again, if we were to conservatively assume that these 10,000 engineers and managers renew their skills every 10 years that still creates a potential Total Available Market (TAM) of 1000 engineers and managers every year who would need SE&M training every year in the DFW alone.

Student Demand

Interests in this new discipline have been verified in discussions with local companies – TI, EDS-HP, Raytheon, Rockwell and others – along with an initial interest in potential commitment of employees to send through this program.

Programs in this field have developed at all tier-1 schools such as MIT, Stanford, Caltech, CMU, Georgia Tech, Cambridge University, and is also strongly supported by the NAE and the NSF.

Enrollment Projections

Based upon strong interests expressed by a number of area companies such as Texas Instruments, Rockwell, Raytheon, EDS-HP and other members of the SOM and ECS Advisory Boards we expect to have a commitment from these companies to send a certain number of students through the program at any given point in time. These discussions suggest that the following progression for enrollment might be very realistic.

Year	1	2	3	4	5
Headcount	20	25	30	35	40
FTSE	20	25	30	35	40

Admission Policy: The program will be targeted to corporate employees **with a minimum of BS degree in engineering or mathematics or physics** (in order to ensure adequate fundamental skills in mathematics) **and at least 5 years of industry experience**, who are potentially high performers in their respective companies, and **will be sponsored by their corporate management** to enhance their skills in both the engineering and management aspects of leading large and complex projects.

Organizational Arrangement: The program will be jointly offered and co-managed by two schools – SOM and ECS. Faculty for the core courses will be from these two

schools. Faculty from other schools on campus will be invited to teach "non-core" courses, as appropriate. Industry leaders with expertise in specific fields will be invited as appropriate, as well.

Credit Hours and Degree Programs: *Each of the 2 separate certificates will require 12 credit hours each, with each certificate to be taken in at most 1 academic year.* The courses will be offered in 4 hour modules, 2 modules per day, over either 3 days or 4 days per month format, thus requiring either 8 months or 6 months per certificate. These certificates constituting a total of 24 credit hours, along with 12 additional elective credit hours of courses, for a total of 36 credit hours will lead to an MS degree – details have been spelled out in the proposal for the Masters Program which has been applied for concurrently.

Course Offerings and Site Locations (note new courses with an asterisk):

Table - 1

Prefix & Number	Core Curriculum	Credit
IA		
SYSM6301	Systems Engineering Architecture & Design (*)	3
SYSM6302	Quantitative Risk, Probability, Stochastic Processes	3
SYSM6303	Systems Engineering Risk & Decision Analysis	3
SYSM6304	Dynamic Systems Modeling & Analysis (*)	3
IB		
SYSM6305	Systems Project Management	3
SYSM6306	Engineering Economics	3
SYSM6307	Human Factors in Complex Organizations	3
SYSM6308	Manufacturing and Service Systems Planning and Analysis	3
IIA		
SYSM6309	Dynamics of Complex Structures	3
SYSM6310	Systems and Control Theory	3
SYSM6311	Software Maintenance, Evolution and Re-engineering	3
SYSM6312	Advanced Requirements Engineering	3
SYSM6313	Software Testing, Validation, Verification	3
SYSM6314	Modeling and Simulation of Engineering Systems	3
IIB		
SYSM6315	Entrepreneurship	3
SYSM6316	Innovation within the Corporation	3
SYSM6317	The Management of High Tech Products (*)	3
SYSM6318	Marketing Management, Marketing Systems Analysis	3
SYSM6319	Business Economics	3
SYSM6320	Strategic Management	3

Location: All courses will be taught at UT Dallas

Table - 2

Faculty/Staffing (assign each course to a faculty member):

Name of Core Faculty and Faculty Rank	Highest Degree and Awarding Institution	Courses Assigned in Program	% Time Assigned To Program
Dr. Farokh Bastani Professor	Ph.D. In Computer Science UC Berkeley	SYSM6313	25%
Dr. Alain Bensoussan Distinguished Research Professor	Ph.D. in Mathematics University of Paris, France	SYSM6303	25%
Dr. Cy Cantrell Professor	Ph.D. in Physics Princeton University	SYSM6314	25%
Dr. Huseyin Cavusoglu Assistant Professor	Ph.D. in MIS UT Dallas	SYSM6330	25%
Dr. R. Chandrasekaran Ashbel Smith Professor	Ph.D. in Operations Research UC Berkeley	SYSM6309	25%
Dr. Kendra Cooper Associate Professor	Ph.D. In Electrical and Computer Engineering, U of British Columbia	SYSM6301	25%
Dr. Milind Dawande Professor	Ph.D. in Algorithms Carnegie Mellon University	SYSM6308	50%
Dr. Greg Dess Professor	Ph.D. in Organizational Behavior U of Washington	SYSM6320	25%
Dr. Nick Gans Assistant Professor	Ph.D. in Systems & Entrepreneurial Engineering, U of Illinois	SYSM6304	25%
Dr. R. Henderson Assistant Professor	Ph.D. in Electrical Engineering U of Michigan	SYSM6312	25%
Dr. Kamran Kiasaleh Professor	Ph.D. in Electrical Engineering USC	SYSM6310	25%
Dr. Robert Kieschnick Associate Professor	Ph.D. in Finance UT Austin	SYSM6306	25%
Dr. Nanda Kumar Associate Professor	Ph.D. in Marketing U of Chicago	SYSM6318	25%
Dr. Duncan MacFarlane Professor	Ph.D. In Electrical Engineering Brown University	SYSM6317	50%
Dr. Mathukumalli Vidyasagar, *Program Co-Head*	Ph.D. in Electrical Engineering University of Wisconsin	SYSM 6304	50%

1. **The Certificate in Systems Engineering *will require at least two courses from Groups IA or IIA*, and two additional courses not already taken from Table-1.**
2. **The Certificate in Systems Management *will require at least two courses from Groups IB or IIB*, and two additional courses not already taken from Table-1.**
3. **Those pursuing more than one certificate, *will be required to take courses that are distinct and different from those taken by them for a previous certificate – in other words, courses cannot be repeated.***

Additional Information:

(1) Course requirements have been developed through discussions with industry partners and colleagues through most of 2008 and the first half of 2009 – most notably Texas Instruments. TI has participated in all discussions about this program through these 18 months.

(2) Program overviews have also been shared with representatives of EDS/HP and Raytheon, with strong support expressed for the objectives of the program.

(3) Presentations have also been made about this program at the Industry Advisory Board Meetings of the Jonsson School and with some members of the SOM Advisory Board as well. These have been very well received with strong encouragement for moving forward with the program.

PROGRAM ASSESSMENT PLAN

Program/Unit Identification

Program or Unit Name: Certificate in **Systems Engineering** *Schools:* **ECS &SOM**

Program or Unit Director: Dr. Rajiv R. Shah & Dr. Duncan MacFarlane

Program or Unit Purpose or Mission Statement or Program Educational Objective

Your mission statement or purpose should be in alignment with the university's mission and the school's mission, explicitly cover the educational mission.

Provide formalized education in a large, growing "unmet" need primarily in the area of **Systems Engineering,** but also additional training in the areas of systems engineering and systems management of increasingly complex, increasingly large "macro" systems that involve a large number of interconnected components and potentially have a very significant societal impact. These areas are at the intersection or overlap of traditionally "silo'd" disciplines of study not only in engineering and in management, but also include – natural sciences, social sciences, as well as arts and humanities. It will employ rigorous quantitative, as well as qualitative methods, leveraging the best faculty in two of the largest and most-quantitatively oriented schools on campus – SOM and ECS, as well as appropriate faculty from other schools and in the local region who are leaders in their respective fields.

Student learning outcomes assessment is defined as the ongoing monitoring of the extent to which students are developing the knowledge, skills, beliefs, and attitudes that are appropriate for graduates of the respective academic programs.

Student Learning Objective #1

Learn advanced techniques in systems engineering including - systems architecture and design; probability and stochastic processes; quantitative risk and uncertainty assessment and engineering decision analysis; dynamic systems and modeling analysis.

#	Performance Criteria	Measures and Procedures	Criteria: What Constitutes Success (Target)	Timeframe
1	Assessment procedures and methods may include those shown in the next column	i. Quizzes, Tests and Exams ii. Case Discussion and Case Studies iii. Class Discussion and Participation iv. Projects, Project Reports and Presentations (SYSM6301 through SYSM6304 or SYSS6309 through SYSM6314)	Student success will be determined by their performance in each of the assessment methods chosen	At the end of Spring 2010, the 1st semester of course launch

Student Learning Objective #2

Learn advanced techniques in systems management including – Project and Program Management; Financial and Accounting Management; Operations Management; and People Management, Organizational Behavior and Leadership

#	Performance Criteria	Measures and Procedures	Criteria: What Constitutes Success (Target)	Timeframe
1	Assessment procedures and methods may include those shown in the next column	i. Quizzes, Tests and Exams ii. Case Discussion and Case Studies iii. Class Discussion and Participation iv. Projects, Project Reports and Presentations (SYSM6305 through SYSM6308 or SYSS6315 through SYSM6320)	Student success will be determined by their performance in each of the assessment methods chosen	At the end of Spring 2010, the 1st semester of course launch

PROGRAM ASSESSMENT PLAN

Program/Unit Identification

Program or Unit Name: Certificate in **Systems Management** *Schools:* **SOM & ECS**

Program or Unit Director: Dr. Rajiv R. Shah & Dr. Duncan MacFarlane

Program or Unit Purpose or Mission Statement or Program Educational Objective

Your mission statement or purpose should be in alignment with the university's mission and the school's mission, explicitly cover the educational mission.

Provide formalized education in a large, growing "unmet" need primarily in the area of **Systems Management,** but also additional training in the areas of systems engineering and systems management of increasingly complex, increasingly large "macro" systems that involve a large number of interconnected components and potentially have a very significant societal impact. These areas are at the intersection or overlap of traditionally "silo'd" disciplines of study not only in engineering and in management, but also include – natural sciences, social sciences, as well as arts and humanities. It will employ rigorous quantitative, as well as qualitative methods, leveraging the best faculty in two of the largest and most-quantitatively oriented schools on campus – SOM and ECS, as well as appropriate faculty from other schools and in the local region who are leaders in their respective fields.

Student learning outcomes assessment is defined as the ongoing monitoring of the extent to which students are developing the knowledge, skills, beliefs, and attitudes that are appropriate for graduates of the respective academic programs.

Student Learning Objective #1

Learn advanced techniques in systems management including – Project and Program Management; Financial and Accounting Management; Operations Management; and People Management, Organizational Behavior and Leadership

#	Performance Criteria	Measures and Procedures	Criteria: What Constitutes Success (Target)	Timeframe
1	Assessment procedures and methods may include those shown in the next column	i. Quizzes, Tests and Exams ii. Case Discussion and Case Studies iii. Class Discussion and Participation iv. Projects, Project Reports and Presentations (SYSM6305 through SYSM6308 or SYSS6315 through SYSM6320)	Student success will be determined by their performance in each of the assessment methods chosen	At the end of Spring 2010, the 1st semester of course launch

Student Learning Objective #2

Learn advanced techniques in systems engineering including - systems architecture and design; probability and stochastic processes; quantitative risk and uncertainty assessment and engineering decision analysis; dynamic systems and modeling analysis.

#	Performance Criteria	Measures and Procedures	Criteria: What Constitutes Success (Target)	Timeframe
1	Assessment procedures and methods may include those shown in the next column	i. Quizzes, Tests and Exams ii. Case Discussion and Case Studies iii. Class Discussion and Participation iv. Projects, Project Reports and Presentations (SYSM6301 through SYSM6304 or SYSS6309 through SYSM6314)	Student success will be determined by their performance in each of the assessment methods chosen	At the end of Spring 2010, the 1st semester of course launch