PROPOSED DEGREE PROGRAM
STAGE II ABSTRACT FORM

Degree and/or Concentration Proposed: Master of Engineering (M.Eng.) in Materials Science and Engineering

Department/School or College: Division of Materials Science and Engineering / College of Engineering

Faculty Contact Person: Assoc. Dean of Research and Graduate Programs
Selim Ünlü 617/353-5067 selim@bu.edu

Anticipated date of matriculation of first students: September, 2011

No. of initial students: 5

Focus of Program:

Preparing students for professional careers in industry pursuing materials engineering and/or engineering management jobs. The program is structured so that students can complete it within one year, and it requires students to be exposed to some engineering management courses.

Need for Program:

This program is aimed at a) graduating senior students who want a quick one-year masters in materials before they look for industrial jobs, b) mid-career professionals who want to switch careers and would like to complete a one-year masters degree between jobs, and c) industry professionals who want exposure to materials and engineering management to further their careers.

Relation to Existing Programs:

The Division of Materials Science and Engineering has existing Ph.D./M.S. programs aimed at students who would seek research careers in academia, national laboratories and industry. These degrees require original research leading to a dissertation/thesis. The M. Eng. program does not involve research and does not have a thesis requirement.

Approved at College of Engineering Faculty Meeting: Date: 08/30/09
(by unanimous voice vote with no opposing votes or indicated abstentions)

Signature of Dean: _____ Date: 9/13/10

Stage II Approval: _____ Date: _____
(Office of the Provost)

Approved Stage II Proposal Distribution (Includes deans/directors or relevant units)

:Faculty Council Curriculum & Degrees Committee Date: _____
:University Council Curriculum & Degrees Committee Date: _____
: _____ Date: _____
: _____ Date: _____
: _____ Date: _____

Proposed Degree Program:
Master of Engineering (M. Eng.) in Materials Science and Engineering

proposed by:

College of Engineering
Kenneth Lutchen, Dean

Executive Summary

This document outlines our proposal for a Master of Engineering (M. Eng.) degree program in Materials Science and Engineering (MSE) to be offered by the College of Engineering. The M. Eng. degree is distinct from the Master of Science (M.S.) degree in Materials Science and Engineering (MSE) as follows: the M. Eng degree is designed to prepare students for careers in industry and requires engineering management courses designed to foster technology leadership skills, and the M. Eng. program does not involve research and does not have a thesis requirement. The program is structured so that students can complete it within one year, if desired.

The degree programs will be managed using the existing administrative, recruiting, admissions, and advising procedures already in place within MSE and the College of Engineering (COE). The needed instructional facilities already exist; hence the incremental costs of this new program will be minimal. No new faculty lines will be required.

No competing degree programs exist within the University.

1. Program Objectives

1.1 Introduction

The Division of Materials Science and Engineering proposes a new program leading to the degree of Master of Engineering in Materials Science and Engineering. The M. Eng. degree is designed to prepare students for careers in industry in materials science and engineering, by complementing technical MSE courses with an engineering management focus that emphasizes elements of technology leadership and product development and management.

1.2 Rationale and Need for the Program

The Division of Materials Science and Engineering has existing Ph.D./M.S. programs aimed at students who would seek research careers in academia, national laboratories and industry. These degrees require original research leading to a dissertation/thesis. Currently, MSE does not offer a degree specifically designed to prepare students for industrial careers. The proposed M. Eng. degree is geared to meet this need.

This program is aimed at a) graduating senior students who want a quick one-year masters in materials before they look for industrial jobs, b) mid-career professionals who want to switch careers and would like to complete a one-year masters degree between jobs, and c) industry

professionals who want exposure to materials and engineering management to further their careers.

There is a demand from industry both nationally and internationally for professional master's degrees. This M. Eng. program will allow students to gain exposure to management issues in the global marketplace in addition to a strong background in materials science and engineering. It will therefore position graduates for successful careers in industry.

1.3 Employment Outlook for Program Graduates

According to the U.S. Bureau of Labor Statistics, "overall engineering employment is expected to grow by 11 percent over the 2008-2018 decade... Competitive pressures and advancing technology will force companies to improve and update product designs and to optimize their manufacturing processes. Employers will rely on engineers to increase productivity and expand output of goods and services". Employment growth for mechanical engineers, already the second largest sector within engineering, is expected to be 6 percent. Additionally, the U.S. Bureau of Labor Statistics states "employment of engineering and natural sciences managers is expected to grow 8 percent over the 2008-2018 decade... Engineers and scientists with advanced technical knowledge and strong communication skills will be in the best position to become managers. Because engineering and natural sciences managers are involved in the financial, production, and marketing activities of their firm, business management skills are also advantageous for those seeking management positions." (www.bls.gov)

The field of materials science and engineering is in the midst of its own metamorphosis. The strong link between materials science and engineering, emerging research, and products in the marketplace means ample job opportunities and a positive future job outlook. Applications for new materials and modifications of existing materials are expected to keep the demand for trained, graduate-level materials scientists and engineers growing. M. Eng. graduates of the MSE program can choose from several career paths. Many will find employment in large organizations such as IBM, Intel, Hewlett-Packard, General Electric, Pratt and Whitney, 3M, Lockheed-Martin, Xerox, Motorola, Monsanto, and Corning developing the next generation of products and processes. The inherent interdisciplinary nature of materials science and engineering also makes graduates attractive to smaller start-up companies. According to the U.S. Bureau of Labor Statistics, materials scientists and engineers are expected to enjoy employment growth well into the next decade. Materials scientists and engineers will be sorely needed for the development of new materials for energy, electronics, and biotechnology sectors, among others.

1.4 Relationship to Existing Programs at Boston University

The proposed program will be built upon courses currently being taught in the current MSE program, involving faculty from all existing departments within the College of Engineering as well as the departments of Physics and Chemistry in CAS. No new courses are proposed for this program. Thus, the new M. Eng. program will have negligible disruptive impact on existing programs within the University, other than a small increase in enrollment in the relevant courses. The matriculation of new cohorts of MSE M. Eng. students should enhance the enrollment and

intellectual richness of the courses shared between the proposed programs and other existing ENG and CAS programs.

The creation of the M. Eng. degree in MSE is consistent with COE's Strategic Vision 2010 document, which lists a goal of creating a suite of new professional masters programs. Currently, M. Eng. degrees are offered in Biomedical Engineering and in Systems Engineering. Proposals for new M. Eng. degrees are also being prepared in Manufacturing Engineering, Mechanical Engineering, Electrical Engineering, Computer Engineering, and Photonics.

It is expected that the MSE M. Eng. Degree will be attractive to the MSE Late Entry Accelerated Program (LEAP) students, who have to complete requirements towards a master's degree. The LEAP program is run by COE and is designed for students who do not have an undergraduate degree in Engineering.

It is expected that there will be a synergistic relationship between the COE's Distance Learning Program (DLP) and the new M. Eng. degree program will utilize the courses taught through the DLP, and the DLP will be a natural feeder for students into the M. Eng. degree program.

Once the M. Eng. degree program in MSE is put into place, the existing M.S. program in MSE will be restructured to require a research thesis, whereas currently, it is an option. Thus, the M.S. degree will prepare students for careers in research whereas the M. Eng. degree will prepare students for careers in industry.

1.5 Documentation of Consultation with Cognate Units

This proposal was prepared as an outgrowth of discussions at the MSE strategic planning meeting held on December 14, 2009. The MSE Steering Committee, that has representation from all cognate units as follows, attended the meeting:

Uday Pal, and S. Basu (Mechanical Engineering)
Theodore Moustakas (Electrical and Computer Engineering)
Amit Meller (Biomedical Engineering)
Karl Ludwig (Physics)
Mark Grinstaff (Chemistry and Biomedical Engineering)
Russell Giordano (Goldman School of Dental Medicine)

The proposal was then presented and approved at the MSE retreat on March 5, 2010, attended by all MSE participating faculty and affiliated faculty from all cognate units (engineering, physics, chemistry, dental school).

1.6 Enrollment Projections

We estimate a short-term enrollment in MSE M. Eng. program over the next two years of around 5 students. The target enrollment over a 5-year time span is about 15 students; and the long-range goal (10-15 years out) is 25 students. The incoming M.S. class in 2010 is 9 M.S. students

(4 domestic (including 2 from the LEAP program) and 5 international). Assuming that a majority of the masters students will opt for the M. Eng. program, the short term goals appear achievable. The DL program will help us recruit domestic students with industrial experience.

1.7 Program Administration

The Division of Materials Science and Engineering will administer the program. The Associate Division Head of MSE in charge of the graduate programs will oversee the MSE M. Eng, program. All MSE curricular issues are first voted on by the MSE Steering Committee and then by the MSE faculty. These issues are then approved by the Graduate Committee of COE followed by a COE faculty vote, where necessary. The Graduate Programs Manager of MSE will handle the academic monitoring and tracking. COE's Graduate Programs Office and MSE's Graduate Applications Review Committee will handle admission into the program.

All M. Eng. students will receive a Program Planning Sheet (PPS) reflecting current curriculum requirements to help in planning course selection. The PPS, the College of Engineering Bulletin, and the Graduate School Bulletin describe course pre-requisite requirements, including courses from other departments that can serve as technical electives. The PPS vehicle has been used for over 20 years in ENG for planning, registration and eventual degree certification.

1.8 Academic Standards

MSE M. Eng. students must maintain a cumulative GPA of 3.00 to remain in good academic standing and to graduate. The graduation GPA includes all coursework taken after matriculation applicable to the degree sought (regardless of grade obtained) and any previous courses submitted in fulfillment of program requirements. Only grades of "C" or better fulfill M. Eng. curricular requirements. This academic standard is consistent with all existing Engineering masters degree programs.

1.9 Recruitment

Recruiting of new students will be supported by our current facilities for publicizing existing College of Engineering graduate programs. One important asset is a well-designed web presence, including an on-line application. Professional society connections, publications will also be used to announce the new program. We have a history of success in marketing our existing graduate programs, hence the existing marketing machinery should serve as a means to advertise the new programs.

Another effective recruitment tool will be one-on-one contact between colleagues, including visits to other schools where prospective students can be interviewed. We will develop mailings and pamphlets to publicize the new degree programs; these will be distributed to faculty for campus visits and meetings.

1.10 Accreditation

Graduate programs in engineering are customarily not subject to accreditation review by the

Accreditation Board for Engineering and Technology (ABET).

1.11 Materials Science and Engineering M. Eng. Programs at Other Universities

The following list indicates some of our peer institutions that offer an M. Eng. program in Materials Science and Engineering:

Massachusetts Institute of Technology
Cornell University
University of Maryland
University of Virginia
Lehigh University
Duke University
Vanderbilt University
University of Connecticut
University of Texas at Arlington
Illinois Institute of Technology
University of Minnesota
Rutgers University
Texas A&M University
Boise State University
University of Utah
Iowa State University

2. Academic Programs

2.1 Overview

The program will make use of existing MSE core, concentration and elective courses, as well as existing engineering management courses already in place. No new courses will be required.

2.2 Catalog Copy for Proposed Programs

Master of Engineering students in MSE are required to complete a minimum of 32 credit hours applicable to the degree according to the program-planning sheet. No master's thesis is required. A minimum of 28 credits must be applied towards graduate courses (500 level or above). A maximum of 4 credits can be applied towards a junior/senior level undergraduate course, if it serves as a pre-requisite for a graduate course taken by the student as part of the program. The undergraduate course will have to be approved by the academic advisor of the student.

The 32 credits must be selected as follows:

- 2 core MSE courses (8 credits). Every MSE M. Eng student must demonstrate competence (grade of C or above) in first-year graduate (mezzanine) level thermodynamics and solid-state physics, either through appropriate selection of the core courses or through prior coursework taken. MSE core courses are listed below.
- 2 other structured MSE courses (8 credits). A structured MSE course is any course with an MS designation as listed below.
- 1 structured engineering management course (4 credits). Structured engineering management courses are listed below.
- 3 other courses (12 credits) can be any engineering, science, or engineering management courses.
- A maximum of 3 engineering management courses (12 credits) can count towards the degree.

MSE Core Courses

ENG MS 503	Kinetic Processes in Materials
ENG MS 504	Polymers and Soft Materials
ENG MS 505**	Thermodynamics and statistical mechanics
ENG MS 508	Computational methods in materials science
ENG MS 543*	Introduction to Solid State Physics
ENG MS 574	Physics of Semiconductor Materials
ENG MS 577*	Electrical, Optical and Magnetic Properties of Materials
ENG MS 582	Mechanical behavior of materials

* Both courses satisfy competency requirement in solid-state physics. Only one of these two courses may be taken for credit.

** Satisfies competency requirement in thermodynamics

MSE Concentration Courses

Biomaterials

ENG MS 506	Physical Chemistry of Cell Structure and Machinery
ENG MS 521	Continuum Mechanics for Biomedical Engineers
ENG MS 523	Mechanics of Biomaterials
ENG MS 524	Skeletal Tissue Mechanics
ENG MS 533	Biorheology
ENG MS 726	Biomaterials and Tissue Engineering I
ENG MS 727	Biomaterials and Tissue Engineering II
ENG MS 736	Biomedical Transport Phenomena
ENG MS 742	Bio-fluids and Structural Mechanics
ENG MS 744	Polymer Physics
ENG MS 771	Biophysics

Materials for Energy and Environment

ENG MS 527	Transport Phenomena in Materials Processing
ENG MS 532	Atomic Structure and Dislocations in Materials
ENG MS 535	Green Manufacturing
ENG MS 545	Electrochemistry of Fuel Cells and Batteries
ENG MS 573	Solar Energy Systems
ENG MS 779	Solid State Ionics and Electrochemistry
ENG MS 781	Advanced Ceramics

Electronic/Photonic Materials

ENG MS 560	Introduction to Photonics
ENG MS 575	Physics of Semiconductor Devices
ENG MS 578	Fabrication Technology for Integrated Circuits
ENG MS 764	Optical Measurement
ENG MS 770	Guided-wave Optoelectronics

ENG MS 774	Semiconductor Quantum Structures and Photonic Devices
ENG MS 776	Fundamentals of Nanoelectronics
ENG MS 777	Nanostructure Optics

Nanomaterials

ENG MS 530	Introduction to Micro and Nanomechanics of solids
ENG MS 555	MEMS Fabrication and Materials
ENG MS 718	Advanced Topics in Nanotechnology
ENG MS 777	Nanostructure Optics
ENG MS 778	Micromachined Transducers

MSE Elective Courses

ENG MS 507	Process Modeling and Control
ENG MS 526	Simulation of Physical Processes
ENG MS 534	Materials Technology for Microelectronics
ENG MS 579	Microelectronic Device Manufacturing
ENG MS 580	Theory of Elasticity
ENG MS 783	Advanced Characterization of Materials

Engineering Management Courses

ENG ME 502	Intellectual Assets: Creation, Protection and Commercialization
ENG ME 517	Product Development
ENG ME 525	Technology Ventures
ENG ME 550	Product Supply Chain Design
ENG ME 583	Product Management
ENG ME 584	Manufacturing Strategy
ENG ME 703	Managerial Cost Accounting
ENG EC 518	Software Project Management
ENG EK 731	Bench to Bedside—Translating Biomedical Innovation from the Laboratory to the Marketplace

2.6 Description of New Courses

The program will leverage existing courses only. No new courses are being proposed.

3. Academic Resources

3.1 Existing Faculty

Most MSE core, concentration and elective courses are already being taught by the existing MSE. The engineering management courses are existing courses being taught by Engineering faculty. Current MSE participating faculty members are listed below:

Hatice Altug
Rama Bansil
Soumendra Basu
Enrico Bellotti
Luca Dal Negro
Linda Doerrer
Kamil Ekinci
Evan Evans
Michael Gevelber
Russell Giordano
Bennett Goldberg
Srikanth Gopalan
Mark Grinstaff
Catherine Klapperich
Xi Lin
Karl Ludwig
Amit Meller
Pritiraj Mohanty
Elise Morgan
Theodore Moustakas
Roberto Paiella
Uday Pal
Vinod Sarin
Kevin Smith
Anna Swan
M. Selim Ünlü
Joyce Wong
Xin Zhang

3.2 New Faculty and Staff Requirements
None directly associated with the program.

3.3 Existing and needed library and computer resources.
No new library and computer resources are anticipated.

3.4 Financial and Physical Resources
No additional financial requests from the Office of the Provost are anticipated.

3.5 Special equipment or supply needs.
No special equipment and supplies are needed for this program.

PRELIMINARY BUDGET FORM

Part I-General

1. Name of Program: MEng in Material Science & Engineering
2. Proposed by:
   Name: Uday Pal Date: 9/13/10
   Unit/Department: ENG 024/207
3. Expected Start Date: 9/1/11

4: Enrollment Headcounts:	Year 1	Year 2	Year 3
a. No. of Full-Time Entering Students:	5	8	10
--MA Students			
--PhD Students			
b. No. of Full-Time Continuing Students			
b. No. of Part-Time Students			
c. TOTAL	5 0	8 0	10 0
5. Faculty Headcounts:			
a. No. of Full-Time Faculty*			
b. No of Part-Time Faculty			
c. TOTAL	0	0	0
6. Staff Headcounts:			
a. 903-No. of Full-Time Administrators*			
b. 904-No. of Part-Time Administrators			
c. 905-No. of Full-Time Support Staff*			
d. 906-No. of Part-Time Support Staff			
e. 908-No. of Student Staff			
f. TOTAL	0	0	0
7. No. of Courses (Credit Hours) Taught:			
a. On-Campus/MA Program	8(32)	8(32)	8(32)
b. On-Campus/PhD Program			
8. If the program requires student housing, identify the number of required bed spaces.	NA	NA	NA

9. Describe any special (program-specific) fees and/or non-standard tuition income that will be generated by the program. NA

10. Describe the extent to which the program will involve students who are enrolled in other programs at Boston University. NA

*Object Codes 900,903,905 to be detailed in Part IV

PRELIMINARY BUDGET FORM (CONT.)

Part II-Income Projections

	Year 1	Year 2	Year 3
1. Tuition Income:			
a. From Full-Time Students	196,570	314,512	393,410
b. From Continuing Student Fees			
c. TOTAL TUITION INCOME	196,570	314,512	393,410
2. Fee Income (When Applicable):			
a. From Full-Time Students			
• Application Fee ($70/Student)	350	560	700
• GSU Fee ($89/Student/Semester)	445	712	890
• Health Fee ($69/Student)	345	552	690
• Program Fee ($ 15 /Student)	75	120	150
• Other Fees (Please Specify)			
b. From Part-Time Students			
• Application Fee ($65/Student)			
• Registration Fee ($40/Student)			
• Other Fees (Please Specify)			
c. TOTAL FEE INCOME	1,215	1,944	2,430
3. Other Income (Please Specify):			
TOTAL OTHER INCOME			
TOTAL INCOME	197,782	316,456	395,840

Note: Fee rates are subject to change. Please be sure to use current fee rates for your calculations.

PRELIMINARY BUDGET FORM (CONT.)

Part III-Expense Projections

1. Salary Expenses:	Year 1	Year 2	Year 3
900 Full-Time Faculty Salaries*			
901 Part-Time Faculty Salaries			
902 Student Teaching Salaries			
903 Administrative Salaries*			
904 Administrative Suppl. Salaries			
905 Support Staff Salaries*			
906 Support Staff Suppl. Salaries			
908 Student Salaries			
TOTAL SALARY EXPENSES	-	-	-
2. Operating Expenses:			
910 Supplies			
911 Telecommunications Equipment			
912 Telecommunications Usage			
913 Equipment-Rental			
914 Postage and Mail Service			
915 Contracted Services			
916 Reproduction and Printing			
917 Books, periodicals, etc.			
918 Travel-Domestic			
919 Meeting Expenses			
920 Dues and Membership			
927 Honoraria			
929 Unclassified			
930 Moveable Capital Equipment			
931 Buildings & Grounds Services			
932 Computer Software and Databases			
934 Travel-Foreign			
953 Minor Equipment			
TOTAL OPERATING EXPENSES	-	-	-
4. Unit 16 Financial Aid :			
939 Tuition aid for two students			
TOTAL EXPENSE	-	-	-

5. Operating expenses already budgeted separately:

Name of Unit/Dept Providing support and description of expenses to be covered.

02/4/2015 Already covers all costs associated with program.

* Complete Part IV for the 900,903, and 905 salary expenses. Amounts should be identical.

PRELIMINARY BUDGET FORM (CONT.)

Part IV-Position and Salary Detail

I New Lines/Positions
900 Full-Time Faculty

	Name (or "open")		Rank	Unit/Dept	Salary Amounts Charged to Program Year 1	Year 2	Year 3
1							
2							
3							
4							

903 Full-Time Administrative Staff

	Name (or "open"), Title	Unit/Dept	Salary Amounts Charged to Program Year 1	Year 2	Year 3
1					
2					

905 Full-Time Support Staff

	Name (or "open"), Title	Unit/Dept	Salary Amounts Charged to Program Year 1	Year 2	Year 3
1					
2					
3					
Total New Lines/Positions:			-	-	-

II Existing Lines/Positions already budgeted separately (description only)
900 Full-Time Faculty

	Name (or "open")	Rank	Unit/Dept
1			
2			
3			
4			

903 Full-Time Administrative Staff

	Name (or "open"), Title	Unit/Dept
1		
2		
3		
4		

905 Full-Time Support Staff

	Name (or "open"), Title	Unit/Dept
1		
2		
3		
4		