

PROPOSED DEGREE PROGRAM
STAGE II ABSTRACT FORM

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

Department/School or College: Mechanical 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:

The Master of Engineering (M.Eng.) degree is designed to prepare students for careers in industry in manufacturing engineering, by complementing technical manufacturing engineering courses with an engineering management focus that emphasizes elements of technology leadership and product development and management.

Need for Program:

Currently, the Department of Mechanical Engineering offers a Master of Science degree in Manufacturing Engineering and a Master of Science degree in Global Manufacturing. The Department does not, however, offer a degree specifically designed to prepare manufacturing engineering students for industrial careers. The proposed M.Eng. degree is geared toward the industrial and management aspects of manufacturing engineering. The degree program will feature a project course rather than a research thesis, and will require up to three engineering management courses. 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 training in technical manufacturing engineering courses. It will therefore position graduates well to succeed in careers in industry.

Relation to Existing Programs:

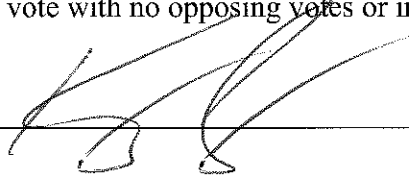
The proposed degree program will be built upon courses currently being taught in the Department of Mechanical Engineering. In 2008, the Department of Aerospace and Mechanical Engineering and the Department of Manufacturing Engineering merged into a single Department of Mechanical Engineering. As a result of this merger, the Department now has a strong suite of courses that includes many technical mechanical and manufacturing engineering courses as well as engineering management courses. This new M.Eng. program is a natural progression of the departmental merger and fills a need for technically trained manufacturing engineers who are also prepared to be technology leaders and managers. Once the M.Eng. degree program is put into place, the existing M.S. in manufacturing engineering will be restructured to require a research thesis. Thus, the M.S. degree will prepare students for careers in research whereas the M.Eng. degree will prepare students for careers in industry.

Approved at College of Engineering Faculty Meeting:

Date: 8/30/10

(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 Manufacturing Engineering**

proposed by:

**College of Engineering
Kenneth Lutchen, Dean**

and

**Department of Mechanical Engineering
Ronald Roy, Chairman**

Executive Summary

This document outlines the proposal for a Master of Engineering (M.Eng.) degree program in Manufacturing Engineering. The M.Eng. degree will differ from the Master of Science (M.S.) degree in Manufacturing Engineering in several ways: it is designed to prepare students for careers in industry; it will not require a research-based thesis; and it requires engineering management courses designed to foster technology leadership skills.

The M. Eng. degree program will be managed using the administrative, recruiting, admissions, and advising procedures that are already in place within the Department of Mechanical Engineering and the College of Engineering. The needed instructional and research laboratories already exist. However, there will be a need for additional faculty lines.

No competing degree programs exist within the University.

1. Program Objectives

1.1 Introduction

The Department of Mechanical Engineering proposes a new program leading to the degree Master of Engineering (M.Eng.) in Manufacturing Engineering. The Master of Engineering (M.Eng.) degree is designed to prepare students for careers in industry in manufacturing engineering, by complementing technical mechanical and manufacturing engineering 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

Currently, the Department of Mechanical Engineering offers a Master of Science degree in Manufacturing Engineering that prepares students well for careers in research. The

Department does not, however, offer a degree specifically designed to prepare students for industrial careers. The proposed M.Eng. degree is geared toward the industrial and management aspects of manufacturing engineering. The degree program will feature a project experience rather than a research thesis, and will require up to three engineering management courses. 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 training in classical advanced engineering courses. It will therefore position graduates well to succeed in 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". Additionally, the U.S. Bureau of Labor Statistics states that "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." The U.S. Bureau of Labor Statistics also states that over one-third of the engineering jobs are in the manufacturing sector. (www.bls.gov)

The proposed M.Eng. program in Manufacturing Engineering will prepare our students well to compete for these engineering management jobs in the coming decade.

Although it is expected that most of the graduates of the M.Eng. program will go to industry, it is possible that this program will also become a feeder of a small number of students to the Ph.D. program.

1.4 Relationship to Existing Programs at Boston University

The proposed degree program will be built upon courses currently being taught in the Department of Mechanical Engineering. In 2008, the Department of Aerospace and Mechanical Engineering and the Department of Manufacturing Engineering merged into a single Department of Mechanical Engineering. As a result of this merger, a set of engineering management courses became part of the suite of the Mechanical Engineering courses. This new M.Eng. program is a natural progression of the departmental merger and fills a need for classically-trained manufacturing engineers who are also prepared to be technology leaders and managers.

Many of the engineering management courses are taught through the Department's Distance Learning Program. It is expected that there will be a synergistic relationship

between the DLP and the new M.Eng. degrees in that the M.Eng. 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 is put into place, the existing M.S. in Manufacturing engineering will be restructured to require a research thesis (currently, it can be 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.

The creation of an M.Eng. degree in Manufacturing Engineering also aids in fulfilling a goal stated in the College of Engineering Strategic Vision 2010 document 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, Material Science and Engineering, Electrical Engineering, Computer Engineering, and Photonics.

1.5 Documentation of Consultation with Cognate Units

This proposal was prepared by the Department of Mechanical Engineering. It has been approved by the Department of Mechanical Engineering, the College of Engineering Faculty, and the College of Engineering Dean.

In the preparation of the College of Engineering Strategic Vision 2010, an *ad hoc* committee which ultimately determined the goal of creating a suite of professional masters programs within the College included members of cognate natural science departments within the College of Arts and Sciences as well as cognate departments within the School of Management.

1.6 Similar Programs at Other Universities

In the 10 Year Plan of the Department of Mechanical Engineering, prepared in the Spring of 2010, seven peer institutions were identified: Duke University, Northwestern University, Rice University, University of Pennsylvania, University of Pittsburgh, Vanderbilt University, and Washington University. Additionally, comparisons are made with other local institutions: MIT, Northeastern University, Rensselaer Polytechnic Institute (RPI), Worcester Polytechnic Institute (WPI), and Cornell University. Almost all of these peer institutions offer some form of professional Master's degrees.

Engineering Management Master's degrees are offered under a variety of names by Duke, Northwestern, Washington University, and Northeastern University. Cornell has an M.Eng. degree in Engineering Management.

Several of the peer institutions have Master of Engineering degrees in Mechanical Engineering, but not Manufacturing. These include Duke, Vanderbilt, Washington University, RPI, and Cornell.

Professional Master's degrees in manufacturing engineering and related fields are offered at Northwestern, which has a two year part-time (weekend) Master of Product Development and a Master of Management in Manufacturing program, and MIT, which has an M.Eng. degree in Manufacturing Engineering.

Worcester Polytechnic Institute (WPI) offers an MS degree in manufacturing engineering, but not a professional Master's. The University of Pennsylvania has an MS degree in Integrated Product Design.

2. Academic Program

2.1 Overview

The program will make use of Manufacturing Engineering core courses and Engineering Management courses already in place in the Department of Mechanical Engineering. No new courses will be required.

2.2 Catalog Copy for Proposed Program

Master of Engineering students 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. All 32 credits must be at the 500 level or above. The 32 credits must be selected as follows:

- 3 courses (12 credits) must be Manufacturing Engineering Core Courses
- 2 courses (8 credits) must be Engineering Management Courses
- 3 courses (12 credits) may be Engineering/Science electives (any 500/700 level engineering or physical science course, with no more than one course from the approved list of Engineering Management Courses)

In addition to these course requirements, students must complete a project experience, approved by the student's academic advisor. The project requirement could be met by completing a project in one of the courses used to satisfy the above course requirements, or by working in one of the college's research laboratories.

Manufacturing Engineering Core Courses

ME 507 *	Process Modeling and Control
ME 510 *	Production Systems Analysis
ME 514 *	Simulation
ME 518 *	Product Quality
EC 524 *	Optimization Theory
ME 526	Simulation of Physical Processes
ME 527	Transport Phenomena in Materials Processing
ME 529	Thermodynamics and Kinetics of Materials and Processes
ME 531	Phase Transformations

ME 532	Atomic Structure and Dislocations in Materials
ME 533	Energy Conversion
ME 534	Materials Technology for Microelectronics
ME 535	Green Manufacturing
ME 544	Networking the Physical World
ME 545 *	Electrochemistry of Fuel Cells and Batteries
ME 555 *	MEMS: Fabrication and Materials
ME 560 *	Precision Machine Design and Instrumentation
MS 573	Solar Energy Systems
ME 579 *	Microelectronic Device Manufacturing
ME 704	Adaptive Control of Dynamic Systems
ME 714 *	Advanced Stochastic Modeling and Simulation
ME 725 *	Queuing Systems
ME 740 *	Vision, Robotics, and Planning
ME 755 *	Communication Networks
ME 778	Micro-machined Transducers

Engineering Management Courses

ME 502 *	Intellectual Assets: Creation, Protection, and Commercialization
ME 517 *	Product Development
ME 525 *	Technology Ventures
ME 550	Product Supply Chain Design
ME 583 *	Product Management
ME 584 *	Manufacturing Strategy
ME 703	Managerial Cost Accounting

* Offered at least every two years

3. Program Administration

3.1 Administration of the Program

The program will be administered by the Department of Mechanical Engineering. The Department's Graduate Committee, which is appointed by the Department's Executive Committee, will be responsible for the oversight of the program. The Graduate Committee is led by the Associate Chair for Graduate Studies and is comprised of faculty members from the Department. One staff member, the Department's Graduate Programs Coordinator, is Ex-officio. All graduate-level curricular issues are first voted on by the Graduate Committee and then by the Department's faculty. Additional support for the program will come from the Department's Distance Learning Committee.

3.2 Recruitment and Admissions

The recruitment of students into this program will utilize the existing mechanisms for recruiting students into all College of Engineering graduate programs. This will include

an announcement in the College of Engineering magazine, as well as well-designed web sites.

The College of Engineering's Graduate Programs Office will handle admissions and financial aid. The requirements for admission will be consistent with other masters programs in the College of Engineering.

We expect that many of the future matriculates into the program will be either mechanical or manufacturing engineers who move directly from an undergraduate ME or MFG program into graduate study, or who are employed by larger engineering firms and are being funded by the company to obtain a graduate degree. Current undergraduates in mechanical or manufacturing engineering will find their job prospects greatly enhanced by the advanced technical training as well as the technology innovation preparation that will be an integral part of the program. Also, many local corporations such as Raytheon and BAE Systems require their engineers to obtain masters degrees and we feel that many will be attracted to the M.Eng. degree program. It is also likely that some matriculates will come from the College's Late Entry Accelerated Program (LEAP).

3.3 Academic and Graduation Standards

The academic requirements and graduation standards will be consistent with other masters programs in the College of Engineering. These requirements can be found in the Graduate Programs Bulletin: "Graduate students must complete their required academic program with a grade point average of at least 3.0 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."

3.4 Advising

The Mechanical Engineering Graduate Programs Coordinator will track all MFG M.Eng. students. All students are assigned a faculty advisor. Every student receives a Program Planning Sheet (PPS) which shows current curriculum requirements. This mode of course tracking has been in use by the College of Engineering for over 20 years and has proven to be an effective method for the purposes of planning, registration, and degree certification. The PPS and the College of Engineering Graduate Programs Bulletin describe all program and course requirements including course pre-requisites.

3.5 Enrollment Projections

We expect an initial cohort of approximately 5 students for Fall 2011, and expect that many of these students will come from the Boston University undergraduate and LEAP populations. Within the next five years, we expect this to grow to 10-20 students per year. There is no minimum number needed since no new courses will be added initially.

3.6 Accreditation

There will be no external accreditation of this program. M.Eng. programs in engineering are customarily not subject to accreditation review by the Accreditation Board for Engineering and Technology (ABET).

4. Resources

4.1 Existing Faculty

The Manufacturing Engineering Core courses, and most of the Engineering Management courses are already being taught within the Department of Mechanical Engineering by the existing ME faculty. Current Mechanical Engineering faculty members are listed below:

Sean Andersson	Michael Howe
Stormy Attaway	Mort Isaacson
John Baillieul	Catherine Klapperich
Lorena Barba	Xi Lin
Paul Barbone	Gregory McDaniel
Eytan Barouch	Elise Morgan
Soumendra Basu	Ray Nagem
Calin Belta	Uday Pal
James Bethune	Harold Park
Thomas Bifano	James Perkins
Michael Caramanis	Allan Pierce
William Carey	Tyrone Porter
Robin Cleveland	Ronald Roy, Chairman
Dan Cole	Vinod Sarin
Theo de Winter	Matthias Schneider
Kamil Ekinici	Andre Sharon
Caleb Farny	Pirooz Vakili
Michael Gevelber	Hua Wang
Srikanth Gopalan	Donald Wroblewski
Sheryl Grace	Victor Yakhot
William Hauser	Katherine Zhang
Yehonathan Hazony	Xin Zhang, Associate Chair for Graduate Studies
R. Glynn Holt	

4.2 New Faculty and Staff Requirements

It is expected that at least one, and possibly two (eventually), new faculty lines will be necessary to handle the increased teaching load specifically in the Engineering Management courses.

4.3 Existing and Needed Library and Computer Resources

The library and computing resources at Boston University and within the College of Engineering will also be available to students in the new M. Eng. Program. No other resources will be required.

4.4 Special Equipment or Supply Needs

No special equipment or supplies will be necessary for the administration of the proposed M. Eng. Program.

4.5 Financial Assistance Available

We expect that most students who will enroll in the new degree program will cover their full tuition expenses. A few may receive Research Assistantships or Graduate Teaching Fellowships.

4.6 Budget Projections

The only additional cost is that required to support a single FTE. It may become necessary to exceed this, if the program grows substantially. It is important to note that this FTE will be shared with the proposed companion program – the M.Eng. in Mechanical Engineering – which has several courses in common.

4.7 Statement from Dean Lutchen Regarding Financial Resources and Space Implications

PRELIMINARY BUDGET FORM

Part I-General

1. Name of Program: MEng in Manufacturing Engineering

2. Proposed by: Name: Ron Roy Date: 9/13/10
 Unit/Department: 024/205

3. Expected Start Date: 9/1/11

4: Enrollment Headcounts:	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
a. No. of Full-Time Entering Students:	<u>5</u>	<u>7</u>	<u>9</u>
--MA Students	_____	_____	_____
--PhD Students	_____	_____	_____
b. No. of Full-Time Continuing Students	_____	_____	_____
b. No. of Part-Time Students	_____	_____	_____
c. TOTAL	<u>50</u>	<u>70</u>	<u>90</u>

5. Faculty Headcounts:			
a. No. of Full-Time Faculty*	_____	_____	_____
b. No of Part-Time Faculty	_____	_____	_____
c. TOTAL	<u>0</u>	<u>0</u>	<u>0</u>

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	<u>0</u>	<u>0</u>	<u>0</u>

7. No. of Courses (Credit Hours) Taught:			
a. On-Campus/MA Program	<u>8 (32)</u>	<u>8 (32)</u>	<u>8 (32)</u>
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

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
1. Tuition Income:			
a. From Full-Time Students	<u>196,570</u>	<u>275,198</u>	<u>353,826</u>
b. From Continuing Student Fees			
c. TOTAL TUITION INCOME	<u>196,570</u>	<u>275,198</u>	<u>353,826</u>
2. Fee Income (When Applicable):			
a. From Full-Time Students			
• Application Fee (\$70/Student)	<u>350</u>	<u>490</u>	<u>630</u>
• GSU Fee (\$89/Student/Semester)	<u>445</u>	<u>623</u>	<u>801</u>
• Health Fee (\$69/Student)	<u>345</u>	<u>483</u>	<u>621</u>
• Program Fee (\$ 15 /Student)	<u>75</u>	<u>105</u>	<u>135</u>
• 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	<u>1,215</u>	<u>1,701</u>	<u>2,187</u>
3. Other Income (Please Specify):			

TOTAL OTHER INCOME			
TOTAL INCOME	<u>197,785</u>	<u>277,499</u>	<u>356,013</u>

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:	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
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	<u>_____</u>	<u>_____</u>	<u>_____</u>
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	<u>_____</u>	<u>_____</u>	<u>_____</u>
4. Unit 16 Financial Aid :			
939 Tuition aid for two students	_____	_____	_____
	_____	_____	_____
TOTAL EXPENSE	<u>_____</u>	<u>_____</u>	<u>_____</u>

5. Operating expenses already budgeted separately:

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

024/205 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

Salary Amounts Charged to Program

	<u>Name (or "open")</u>	<u>Rank</u>	<u>Unit/Dept</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
1	_____	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____	_____

903 Full-Time Administrative Staff

Salary Amounts Charged to Program

	<u>Name (or "open"), Title</u>	<u>Unit/Dept</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
1	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____

905 Full-Time Support Staff

Salary Amounts Charged to Program

	<u>Name (or "open"), Title</u>	<u>Unit/Dept</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
1	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____
Total New Lines/Positions:			-	-	-

II Existing Lines/Positions already budgeted separately (description only)

900 Full-Time Faculty

	<u>Name (or "open")</u>	<u>Rank</u>	<u>Unit/Dept</u>
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____

903 Full-Time Administrative Staff

	<u>Name (or "open"), Title</u>	<u>Unit/Dept</u>
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____

905 Full-Time Support Staff

	<u>Name (or "open"), Title</u>	<u>Unit/Dept</u>
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____