AC 2010-1253: MASTERS OF SCIENCE IN TECHNICAL ENTREPRENEURSHIP AND MANAGEMENT (TEAM)

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Masters of Science in Technical Entrepreneurship And Management (TEAM)

Abstract

The Master of Science in Technical Entrepreneurship and Management, or TEAM, degree program at the University of Rochester offers students the opportunity to immerse themselves in a technical concentration of their choice while receiving a strong foundation in entrepreneurial management. TEAM is designed for students with an undergraduate degree in engineering, science, or mathematics, who wish to pursue a master's level technical education in combination with business, entrepreneurial management, and leadership courses.

The TEAM Master of Science program is offered jointly by the Simon Graduate School of Business and the Edmund A. Hajim School of Engineering and Applied Sciences and is administered by the University of Rochester Center for Entrepreneurship.

Students accepted into the TEAM program may choose any technical concentration, such as optics, energy and the environment, computer science, biomedical engineering, chemical engineering, electrical and computer engineering, materials sciences, or mechanical engineering. Students will simultaneously be taking courses at the Simon School and the Hajim School of Engineering.

The core of the TEAM program consists of three entrepreneurially focused business courses developed and offered by the Simon Graduate School of Business, three graduate level engineering courses offered by the Hajim School of Engineering and Applied Sciences, and either an additional technical or entrepreneurship elective. A required practicum accompanied by a written business plan and oral presentation ensures students have practical experience, while graduate level technical courses of the student's choosing serve to extend the student's science and engineering background.

Technical Entrepreneurship and Management students have the unique option to choose an existing patented technology from the University's Offices of Technology Transfer (OTT) and create a business plan for its commercialization. Students can compete for start-up funding in the University of Rochester's Mark Ain Business Model Competition and apply for funding from angel investors and venture capital firms. Graduates of this program have the potential to launch their own businesses based on over 400 University of Rochester technology patents that are available for licensing.

The depth of knowledge provided by the TEAM curriculum creates well-rounded, business-savvy engineers and scientists who are prepared to take on both the technical and business challenges of any industry in a global world.

There are several outcomes and areas of success the program expects to achieve. First, we want to increase the number of businesses started by University of Rochester alumni will increase. We also hope these alumni choose to remain in the Rochester/Upstate NY area. These businesses

started by TEAM alumni will have a positive economic impact and will provide additional jobs for the local workforce. The University of Rochester will develop new external partners as a result of businesses and organizations working with TEAM students during their practicum, internship, or in class presentations. In addition, the University believes that the need for additional professors specializing in entrepreneurship will increase. Finally, other schools at the University of Rochester (i.e. School of Nursing, School of Medicine and Dentistry, Warner School of Education) will develop similar joint degrees based on the TEAM model.

Program Overview

The Master of Technical Entrepreneurship and Management[1], or TEAM, program at the University of Rochester in upstate New York is offered jointly by the University's Hajim School of Engineering and Applied Sciences and the Simon Graduate School of Business, and is administered by the University's Center for Entrepreneurship. Students are able to complete the TEAM degree in as little as one year. A longer track, created especially for international students, includes a summer internship or research component.

TEAM is based on the premise that a student finishing the degree will be able to "speak" three languages- 1) that of their undergraduate engineering, science or mathematics degree, 2) that of their graduate cluster which we advise to be different from their undergraduate major and 3) that of business. TEAM graduates are equipped with detailed technical knowledge in their field as well as business-savvy. They have the tools to innovate, lead, and strategically manage in an industry that increasingly rewards interdisciplinary expertise.

Entrepreneurial Background

This degree program is a result of the University of Rochester's successful Kauffman Foundation grant received in 2004, which awarded the University $3.6 million over five years, and the US Department of Labor Finger Lakes WIRED grant, which awarded the Rochester community $15 million over 4 years.

The University of Rochester has transitioned its focus from big businesses to smaller start-up ventures. The University of Rochester is committed to helping local economic development. The Rochester community was stable for most of the 20th century because of entrepreneurs like George Eastman (Eastman Kodak), Joseph Wilson (Xerox) and Jon Jacob Bausch and Henry Lomb (Bausch and Lomb). By the end of the 20th century, the employment for all three companies was significantly lower than it was in the 1980's. In 2008, the UR became the largest employer in the greater Rochester area.

In 2004,The Council of Competitiveness studied Rochester, New York and produced a report entitled "Fanning the Flame". The Council reported that Rochester has a well-educated workforce but has insufficient people who have the expertise in starting businesses. The report was used to win a WIRED Grant from the US Department of Labor. The program was a community based grant and was administered through the NY State Department of Labor. About 20% of the grant was designated to support entrepreneurship in the community. After an unsuccessful attempt to model the University of Texas Masters of Science in Science and

Technology Commercialization, the TEAM degree was born. New York State Department of Education approved the degree in the summer of 2009. The first full class will be admitted in the fall of 2010.

Curriculum

The core of the TEAM program consists of three entrepreneurially focused business courses developed and offered by the Simon Graduate School of Business, three graduate level engineering courses offered by the Hajim School of Engineering and Applied Sciences, and either an additional technical or entrepreneurship elective. A required practicum accompanied by a written business plan and oral presentation ensures students have practical experience, while graduate level technical courses of the student's choosing serve to extend the student's science and engineering background.

Students accepted into the TEAM program may choose any technical cluster, such as optics, energy and the environment, materials science, computer science, biomedical engineering, chemical engineering, electrical and computer engineering, or mechanical engineering. Students will simultaneously be taking courses at the Simon School and the Hajim School of Engineering.

To receive a Master of Science degree in Technical Entrepreneurship and Management, a student must complete:

* Three core entrepreneurship management courses
* Three technical elective courses
* One additional technical or entrepreneurship management elective
* One semester long practicum
* Written business plan and oral presentation

The TEAM program has developed five entrepreneurship courses in conjunction with the Simon Graduate School of Business specifically tailored for students in this degree program. Core required and elective courses are listed below.

Required Entrepreneurship Courses:

TEM 401 Economics, Marketing and Strategy: This course will introduce students to situation and market analysis. Students will learn how to make strategic decisions, alliances, and relationships. It will teach students to find an unmet need and conduct proper market research to understand the market size, segmentation, and target customer. Finally students will develop a marketing plan and strategy for a selected technology.

TEM 402 Financial Management of New Ventures: This course will introduce students to the topics of accounting, finance, cash flow, funding sources, and exit strategies. Students will learn how to generate a financial model, develop a balance sheet, and create deal structures. The key deliverable for this course will be the feasibility plan.

TEM 411: General Management of New Ventures: This course will introduce students to the topics of legal, regulatory, organizational structure, and human resources. Students will be exposed to contract law, intellectual property, and compensation structure and strategies. Finally students will continue to mature their business plan and begin their presentation.

Entrepreneurship Electives:

TEM 437: Technology Commercialization in Global Economy: This course will introduce students to the topics of internationalization and globalization. It will teach students market considerations, business cultures, and foreign regulations.

TEM 445: Managing Product Development and Customer Satisfaction: This course will introduce students to product development methodologies and function analysis. Topics covered will include life cycle management, vendor management, customer needs, and innovation. Finally students will develop a product development plan and ROI analysis.

Technical electives enable students to customize their technical coursework to satisfy their academic preferences. Elective offerings are designed to provide variety, flexibility, and breadth of knowledge. Though not required by the TEAM program, students are encouraged to choose a technical concentration outside of their undergraduate degree.

Technical concentrations include:

- Biomedical Engineering
- Chemical Engineering
- Electrical & Computer Engineering
- Mechanical Engineering
- Materials Science
- Optics
- Computer Science
- Energy & the Environment

All students are also required to participate in a semester long practicum experience. Under the direction of an advisor, students will work with the Office of Technology Transfer. Students will utilize the office's intellectual property to develop technology and business cases around various technology patents. Students will participate in the strategy, design, and technology validation process. Students will also be required to write a business plan and present an accompanying oral presentation. During this project students must work in teams to create a professional, well-written document.

Technical Entrepreneurship and Management students have the unique option to choose an existing patented technology from the University's Offices of Technology Transfer (OTT) and create a business plan for its commercialization. Students can compete for start-up funding in the University of Rochester's Mark Ain Business Model Competition and apply for funding from angel investors and venture capital firms. Graduates of this program have the potential to launch their own businesses based on over 400 University of Rochester technology patents that are available for licensing.

The TEAM degree can be completed in as little as academic one year, or two semesters. However, for the students who select the research option will complete their degree in three semesters. Others who wish to take classes on the part time basis will extend their time to degree. Students looking to receive some practical experience can choose the three semester academic schedule and can participate in an additional internship or research experience over the summer.

Full-time Students:

Semester 1	**Semester 2**
ENT 401 Economics, Marketing, and Strategy	ENT 411 General Management of New Ventures
ENT 402 Financial Management of New Ventures	ENT 441 Practicum
Technical Elective 1	Technical Elective 3
Technical Elective 2	Technical or Entrepreneurship Elective

Three Semester Option:

Semester 1	**Semester 2**	**Summer**	**Semester 3**
ENT 401 Economics, Marketing, and Strategy	ENT 411 General Management of New Ventures	Internship or Research Experience	Technical Elective 3
ENT 402 Financial Management of New Ventures	ENT 441 Practicum		Technical or Entrepreneurship Elective
Technical Elective 1	Technical Elective 2		MGC 401 Interpersonal Communication Strategies
Identify Research Option	Begin Research	Continue Research	Research Presentation

During the fall semester, the student will identify a research project with his/her advisor. The source of the ideas may come from the Office of Technology Transfer at the University of Rochester or other universities, small or large businesses, startup firms, or the traditional path from a faculty advisor. During the spring and summer, the research will continue with completion in the fall of the second year.

The research experience in the Technical Entrepreneurship and Management (TEAM) degree will be completely integrated with the existing course requirements. The start of research will be during the orientation program for all TEAM students where they will select three or four patents of the several hundred currently unlicensed patents that the University of Rochester owns. During the fall semester as part of the traditional TEAM degree, the students assess the viability of the technology from a technical standpoint. During the spring semester, working in teams of three, students analyze the business opportunity by taking a course on business plan development. As we teach at the University of Rochester, innovation is the product of the

invention and the market opportunity. If either is zero, there is no innovation. The result of this course is a 30 to 40 page business plan and a presentation before a "venture capital" panel. The students with the best business plans then compete in the campus wide business plan contest, the Mark Ain Business Model Competition, sponsored by Mark Ain, founder of Kronos, Inc.

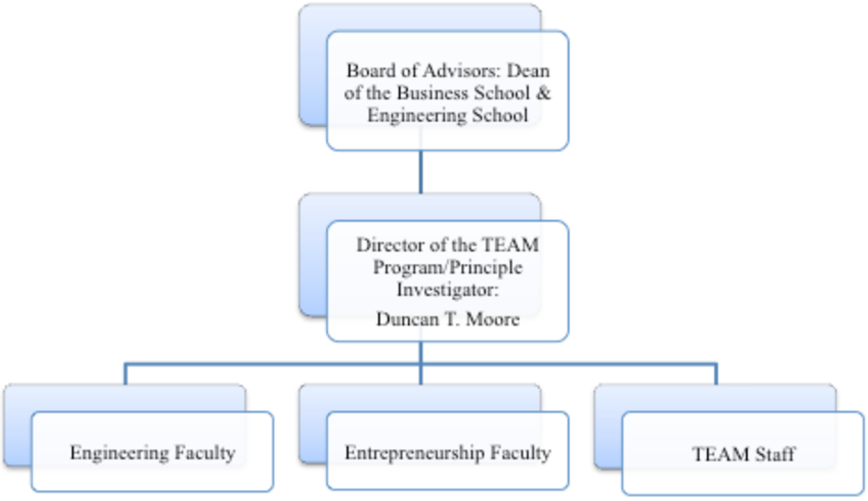
The student(s) can then choose to work with the inventor of the intellectual property to further the research towards the business opportunity during the summer and fall. Near the end of the fall semester of their second year, a public presentation will be held for the University of Rochester community including local businesses. The hope is that the technology will have been advanced enough to start a new company or be taken into an existing business. The advisors for these students will be a representative of Office of Technology Transfer, the inventor, and a faculty member (not the inventor) from one of the eight technology clusters.

Alternatively, several companies have said they would like to have interns from the TEAM program working in their laboratories. If a student chooses this option, the research activity will be identified in the fall of the first year. The student will take the business plan course in the spring and complete a business plan on the topic to be researched in the summer. In the summer, the students will intern at the company site for 10 to 12 weeks. They will then participate in the fall presentations. Students will be advised by a member of the faculty from the business school and one from the cluster, which is closest to the topic.

Finally, the students can choose the traditional route of working in a faculty member's laboratory. Again, the students will identify the topic in the fall in conjunction with a faculty adviser in one of the eight areas that have been selected for the technical cluster (biomedical engineering, chemical engineering, computer science, electrical and computer engineering, energy and environment, mechanical engineering, material science, and optics). These students will follow the same track as the other students with the business plan in the Spring, the research activity in the summer and Fall and the presentation in late Fall of the second year.

Organizational Management and Support

The Technical Entrepreneurship and Management degree program is based on a tuition revenue model in which the tuition revenue is fully returned to the Center for Entrepreneurship. This program will be sustained by revenue brought in by enrolled students. This assures that the Center for Entrepreneurship, its programs, and this degree will continue. In addition, the senior leadership of the University including the Chairman of the Board of Trustees, President, Provost, and Deans are fully supportive of this program. Through their leadership we will be raising an endowment to support the missions of Center for Entrepreneurship including the continuation of this program.



There currently is and has been a great deal of institutional commitment behind the Technical Entrepreneurship and Management program. There has been a very strong partnership in the development and mutual understanding in the execution of the degree program between the Simon Graduate School of Business and the Hajim School of Engineering. Both deans have been in constant communication in regards to the program. The required New York State Department of Education proposal that was developed for the TEAM degree received approval from NYS in less than two weeks. The chairman of the board of trustees, the University president, and provost are all supporters of the program and promote the program regularly in their public speeches and correspondence.

On September 8, 2009 President Joel Seligman announced the new degree program during his yearly state of the University address. He stated, " This year the College will introduce four new Public Health majors that were developed in partnership with the Medical Center and add a new Technical Entrepreneurship and Management master's degree jointly created by the Hajim School of Engineering and Applied Sciences and the Simon School of Business[2]."

Recruitment and Retention

Students will be recruited based on their grade point averages, standardized test scores, and work/internship experience. Only students with undergraduate degrees in natural science, engineering, or mathematics will be considered. The admissions committee will be looking for candidates with strong grade point averages, rank, and test scores to ensure their preparedness for the program. Targeted mailings and emails will be sent to potential students based on their reported standardized test scores. Marketing efforts and materials will target underrepresented groups. Members of the admissions committee will consist of underrepresented groups.

The University of Rochester is a member of several national associations that will assist in its recruitment of underrepresented groups. The University also has the David T. Kearns Center for Leadership and Diversity in Arts, Science, and Engineering[3], named after the former CEO of Xerox. The David T. Kearns Center at the University of Rochester focuses on the creation of

replicable and scalable educational models that will increase the number of low-income and historically underrepresented individuals pursuing undergraduate, graduate and professional education. The Kearns Center partners with the National Science Foundation, the U.S. Department of Education, the Xerox Corporation, the Ford Foundation and a host of private donors to promote the successful engagement of a diverse student body in higher education.

Advising and mentoring will play a large role in the retention of students in the TEAM program. Each student will have two academic advisors, one from the Simon Graduate School of Business and one from Hajim School of Engineering and Applied Sciences based on their chosen technical field. Students will also work with mentors during the formation of their business plan. These mentors will connect students to other prominent business people in the Rochester area. Students will be able to develop a strong network of individuals to help them succeed in the program and with any future endeavors.

The University of Rochester is committed to the recruitment and retention of diverse faculty and staff, which would serve as mentors to the TEAM students. The University of Rochester has a full time position, Deputy to the President and Vice Provost for Faculty Development and Diversity, devoted to the recruitment and retention of diverse faculty. Female faculty throughout the University increased to 31 percent in fall 2008. Faculty who identified themselves as a member of an underrepresented group increased to 3.2 percent during that period. For professional staff, the percent of underrepresented minorities increased to 6.4 percent between fall 2006 and fall 2008.

There are several college level and graduate level programs that support and increase diversity on campus. At the college level, the Ronald E. McNair Post-Baccalaureate Achievement Program has the objective to increase the numbers of low-income, first-generation and underrepresented minority undergraduates who pursue doctoral degrees (specifically the Ph.D.) and go on to careers in research and teaching at the University level. Another program at the undergraduate level, the National Science Foundation (NSF) Scholars program currently supports undergraduates interested in pursuing baccalaureate degrees in science, technology, engineering and mathematics. Finally, the Xerox Undergraduate Research Fellows program is designed to provide engineering undergraduates with an opportunity to participate in a research experience in the Hajim School of Engineering and Applied Sciences during the summer preceding their senior year, which will continue through the fall and spring semesters. The newly launched competitive program will include faculty and students from all departments within the School of Engineering and Applied Sciences and the Institute of Optics.

At the graduate level, the University of Rochester has been accepted into the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM), a non-profit organization that provides science and engineering fellowships to minority students pursuing graduate degrees. GEM is a consortium of universities and corporations that builds a strong support system for students pursuing advanced degrees. As GEM Fellows, students have access to internship opportunities with corporations including Ford Motor Company, DuPont, Bausch & Lomb, and Exxon Mobil, among others. In addition, GEM Fellows receive a stipend while attending graduate school, which is supplemented by member universities. Students who enroll at the University of Rochester will attend tuition-free.

The first GEM student was accepted into the TEAM program this fall semester. Current undergraduates will also see the benefits of attending a GEM institution. University of Rochester seniors can access to GEM's Getting Ready for Advanced Degrees (GRAD) Lab, a series of one-day workshops and webinars designed to expose underrepresented students to the value of research and technology careers.

In addition to utilizing the University's internal and national network through the organizations listed above, the University also has several student associations that provide recruitment opportunities and support for underrepresented groups. These organizations include: the National Society of Black Engineers, the Society of Hispanic Professional Engineers, the Society of Women Engineers, and Women in Science and Engineering.

Areas of Assessment

One of the main areas of assessment will be career placement of TEAM students. The number of students who start entrepreneurial ventures and are placed in competitive positions will provide the main metric for success. The program will also track the number of offers students receive, the number of students placed six months after graduation, the starting salary for graduates, the type of industry students are placed in, the number of businesses started out of the program, and the number of technologies evaluated for the Office of Technology Transfer.

We will also track the number of applicants per year, the quality of applications received, and the quality of applicant acceptance. We define quality by undergraduate grade point average, standardized test scores, letters of recommendation, extra-curricular activities, and entrepreneurial, internship, or work experience. Another area of assessment we will analyze is student satisfaction and retention. The number of new incoming faculty associated with the TEAM degree and new research projects resulting from the program will also be considered areas of success. The new of new external partners for internships, career placement opportunities, and mentors will also be considered an area of success.

Students are required to write and present a business plan to outside reviewers and faculty as their culminating element. The quality and sophistication of the report and presentation will help us evaluate faculty performance and effective student learning. Students are also encouraged to submit their business plan to University and community business plan competitions. The number of students who place or win these competitions will also serve as a means to measure success of the program.

Most of the areas of assessment will be tracked by information gathering and reporting. Student and alumni satisfaction will be assessed through yearly surveys. The Center for Entrepreneurship will collect employer evaluations and build employer relationships with companies where students are placed. We have worked with the Warner School of Education's assessment team on a yearly basis in regards to evaluating other programs funded by the Kauffman Foundation and will utilize that resource once again to assess the TEAM program.

Similar Programs

There are several universities with similar programs across the United States. All of the programs are housed and administered out of a school or academic department. The Masters of Science in Technical Entrepreneurship and Management is unique in that the degree is housed in a non-academic department on campus, the Center for Entrepreneurship. The Technical Entrepreneurship and Management program is also the only program with the term entrepreneurship in its degree title.

Duke's Master of Engineering Management (MEM) Program[4] is housed in the school of engineering and is offered with the support of the Fuqua School of Business and the School of Law. The program prepares engineering and science graduates to become future industry leaders. The core curriculum consists of marketing, finance, intellectual property and business law, and management, similar to key courses in an MBA curriculum. Technical electives provide flexibility to focus on technology management, innovation management, operations management, entrepreneurship, financial engineering or master's courses in specific engineering disciplines.

Dartmouth's Master of Engineering Management (M.E.M.) program[5] is a professional degree program administered out of the Thayer School of Engineering. M.E.M. engineering and management courses are taught by faculty from Thayer School and Tuck School of Business. The mission of Thayer School's M.E.M. program is to develop managers who understand both the engineering and business aspects of technology.

Carnegie Mellon offers a one year interdisciplinary MS degree in Engineering and Technology Innovation Management (E&TIM)[6]. The program is coordinated by the Department of Engineering and Public Policy with collaboration from other schools, including the Heinz School of Public Policy and Management, the Department of Social & Decision Sciences (in the College of Humanities & Social Sciences) and the Tepper School of Business. The one-year program runs from January to December and includes a summer internship.

Case Western Reserve University's Master of Engineering and Management Degree[7] program is a 42 credit hour program that takes three semesters to complete. Courses are taught by the Case School of Engineering and Weatherhead School of Management. The Institute for Management and Engineering (TiME), which brings together the resources of the University's Case School of Engineering, and Weatherhead School of Management manages the Master of Engineering and Management Degree program.

Northwestern University's Master of Engineering Management[8] is run out of the McCormick School of Engineering. The degree offers full-time and part-time program options. Classes are scheduled in the evenings and are designed to fit the schedule of working professionals. The curriculum consists of 12 courses.

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