UNDERGRADUATE CERTIFICATE IN PRODUCT REALIZATION

1.0 BACKGROUND

- Employers now seek engineers with skills in these technologies and who also are able to work under the added pressure of moving products from conception to market in extremely short time periods. With this increased emphasis on minimizing the time to market, it has become essential for engineers to *integrate marketing and business strategies with new products design skills*.

- The *Certificate in Product Realization* cuts across the School of Engineering and into the College of Business Administration of the Katz Graduate School of Business. The *objectives* of the proposed Certificate in Product Realization are:
    - *To close* the current competency gaps that exists between academia and industry in the areas of design and product creation, and
    - *To create* a benchmark educational program that can serve as a model throughout academia.

- The *Certificate in Product Realization* specifically targets competency gaps that exist in the following educational areas:
    - Advanced computational analysis methods,
    - Virtual and rapid prototyping techniques,
    - Micro electronic mechanical systems (MEMS),
    - Digital control systems and wireless communication,
    - Business aspects of product creation,

- Coursework takes advantage of state-of-the-art facilities that currently exist in the *Swanson Center for Product Innovation (SCPI).*

- The certificate is designed for undergraduate engineering students, as well as qualified students in the College of Business Administration with an interest in new product development. Students from the Bio, Industrial, Mechanical, and Electrical/Computer engineering programs may be most interested in obtaining the Certificate.

2.0 CURRICULUM

- Students will take a total of five courses to include at least one College of Business Administration course, two engineering courses and the capstone design course, as described in Figure 1.

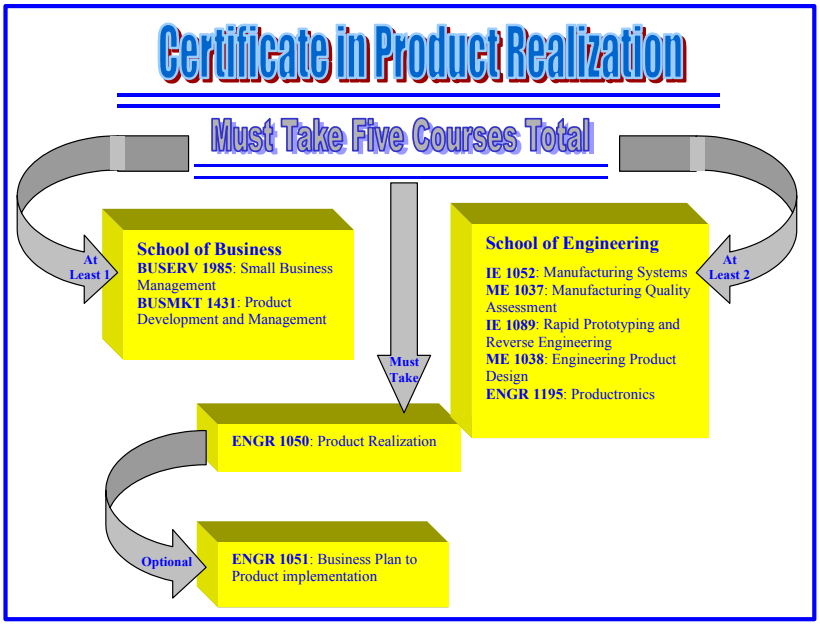

Figure 1. Proposed Curriculum for a Certificate in Product Realization

- **AREA 1: College of Business Courses (students will choose at least one)**
  BUSERV 1985: Small Business Management — Introduces basic principles and practices for successful management of a small business. Topics include the economic environment, development of personal and organizational objectives, marketing, production, finance, credit, accounting, business law, and records management. (No prerequisite.)
  BUSMKT 1431: Production Development and Management — Addresses all stages of the product life cycle beginning with the various phases of new product development, including creativity and new product concept generation, concept testing and evaluation, pricing, demand forecasting, and new product marketing strategies. Also deals with special challenges related to marketing mature products/services, improving marketing implementation effectiveness, and marketing the intangible features of products.

- **AREA 2: Engineering Courses (students will choose at least two)**
  ME 1037: Manufacturing Quality Assessment — State-of-the-art methods for assessment of product quality prior to shipment, using both on- and off-line measurement process, system design strategies, economic impact of quality measurement alternatives on manufacturing. This course currently exists in the mechanical engineering curriculum.
  IE 1052: Manufacturing Systems Analysis — An introduction to traditional and non-traditional processes, product design, geometric tolerancing, cellular design, flexible flow lines, lead time analysis, and work flow leveling and balancing.
  IE 1089: Rapid Prototyping and Reverse Engineering — This course will allow students to follow the entire life cycle of product design and development from conceptual model development to prototype to pilot part. Students first will study the development of conceptual models on existing CAD systems. This information is then translated into special format files that are compatible with Rapid Prototyping machine tools. Alternatively, students will learn how to reverse engineering products from physical to computer-based models that can be analyzed and further refined. Finally, they will study the applications of these technologies to product development and gain valuable hands-on experience working with cutting edge machines.
  ME 1038 Design For Manufacturing - This course allows students to develop skills in specification writing and in the design process. Students will be introduced to several aspects of designing manufacturing processes to include tolerancing, material selection for manufacturing; design for assembly, Taguchi quality methods, and cost estimating for manufacturing.
  ENGR 1195: Productronics — Current electronic technology can be used to provide a number of controller and other embedded functions when used as a part of an electronic control system including wireless communication. The goals of this course are to: (1) develop the conceptual framework that allows someone with little or no knowledge of current electronic design or fabrication to take advantage of its tremendous potential; (2) produce a number of prototype discrete devices that cover a wide range of applications to provide a basis for conceptualization to persons not familiar with the VLSI process; and (3) develop a number of modules that can be used by persons not familiar with VLSI design. These modules can be modified to fit a number of distinct applications. Specific areas of design include: (1) energy source alternatives (battery, photocell, etc.), (2) selection of alternative sensors, (3) RF communications - frequencies, power levels, baud rates, bit encoding states, (4) micro processor clock rates, software utilities selection (filter type, bandwidth, etc.), I/O port connections, fixed program selection, custom programs (software), (5) identification alternatives, IP for network connection, response format for transponders, blue tooth, etc. Applications will span several engineering disciplines and involve a variety of industrial and organizational collaborators.

- **AREA 3: Capstone Design Course**
  ENGR 1050: Product Realization (required) — This interdisciplinary course considers the diverse aspects of the product realization process. These aspects generally include: 1) defining user requirements, 2) the creation of a computer based model and designs of a product from an existing product, 3) rapid prototyping techniques, and 4) the development of a manufacturing plan. Working in multidisciplinary design teams (3-5 students) from engineering and business, students will take a product from concept to business plan. In doing this they will address issues of market analysis, design, manufacturing design, and production planning. The course will culminate in a final presentation of business plans to a panel from industry and academia. Students whose plans are accepted will receive up to $2,500 from the Pitt Venture Fund to be used to complete *ENGR 1051* below. Some funding will be available for students to make conceptual prototypes and mock-ups as part of their business plan presentation to the panel.

ENGR 1051: Business Plan to Product Implementation (optional) — This independent study course will allow selected design teams (via the competitive judging process of ENGR 1050) to advance product ideas to prototyping and potential commercialization. Each student team will begin with their business plan and up to $2,500 they will have been awarded from the venture capital committee for use in further developing their product using the New Product Incubator. We plan to raise sufficient funds so that up to 10 design teams can be funded annually from the "mini Pitt Venture Capital" fund.

- Curricular Notes:
  (1) With the exception of IE 1052, all courses are considered technical electives in the respective department and are taught on a regular basis (IE 1052 is a core course for all industrial engineering students).
  (2) For the courses that require pre-requisites, Certificate seeking students will be able to obtain special permission to take the course without the prerequisite.
  (3) ENGR 1050 fulfills the requirements for senior project in Mechanical and Electrical/Computer engineering. For all other engineering programs, it serves as a technical elective. The teaching of this course will rotate between Mechanical, Electrical/Computer, and Industrial Engineering.
  (4) ENGR 1051 is primarily an independent study course for those teams that will to advance their product ideas to commercialization. For this course, faculty will rotate between the Executive Director (M. Lovell) and the Educational Director (M.Besterfield-Sacre).

3.0 ADMISSION AND COMPLETION REQUIREMENTS

- A minimum 2.5 QPA is required for students to participate in the certificate. Further a QPA of 2.5 in the five courses is required to obtain the certificate.

- Students fulfilling the requirements of the Certificate will receive notification on their permanent academic transcript. In addition, such students will be recognized publicly at the Senior Recognition Night that the School of Engineering hosts each year for graduating seniors and their families.

4.0 COURSE OFFERINGS AND SCHEDULES

- The "typical" offering of courses is provided in Table 1.

Table 1. Product Realization Course Offerings

Fall	Spring	Summer
IE 1089	IE 1052	ME 1038
ME 1038	BUSERV 1985	ENGR 1050
ME 1037	ENGR 1195	ENGR 1051
BUSMKT 1431	ENGR 1050	
ENGR 1050	ENGR 1051	
ENGR 1051		

- Tables 2 and 3 provide example schedules of course offerings to accommodate students who COOP.

Table 2. COOP Example Plan #1

Semester Level	Fall	Spring	Summer
Sophomore	Primary Degree Requirements	Primary Degree Requirements	COOP 1
Junior	BUSMKT 1431 IE 1089 &/or ME 1038 &/or ME 1037	COOP 2	Primary Degree Requirements
Senior	COOP 3	IE 1052 &/or ENGR 1195 ENGR 1050 (IEs)	If Here, ME 1038 ENGR 1050 or ENGR 1051
Senior +	ENGR 1050 (capstone ME, EE/CoE) or 1051		

Table 3. COOP Example Plan #2

Semester Level	Fall	Spring	Summer
Sophomore	Primary Degree Requirements	Primary Degree Requirements	Primary Degree Requirements
Junior	COOP 1	BUSERV 1985 IE 1052 &/or ENGR 1195	COOP 2
Junior +	IE 1089 &/or ME 1038 &/or ME 1037	COOP 3	If Here, ME 1038 ENGR 1050
Senior	ENGR 1050 (tech elect IE; capstone ME, EE/CoE) or 1051	ENGR 1050 (tech elect IE; capstone ME, EE/CoE) or 1051	

5.0 FOR MORE INFORMATION

Students wishing to participate in the certificate program may contact their respective undergraduate coordinator or one of the *SCPI* Directors for more information, as shown below. Management of the certificate is done through Besterfield-Sacre.

- Swanson Center for Product Innovation - www.engrng.pitt.edu/SCPI

- Michael Lovell, Executive Director, SCPI
  624-9601, BEH 635, mlovell+@pitt.edu

- Mary Besterfield-Sacre, Education Director, SCPI
  624-9836, BEH 1040, mbsacre@engrng.pitt.edu