

AC 2009-2231: UNIQUE AND HIGH QUALITY MANUFACTURING ENGINEERING (ME) GRADUATION PROGRAM

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Unique and High Quality Manufacturing Engineering (ME) Graduation Program

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Abstract

Engineering education has become the huge challenge of present time in every Country of the world. New competences are required for engineers and they are driving the changes in engineering education institutions worldwide. Engineering Schools have been implementing more flexible programs in partnership with industries, promoting more exchanges programs and so on. It is the education evolution in order to adequate the formation of engineers for the 21st. Century. This work constitutes of a brief presentation about the manufacturing graduation program that attends the new demands of a challenging global world. It is about the COPEC Institute of Education and Research New Graduation Program: The Manufacturing Engineering (ME) Program. It has been specially designed in order to fulfill the lack of formation of dedicated professionals to work hard with the goal of promoting the development of Manufacturing and Management researches. The program fits the necessities of professionals and enterprises interested in the improvement of career and quality performance. It is a flexible program that is developed in according to the needs for the accomplishment of the main goal of the group. It is important to point out that it has also hands on study totally developed in teams, which is not easy but necessary. No doubt that it is the most difficult part of the program, to work in teams, but as much as possible the groups try their best to overcome the obstacles such as communication, stress management and so on. The classes also serve as research laboratory for creating a better understanding of the process of rapid response to customer input. Entrepreneurship driven mind and rapid response of product design are desirable skills that the program focuses and pursues as these are some of the qualities of the manufacturing engineer of this century.

1. Introduction

Science and technology are essential for the development of human kind from now on and engineering has a big part on this development however Engineering that is so important is suffering with a shortage of engineers in several areas world wide. So it is necessary to promote the formation of the best professionals to supply the demanding work market. So it is imperative the fostering of quality programs, principally in graduation level. In order to accomplish such task COPEC - Council of Researches in Education and Sciences education team has designed a new program in graduation level: The Manufacturing Engineering (ME) Program, which offers two graduate degrees: the master of science and the doctor of philosophy.

The graduate programs in manufacturing engineering provide opportunities for students to study current manufacturing techniques while allowing each student the flexibility to customize their educational program. Course material and research activities often draw from the traditional fields of computer science control engineering, electrical and computer engineering, environmental engineering, industrial engineering, materials science and engineering, mechanical engineering, and management. The intention of this program is to build a solid and broad foundation in manufacturing theories and practices, and allow for further concentrated study in a selected specialty.

The program fits the necessity of the region, the Atlantic Forest Region, which has the largest industrial park, in Cubatão City; and the ABC region, where there is the largest number of car industries of South America. Besides in Santos, there is the largest sea port of Latin America from which 90% of exportation goods goes out and imported goods come in [1].

2. Admission Requirements

Candidates requirements for admission and should have a bachelor's degree in science, engineering, or management, preferably in such fields as computer science/engineering, electrical/ control engineering, industrial engineering, environmental engineering, manufacturing engineering, materials science and engineering, mechanical engineering, or management. Students with other backgrounds will be considered based on their interest, formal education and experience in manufacturing.

3. Course Information

The master's programs require at least 30 graduate-level credits (for the M.S., 6 of these are for thesis research). The following core courses are preferred for first year master's students:

Current Topics in Manufacturing Seminar;
Control and Monitoring of Manufacturing Processes;
Design and Analysis of Manufacturing Processes;
Computer-Integrated Manufacturing;
Design for Manufacturability.

The Manufacturing Engineering (ME) program is intended to be flexible in order to meet student needs. Many ME graduate students work full time as engineers, others are graduate teaching and research assistants. Some of the courses are offered in the evenings.

The M.S. Degree in ME requires 30 credit hours of graduate studies. The 30 credits consist of a minimum of 12 credit hours of coursework, plus 12 credit hours of any combination of coursework, independent study, directed research or thesis that complies with the following constraints: if there is a thesis, it must at least 6 and no more than 12 credits; there can be no more than 9 credits of directed research; and the total number of credits from the Management Department cannot exceed 14.

The minimum of 12 credit hours of coursework must include a minimum of two credits each in at least four of the seven core areas. The coursework should be selected in consultation with an advisor from the ME faculty. All full-time students are required to participate in the non-credit seminar course.

The seven core areas, and corresponding suggested courses that students can select to fulfill the requirements in each of these areas, are listed below. Courses that appear in more than one core area can only be used to fulfill the requirements in one.

a. Manufacturing Systems

Computer Integrated Manufacturing
Supply Chain Analysis and Design
Productivity Management
Learn Process Design
System Design and Development
Enterprise Systems

b. Manufacturing Processes

Design and analysis of Manufacturing Processes
Industrial Robotics
Or any graduate Manufacturing Engineering or Materials Science and Engineering course on a manufacturing process that has been a requirement in terms of top course.

c. Control Systems

Controls and Monitoring of Manufacturing Processes
Industrial Robotics
Or any graduate course in the Dynamics and Controls section of Mechanical Engineering

d. Design

Design for Manufacturability
Design and Analysis of Manufacturing Processes
Computer-aided Design and Geometric Modeling

e. Materials

Any graduate course in Materials Science and Engineering

f. Financial Processes

Financial Accounting
Finance
Economics of the Firm
Domestic and Global Economic Environment of Business
Business Analysis for Technological Managers

g. Statistics and Quality Assurance

Quantitative Methods
Principles of Marketing

Designing and Managing Six-Sigma Processes
Or any graduate Mathematical Sciences course on statistics

4. Doctoral of Philosophy (Ph.D.) in Manufacturing Engineering

The requirements for the Doctor of Philosophy Degree consist of written exam, which must be successfully completed. A member of the Engineering Faculty will be appointed to be Chairperson of the Admission Committee. This person should not be the student's Ph.D. dissertation advisor. The student's Ph.D. dissertation advisor may be another member. At the present time the Admission Committee will consist of all members of the Manufacturing Engineering Faculty with the rank of Assistant Professor or higher. Faculty from other departments at COPEC Institute of Education and Research or other colleges/universities may be asked to participate in this examination if the Manufacturing Engineering Faculty feels that it is necessary [2].

The written exam will be open book. The written exam will be given in four hour section in one day.

The student has the choice to select three of the following seven areas for the written examination:

- Manufacturing Systems;
- Manufacturing Processes;
- Control Systems;
- Design;
- Materials;
- Financial Processes;
- Statistics and Quality Assurance.

The detail description of the seven areas is the same as it is for M.S. Degree in Manufacturing Engineering. In addition, the student must select one additional area for examination that is related to the student's proposed area of research (ex. Artificial Intelligence, Materials Science, Statistics, etc.). This area must be approved by the student's academic advisor and the Manufacturing Engineering Graduate Committee. Questions of both a theoretical/scientific and a practical /engineering nature will be included in the written exam. In each of the above sections, a choice of questions will be given. The writer of the question will grade that question with a grade between 0 and 100. The student must pass each section of the exam. The Admission Committee will determine the passing grade each time the exam is given. Deficiencies found in the written exam may be further questioned in the oral exam.

5. Admission to Candidacy

To be admitted to candidacy for the Ph.D. in Manufacturing Engineering a student must:

- Pass the exam;

- Submit and receive approval for Admission to Candidacy summarizing the student's course of study. This application must be approved by the Manufacturing Engineering Graduate Committee.

It is recommended that the student develop a plan of study early in the Ph.D. program in cooperation with the dissertation advisor and the dissertation committee. The plan of study may be submitted to and approved by the Manufacturing Engineering Program prior to taking the exam. The application for candidacy with the plan of study should be submitted to the Committee on Graduate Studies and Research after the exam is passed.

The additional requirements of the Manufacturing Engineering PhD Program are:

Independent Research Presentation: Prior to admission to candidacy for the Ph.D. in Manufacturing Engineering the student must present a seminar for the Manufacturing Engineering Faculty;

Written Examination Successful completion of the Manufacturing Engineering Doctoral Qualifying / Written Examination described above;

Research Proposal Successful completion and oral defense of the Ph.D. Research Proposal before the student's Dissertation Committee. A description of the Ph.D. Research Proposal follows. A description of the Dissertation Committee also follows.

6. The Exam

- The student passes and continues to work towards the Ph.D.;
- The student may fail but be allowed to take the exam for a second in at least one semester after the first time. The Admission Committee will identify the areas of deficiency for the student. This result may be determined after just the written component of the examination, or after both the written and oral components, have been taken;
- The student may fail the exam and not be allowed to continue in the Manufacturing Engineering Ph.D. program at COPEC Institute of Education and Research. This result may be determined after just the written component of the examination or after both the written and oral components have been taken.

7. Ph.D. Research Proposal

At least one year prior to completion of the Ph.D. dissertation, the student must present a formal seminar to the public describing the proposed dissertation research project. It is part of a big project developed by the team in which the student is involved. This Ph.D. Research Proposal will normally be presented after admission to candidacy and in most of the cases its the continuation of the project part of the Master level. A formal written research proposal must be given to the student's Ph.D. Dissertation Committee at least one week prior to the presentation. There is no grade for the research proposal. The purpose of the proposal defense is to test the candidate the ability of research and help the student in directing the research toward a successful Ph.D. dissertation. Therefore, suggestions and redirections of the dissertation research will be made by the Dissertation Committee. Formal written and oral Ph.D. Research Proposal also provides the opportunity to inform the Dissertation Committee and the entire Manufacturing

Engineering community of the proposed research project and to obtain input from all interested parties [3].

The student's Ph.D. dissertation advisor is the chairperson of this committee. The same Ph.D. Dissertation Committee will judge the student's dissertation.

8. Ph.D. Dissertation Presentation and Defense

Upon completion of the Ph.D. dissertation, the student must successfully defend the dissertation. The same format as the research proposal will be used.

The student's Ph.D. Dissertation Committee, with the dissertation advisor acting as chairperson, will determine if the student passes, by a simple majority vote. The possible results of the dissertation defense are:

- Pass;
- Pass with modifications to the dissertation that must be finally approved by the dissertation advisor and /or the entire committee;
- Not pass, correct deficiencies and present the dissertation again to the committee;
- Fail, and try again in six months.

9. Ph.D. Dissertation Committee

The student's dissertation advisor chairs this committee. With the advisor of the dissertation advisor, the student will select a dissertation committee. This committee must have at least five members. The committee should be made up from members of the Manufacturing Engineering Faculty representing more than one department or person from outside COPEC Institute of Education and Research. (i. e. from industry or another college/university) [4].

This committee will participate in the "Ph.D. Research Proposal" and the "Ph.D. Dissertation Defense". The student should call on the members of this committee for advice with regard to course selection and research projects during the entire Ph.D. program. It is recommended that this committee be selected early in the students Ph.D. program and prior to take the written Examination.

The Committee will exercise its discretion in handling any extenuating circumstances or problems.

10. Conclusion

It is a flexible program that is developed in according to the needs for the accomplishment of the main goal of the groups involved with the projects. It is important to point out that it has also hands on study totally developed in teams, which is not easy but necessary. The final thesis is a part of a big project developed by the team. In general the projects proposed by the teachers are real ones developed (or just proposed) of real work environment. No doubt that it is the most

difficult part of the program, to work in teams, but as much as possible the groups try their best to overcome the obstacles such as communication, stress management and so on.

The program acceptance has been very positive and the reviews from students and enterprises have been very good once it has corresponded to their expectations. The program has been a success such that this concept of customized program will be extended for other engineering areas.

References

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