<TITLE>

A Co-op Thesis written for

<EMPLOYER NAME>

and submitted to

KETTERING UNIVERSITY

in partial fulfillment
of the requirements for the
degree of

BACHELOR OF SCIENCE IN <DEGREE>

by

<STUDENT NAME>

<year of graduation>

_____
Student

_____
Employer Thesis Advisor

_____
Faculty Thesis Advisor

<TITLE>

A Research Thesis written for

KETTERING UNIVERSITY

and submitted to

KETTERING UNIVERSITY

in partial fulfillment
of the requirements for the
degree of

BACHELOR OF SCIENCE IN <DEGREE>

by

<STUDENT NAME>

<year of graduation>

_____
Student

_____
Faculty Thesis Advisor

_____
Committee Member

<TITLE>

A Professional Practice Thesis written for

COMPANY NAME

and submitted to

KETTERING UNIVERSITY

in partial fulfillment
of the requirements for the
degree of

BACHELOR OF SCIENCE IN <DEGREE>

by

<STUDENT NAME>

<year of graduation>

_____
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Company Liaison

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An E-Ship Thesis written by

STUDENT NAME

and submitted to

KETTERING UNIVERSITY

in partial fulfillment
of the requirements for the
degree of

BACHELOR OF SCIENCE IN <DEGREE>

<year of graduation>

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Committee Member

DISCLAIMER

This thesis is submitted as partial fulfillment of the graduation requirements of Kettering University needed to obtain a Bachelor of Science in Degree.

The conclusions and opinions expressed in this thesis are those of the student author and do not necessarily represent the position of Kettering University or anyone else affiliated with this culminating undergraduate experience.

PREFACE

This thesis represents the capstone of my five years combined academic work at Kettering University and past work experiences. My Culminating Undergraduate Experience provided the opportunity for me to use the knowledge and skillset learned while at Kettering to manage a project of this magnitude.

Although this thesis represents the compilation of my own efforts, I would like to acknowledge and extend my sincere gratitude to the following persons for their valuable time and assistance, for without whom the completion of this thesis would not have been possible:

1.

2.

3.

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I. INTRODUCTION

Problem Topic

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ABET PROGRAM OUTCOMES

If this appendix is your ONLY Appendix delete the main appendix divider page and the divider page provided for Appendix A. Delete the letter B that appears at the end of the 1st heading line on this page.

Please select your degree program outcomes from this section and respond to all statements. Delete program outcomes for all other degrees.

APPLIED PHYSICS STUDENT OUTCOMES
Applied Sciences Accreditation Board (AP Degree)

Applied Physics Student Outcomes (previously referred to as Program Outcomes by ABET) are the same as those indicated by ABET (a) - (k) criteria. Applied Physics degree follows the criteria established by the Applied Sciences Commission

A. An ability to apply knowledge of mathematics, science, and engineering.

B. An ability to design and conduct experiments, as well as to analyze and interpret data.

C. An ability to formulate or design a system, process, or program to meet desired needs.

D. An ability to function on multi-disciplinary teams.

E. An ability to identify and solve applied science problems.

F. An understanding of professional and ethical responsibility.

G. An ability to communicate effectively.

H. The broad education necessary to understand the impact of solutions in a global and societal context.

I. A recognition of the need for, and an ability to engage in lifelong learning.

J. A knowledge of contemporary issues.

K. An ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

PROGRAM OUTCOMES
CHEMICAL ENGINEERING

Upon graduation, students receiving the Bachelor of Science in Chemical Engineering Degree from Kettering University will have the following knowledge, skills, and abilities:

A. An ability to apply knowledge of mathematics, science and engineering.

B. An ability to design and conduct experiments, as well as to analyze and interpret data.

C. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

D. An ability to function on multi-disciplinary teams.

E. An ability to identify, formulate, and solve engineering problems.

F. An understanding of professional and ethical responsibility.

G. An ability to communicate effectively.

H. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

I. A recognition of the need for, and an ability to engage in lifelong learning.

J. A knowledge of contemporary issues.

K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CHEMISTRY AND BIOCHEMISTRY
PROGRAM EDUCATIONAL OBJECTIVES AND OUTCOMES

PEO 1: The graduates of the Chemistry Degree Program will have a broad, fundamental and mathematically rigorous understanding of theoretical and experimental chemistry.

Outcome 1: Students will have a working understanding of basic chemistry concepts.

Outcome 2: Students will be competent in using modern instrumentation.

Outcome 3: Students will graduate with a sufficiently diverse academic background in theoretical and experimental chemistry.

PEO 2: The graduates of the Chemistry Degree Program will function effectively and ethically within an organization and society as professional chemists.

Outcome 4: Students will have an ability to apply knowledge of mathematics and science.

Outcome 5: Students will have an ability to conduct experiments, as well as to analyze and interpret data.

Outcome 6: Students will have an ability to design experiments.

Outcome 7: Students will have an ability to function as members of a work or research team.

Outcome 8: Students will have an understanding of professional and ethical responsibility.

Outcome 9: Students will have an ability to successfully access and use chemical information, including professional journals, abstracts, and databases.

Outcome 10: Students will be competent in using computers, including programming, data acquisition and use of data bases and application software.

PEO 3: The graduate of the Chemistry Degree Program will have the skills necessary to effectively communicate their chemical understanding to the general public and to the professional chemical community.

Outcome 11: Students will be competent in oral presentation of scientific work.

Outcome 12: Students will be competent in the writing of scientific papers and in other written presentations of scientific work.

PEO 4: The graduates of the Chemistry Degree Program will be familiar with health and safety concerns and the use of chemicals in industry.

Outcome 13: Students will have the broad education necessary to understand the impact of chemicals on industry, the environment, and the global economy.

Outcome 14: Students will be familiar with the handling of hazardous materials.

Outcome 15: Students will be familiar with fundamentals of toxicology.

Outcome 16: Students will have an understanding of environmental polices.

PEO 5: The graduates of the Chemistry Degree Program will be able to pursue an advanced degree.

Outcome 17: Graduates of the program will compare favorably with chemistry undergraduates from other institutions.

Outcome 18: Students will be adequately prepared for graduate studies.

Outcome 19: Students will be able to pursue independent research.

RELATIONSHIP TO COMPUTER ENGINEERING PROGRAM OUTCOMES

Each graduate of the Computer Engineering program will have demonstrated the ability to do each of the following:

Program Outcome 1. Assembly language. Analyze, design, develop, debug, and document structured assembly language programs for at least two different embedded-computer platforms, including at least one with a 32- or 64-bit architecture. Use appropriate techniques and modern embedded-computer development tools.

Program Outcome 2. High-level language. Analyze, design, develop, debug, and document programs in at least one structured high-level programming language. Use appropriate techniques and modern software development tools.

Program Outcome 3. Real-time operating systems. Develop, debug, and document a simple real-time operating system and design, develop, debug, and document application programs for it to implement a complete real-time system that meets specifications. Use appropriate techniques and modern embedded-computer development tools.

Program Outcome 4. Analyze, design, prototype, debug, and document combinational and sequential digital circuits. Use appropriate techniques and modern digital-systems development tools and implementation technologies.

Program Outcome 5. Computer architecture. Design and verify the operation of a basic central processing unit for a general-purpose computer. Use appropriate techniques and modern digital-systems simulation tools.

Program Outcome 6. Circuits, electronics, and systems. Model, analyze (at DC and AC steady state), and design electrical and electronic circuits and systems. Use modern electronic design and test equipment.

Program Outcome 7. Elective areas. Use understanding of basic principles and appropriate tools to analyze, design, develop, debug, and document simple systems in at least two of the following areas of computer engineering: computer networks, programmable logic controllers, expert systems, database systems, VLSI systems.

Program Outcome 8. Teamwork. Work productively in a multidisciplinary team, in particular to carry out projects involving computer engineering.

Program Outcome 9. Ethics and professionalism. Act in a professional and ethical manner in the workplace.

Program Outcome 10. Written and oral communication. Communicate effectively through written reports and oral presentations appropriate for other computer engineers or for non-technical audiences, as required.

Program Outcome 11. Global and societal context. Understand the impact of engineering solutions in a global and societal context.

Program Outcome 12. Lifelong learning. Independently acquire the information and understanding necessary to complete projects or undertake other responsibilities in unfamiliar areas from appropriate sources such as books, training courses, technical documentation, and application notes.

Program Outcome 13. Contemporary issues. Understand contemporary issues, especially as they relate to employment as a computer engineer.

COMPUTER SCIENCE PROGRAM OUTCOMES

The Computer Science department at Kettering University set forth these four program objectives:

1. Computer Science graduates will have a broad, mathematically rigorous program in the fundamental areas of computer science that will allow them to continue their professional development and sustain a life-long career in computer science either through graduate study or continuing self-directed learning and development activities.

2. Computer Science graduates will have developed a sufficient depth of understanding in computer science, and the skill, confidence, professionalism, and experience necessary for successful careers in computer science and related fields.

3. Computer Science graduates will have the teamwork, communication, and interpersonal skills to enable them to work efficiently with interdisciplinary teams in industry, government, and academia.

4. The Computer Science faculty will provide its degree majors an excellent education experience through the incorporation of current pedagogical techniques, understanding of contemporary trends in research and technology, and hands-on laboratory experiences that enhance the educational experience.

RELATIONSHIP TO ELECTRICAL ENGINEERING PROGRAM OUTCOMES

Program Outcome a. An ability to solve electrical engineering problems by applying knowledge of such fundamental and advanced mathematics as calculus, differential equations, linear algebra, probability and statistics, and science and engineering principles.

Program Outcome b. An ability to design and conduct experiments in electrical engineering, as well as to collect, analyze and interpret data to reach appropriate conclusions.

Program Outcome c. An ability to design an electrical system, component, or process to meet desired technical, environmental, safety and economical specifications.

Program Outcome d. An ability to participate and contribute in multi-disciplinary team activities.

Program Outcome e. An ability to identify, formulate, and solve engineering problems.

Program Outcome f. An understanding of professional and ethical responsibility and the consequences of failing in it.

Program Outcome g. An ability to communicate effectively in both oral and written fashion.

Program Outcome h. The broad education necessary to understand the impact of engineering solutions in a global and societal context.

Program Outcome i. An appreciation for the need for, and preparedness to engage in life-long learning.

Program Outcome j. A knowledge of contemporary social, economical and political issues and their impact on engineering profession.

Program Outcome k. An ability and experience in using the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Outcome l. A knowledge of computer science and computer engineering, and engineering sciences necessary to analyze and design systems containing hardware and software components.

ENGINEERING PHYSICS STUDENT OUTCOMES

Engineering Accreditation Board (EP Degree)

Engineering Physics Student Outcomes (previously referred to as Program Outcomes by ABET) are the same as those indicated by ABET (a) - (k) criteria. Engineering Physics degree has adopted criteria established by the Engineering Commission

A. An ability to apply knowledge of mathematics, science, and engineering.

B. An ability to design and conduct experiments, as well as to analyze and interpret data.

C. An ability to design a system, component, or process, to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

D. An ability to function on multi-disciplinary teams.

E. An ability to identify, formulate, and solve engineering problems.

F. An understanding of professional and ethical responsibility.

G. An ability to communicate effectively.

H. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

I. A recognition of the need for, and an ability to engage in lifelong learning.

J. A knowledge of contemporary issues.

K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PROGRAM OUTCOMES
INDUSTRIAL ENGINEERING

A. An ability to apply knowledge of mathematics, science, and engineering.

B. An ability to design and conduct experiments, as well as to analyze and interpret data.

C. An ability to design a system, component, or process to meet desired needs.

D. An ability to function on multi-disciplinary teams.

E. An ability to identify, formulate, and solve engineering problems.

F. An understanding of professional and ethical responsibility.

G. An ability to communicate effectively.

H. The broad education necessary to understand the impact of engineering solutions in a global and societal context.

I. A recognition of the need for, and an ability to engage in lifelong learning.

J. A knowledge of contemporary issues.

K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

L. Understand and serve in Industrial Engineering roles.

M. Describe, model, and measure current processes and systems and identify areas of improvement.

N. Estimate current, and forecast future, resource requirements.

O. Design and organize work spaces and places.

P. Track the results of improvement efforts as part of a continuous improvement process.

PROGRAM OUTCOMES
MANAGEMENT

A. Students graduating with a Bachelor of Science Degree in Management will have a broad knowledge and understanding of business fundamentals so that they are academically prepared for a business career; compare favorably when evaluated on a national norm, and as alumni, are successful in advanced studies, other professional fields, or in advancing themselves within an organization.

B. Graduating undergraduate students will have the positive perspectives and skills that create productive employees and managerial leaders.

C. The undergraduate Business Program Faculty will demonstrate teaching effectiveness by using appropriate educational and learning techniques in the classroom.

PROGRAM OUTCOMES
MANUFACTURING ENGINEERING

A. An ability to apply knowledge of mathematics, science, and engineering.

B. An ability to design and conduct experiments, as well as to analyze and interpret data.

C. An ability to design a system, component, or process to meet desired needs.

D. An ability to function on multi-disciplinary teams.

E. An ability to identify, formulate, and solve engineering problems.

F. An understanding of professional and ethical responsibility.

G. An ability to communicate effectively.

H. The broad education necessary to understand the impact of engineering solutions in a global and societal context.

I. A recognition of the need for, and an ability to engage in lifelong learning.

J. A knowledge of contemporary issues.

K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

L. Have proficiency in materials and manufacturing processes: understanding the behavior and properties of materials as they are altered and influenced by processing in manufacturing.

M. Have proficiency in process, assembly and product engineering: understanding the design of products and the equipment, tooling and environment necessary for their manufacture.

N. Have proficiency in manufacturing competitiveness: understanding the creation of competitive advantage through manufacturing planning, strategy and control.

O. Have proficiency in manufacturing systems design: understanding the analysis, synthesis and control of manufacturing operations using statistical and calculus based methods, *simulation, and *information technology.

P. Have proficiency in laboratory experience: graduates must be able to measure manufacturing process variables in a manufacturing laboratory and make technical inferences about the process.

APPLIED MATH PROGRAM OUTCOMES

A. An ability to apply knowledge of mathematics, science, and engineering.

B. An ability to design and conduct experiments, as well as to analyze and interpret data.

C. An ability to design a system, component, or process to meet desired needs.

D. An ability to function on multi-disciplinary teams.

E. An ability to identify, formulate, and solve engineering problems.

F. An understanding of professional and ethical responsibility.

G. An ability to communicate effectively.

H. The broad education necessary to understand the impact of engineering solutions in a global and societal context.

I. A recognition of the need for, and an ability to engage in lifelong learning.

J. A knowledge of contemporary issues.

K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PROGRAM OUTCOMES
MECHANICAL ENGINEERING
(Updated for 2008/09 Academic Year)

Upon graduation, students receiving the Bachelor of Science in Mechanical Engineering Degree from Kettering University will have the following knowledge, skills, and abilities:

L. An ability to apply knowledge of mathematics, science and engineering.

M. An ability to design and conduct experiments, as well as to analyze and interpret data.

N. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

O. An ability to function on multi-disciplinary teams.

P. An ability to identify, formulate, and solve engineering problems.

Q. An understanding of professional and ethical responsibility.

R. An ability to communicate effectively.

S. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

T. A recognition of the need for, and an ability to engage in lifelong learning.

U. A knowledge of contemporary issues.

V. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

W. Familiarity with statistics and linear algebra.

X. A knowledge of chemistry and calculus-based physics with a depth in at least one of them.

Y. An ability to model and analyze inter-disciplinary mechanical/electrical/hydraulic systems.

Z. An ability to work professionally in the area of thermal systems including the design and realization of such systems.

AA. An ability to work professionally in the area of mechanical systems including the design and realization of such systems.