

ACADEMIC PLAN

APPLIED MECHANICAL ENGINEERING PROGRAM

**KING SAUD UNIVERSITY- COLLEGE OF
ENGINEERING- MUZAHMIA BRANCH**

DEGREE REQUIREMENTS

MAY, 2014

KING SAUD UNIVERSITY - MUZAHMIA BRANCH
COLLEGE OF ENGINEERING
APPLIED MECHANICAL ENGINEERING PROGRAM

1- INTRODUCTION

Mechanical Engineering applies the discoveries of science to the design and creation of things that are safe, reliable and practical. Mechanical Engineers direct their efforts towards the creation of physical or mechanical things, whether they are single components, complete machines, or complex processes. Mechanical Engineering rests on some basic principles: the effects of forces and energy on solids and liquids; the properties of materials; the design of mechanisms and manufacturing processes; and the integration of mechanical, electronic and computer systems. With today's technology and tools, Mechanical Engineers can apply these fundamentals to create a stunning variety of cutting-edge products. Mechanical Engineering is a broad, diversified and well-established discipline, with career opportunities in almost any field.

The Applied Mechanical Engineering (AME) program has been designed in accordance with the international standards and criteria of engineering education to serve the goals of the development plans of the Kingdom in preparing the graduates to fit in different job sectors within the field of specialization. In addition to that, a minor in business is proposed as an optional choice for willing students.

2- BACHELOR OF ENGINEERING IN APPLIED MECHANICAL ENGINEERING PROGRAM

The undergraduate Applied Mechanical Engineering program leads to the Bachelor of Engineering Degree with a Major in Applied Mechanical Engineering (AME). The program is carefully designed to provide a wide knowledge in important areas of modern mechanical engineering. The B.S. program is a five-years/ten-semesters program that focuses on applied mechanical engineering courses and project as well as general science and engineering soft skills to prepare students for the future with solid foundations in theory and practice which is intended to make the engagement of our graduated students in the industry smooth and effective.

The degree in applied mechanical engineering is a ten-semester full-time program. The first year curriculum focuses on physics, math, chemistry and other complementary courses, and the following years are intended to focus on applied mechanical engineering courses and project. To facilitate the real industry practices of our students, they have to take summer and Cooperative Training for duration of about six months. This training represents a unique partnership program with industry that allows students to work in teams and solve real-world engineering problems and improve their engineering skills as well. We aim to give the students an opportunity to apply their skills in the real world, explore career opportunities within industry and to improve their understanding of how the topics they study are related to the industry. This scheme of education helps students to launch own careers. They can explore their career opportunities before graduation that best suit their skills and interests.

The undergraduate program offered by the Program of Applied Mechanical Engineering is designed to provide the students with a strong combination of theory and practice and equipped them with high practical engineering sense. The applied nature of the program is reflected in the following:

- Industry Experience:

The program is keen to enhance the mutual relation with the industry and to increase the awareness and industrial experience of student. The program intends to fulfill this by the following:

1- Co-operative Training Course: 9 credits

This course allows students to gain valuable experience in employment that relates directly to their major and career goals. At the same time, it provides employers with opportunities to evaluate students as potential full-time employees, while having them complete meaningful projects. This course is designed to be of a significant benefit to students and employers alike. Students get a chance to apply the knowledge they have learned to hands-on projects in industry. In the six months of their co-op training, students should actively

participate in actual company projects and activities. Students return to college with a renewed interest in their studies along with a better idea of their course and career preferences. In addition, the co-op training provides a potential career opportunity with the participating companies. The companies benefit as well from the co-op training program. It gives them the opportunity to observe students over a sufficient amount of time in order to evaluate their pertinent performance. With this familiarity of student work ethic, employers can make sound judgments in recruiting decisions. Therefore, we hope that this cooperative training course is turned to be both productive and beneficial for all parties.

The course starts typically during the summer session upon completion of 125 credit hours. The student will spend the whole summer and one full semester at a company. However, he is required to communicate regularly with his academic advisor to follow up on his training and project progress. In addition, the academic advisor will visit the student on site and he will be in close contact with his industry advisor. At the end of his co-op training, the student is required to submit a full professional technical report about his training experience and the engineering skills and experience he has acquired. A public oral presentation by the student is required to be given in front of an examination committee that includes both advisors and other invited examiners and it is preferred to be given at the company site. The student's co-op training final grade depends on his performance during training sessions, quality of work and report, presentation and the acquired engineering skills as well.

2- Capstone Senior Design Project: 3 credits

Based on his summer experience within the company and with the consultation of the industrial training advisor, the student should develop a proposal about an engineering problem related to his major and the company requirements. The student will hand-in his proposal at the beginning of the following semester and after the program approval he will be assigned an academic advisor to follow up on his training progress with the cooperation of the industrial advisor and to supervise his capstone design project he proposed. The student will spend the whole semester at the company. However, he is required to communicate regularly with his academic advisor to follow up on his capstone design project progress. At the end of the semester the student is required to give a complete report and a presentation regarding his design project in front of an examination committee from the program and a grade will be given according to his performance and his engineering background as well.

Remarks:

- i. It should be cleared out that the co-op training and capstone design project will be graded independently.
 - ii. A group project and co-op training is highly encouraged and recommended to enhance team skills.
 - iii. In case the student fails to propose a sound capstone design project topic or at some circumstances which are based on program judgment, the program may assign project topic to an individual student or a group of students and direct student(s) to specific company or industry to complete his/their co-op training and capstone design project.
 - iv. For the benefit of students, the program will make all the effort necessary to solicit companies and industry for sound engineering practical design projects that can be completed in a one semester period.
- Increasing labs and practical work to about 25-30% of the plan without scarifying theory and foundation of the field. Some laboratories are merged together so the student will grasp an integrated picture of the field. Also in the elective courses the plan concentrate on project based learning (Project Leads the Way) in which the instructor is required to give student some projects during semester.
 - In the proposed plan, two selected-topic courses are offered to meet certain requirements of the current industry. The courses are expected to be flexible to accommodate new changes and advancements in the major or in the industry.
 - According to some studies showing that engineering students lack important soft skills, a compulsory management skills course is proposed in addition to traditional engineering management and economy courses.
 - In addition, a seminar course is proposed to train student on presenting his self to enhance his communication skills, also some outsider speakers will be invited to give talks to students in order to increase their relation and awareness of real work environment before graduation.

Finally, an optional Minor in business is proposed in which students are given the opportunity to take a sequence of carefully chosen courses in management to increase their competence. Finally, this balanced combination among the various attributes of engineering knowledge is manifested in the designed coherent program. Accordingly, graduates of this program will acquire an excellent knowledge in Applied Mechanical Engineering Science to be used in solving new problems in better, more efficient, and more economic methods.

2.1 Program Objectives

The Program Educational Objectives (PEOs) are:

- i. AME graduates will have successful careers in mechanical engineering, and graduate or professional studies in mechanical and related disciplines, if pursued.
- ii. AME graduates will have solid practical knowledge and strong combination between theory and practice.
- iii. AME graduates will have valuable practical knowledge in business and engineering management.
- iv. AME graduates will possess a high degree of professionalism.
- v. AME graduates will be applying practical knowledge in the global marketplace and will be continuously developing their skills throughout their careers.

2.2 Program Requirements

The requirements for the Bachelor Degree of Engineering in Applied Mechanical Engineering Program consist of 160 credit-hours plus two months of Industrial Summer Training. The breakdown of the program credit hours is explained below:

- 31 credit hours (two semesters) of skills and pre-calculus. This year is called preparatory year. (Table 1)
- 8 credit hours of university requirements (Table 2)
- 52 credit hours of college requirements, which are compulsory for all programs (Table 3)
- 69 credit hours of program requirements of which:
 - 48 credit hours for core courses (Table 4A)
 - 3 credit hours for an electrical engineering course (Table 4B)
 - 9 credit hours of Summer and Cooperative Training (Table 4C)
 - 3 credit hours of Capstone Senior Design Project (Table 4D)
 - 6 credit hours for elective courses (Table 4E)

2.2.1. Preparatory Year

The program starts by preparatory year that intended to enhance the skills of students and prepare students for future study in the program. This is done through intensive English courses, courses that improve their communication and computer skills and pre-calculus as well. The table below illustrates the modules studied during this year.

Table 1: PREPARATORY YEAR COURSES

Course Code	Course Title	Cr. Hr. T(X,Y,L)*
MATH 140	Introduction to Mathematics	2(2,1,0)
MATH 150	Differential Calculus	3(3,1,0)
ENG 140	English Language I	8(20,0,0)
ENG 150	English Language II	8(20,0,0)
IT 140	Computer Skills	3(0,0,6)
CHS 150	Health & Fitness	1(1,1,0)
CUR 140	Learning, Thinking and Research Skills	3(3,1,0)
ENT 101	Entrepreneurship	1(1,1,0)
COM 140	Communication Skills	2(2,1,0)
Total		31

*T(X-Y-L) T=Total Credit Hours X = Lectures Y = Tutorials L = Laboratory

2.2.2. University Requirements

Each student is required to take one compulsory Islamic course and select 3 other courses (A total of 8 cr. hr.) from the Islamic Culture Courses pool provided by College of Education, department of Islamic Culture. The table below shows the required and suggested courses by the program:

Table 2: COMPULSORY AND SUGGESTED UNIVERSITY REQUIREMENTS

Course Code	Course Title	Cr. Hr. T(X,Y,L)	Remarks
IC 103	Economic system in Islam	2(2,0,0)	Suggested
IC 105	Human Rights	2(2,0,0)	Suggested
IC 107	Work Ethics in Islam	2(2,0,0)	Compulsory
IC 108	Current Issues	2(2,0,0)	Suggested
Total		8	

2.2.3. College Requirements

There are 52 credit hours of college requirements, these courses are compulsory courses for all programs and provide the students with the basis and foundation of engineering. These courses are listed in Table 3:

Table 3: COLLEGE REQUIREMENTS

Course Code	Course Title	Cr. Hr. T(X,Y,L)	Requisites	
			Pre-	Co-
MATH 1110	Calculus For Engineers	3(3,2,0)	MATH 140 MATH 150	---
MATH 1120	Linear Algebra and Vector Analysis	3(3,2,0)	MATH 1110	---
MATH 1130	Differential Equations	3(3,2,0)	MATH 1120	---
AGE 1150	Engineering Probability and Statistics	3(3,1,0)	---	---
PHYS 1210	Physics for Engineers I	4(3,0,2)	---	---
PHYS 1220	Physics for Engineers II	4(3,0,2)	PHYS 1210	---
CHEM 1230	Chemistry for Engineers	4(3,0,2)	---	---
AGE 1310	Basics of Engineering Drawing	3(1,0,4)	---	---
AGE 1320	Introduction to Manufacturing	2(1,1,2)	---	---
AGE 1510	Technical Writing	2(2,1,0)	---	---
MATH 2140	Numerical Methods	3(3,2,0)	MATH 1120 MATH 1130	---
AGE 2330	Engineering Mechanics	3(3,1,0)	MATH 1110 MATH 1120	---
AGE 2340	Basic Engineering Measurements	2(1,1,2)	AGE 1150	---
AGE 2410	Computer programming	3(2,1,2)	---	---
AGE 2520	Management Skills	2(2,1,0)	---	---
AGE 3350	Introduction to Design	1(1,1,0)	AGE 1310	---
AGE 4530	Engineering Economy	2(2,1,0)	---	---
AGE 4540	Seminar	1(0,0,2)	---	---
AGE 4550	Engineering Management	2(2,1,0)	---	---
AGE 4560	Industry and Environment	2(2,1,0)	---	---
Total			52	

2.2.4. Program Requirements

There are 69 credit hours of program requirements. These courses are compulsory courses for all Applied Mechanical Engineering students and divided into five parts as follow:

2.2.4.1 Program Core Courses

The core courses are intended to give a wide perspective of various domains in Applied Mechanical Engineering. 48 credit hours of core courses are listed in the Table 4A.

2.2.4.2 Electrical Engineering Course

This course is intended to cover necessary electric concepts required to all AME students to enhance their understanding of electric circuits and machines. 3 credit hours of electrical engineering course is listed in the Table 4B

Table 4A: APPLIED MECHANICAL ENGINEERING PROGRAM CORE COURSES REQUIREMENTS

Course Code	Course Title	Cr. Hr. T(X,Y,L)	Requisites	
			Pre-	Co-
AME 2110	Manufacturing Processes	4(3,1,2)	AME 2510	AME 3320
AME 2210	Mechanical Engineering Drawing	3(1,0,4)	AGE 1310	---
AME 2310	Mechanics of Materials I	3(3,1,0)	AGE 2330	---
AME 2510	Engineering Materials Science	4(3,1,2)	PHYS 1220 CHEM 1230	---
AME 2710	Engineering Thermodynamics	4(3,1,2)	PHYS 1220	AME 3810
AME 3010	Mechanical Engineering Design	4(3,1,2)	AME 3320	---
AME 3120	Modern Production Management	3(3,1,0)	AME 2110	---
AME 3320	Mechanics of Materials II	4(3,1,2)	AME 2310	---
AME 3330	Mechanics of Machinery	4(3,1,2)	AGE 2330	---
AME 3610	System Dynamics and Control	4(3,1,2)	AGE 2330 AME 3620	---
AME 3720	Heat Transfer	4(3,1,2)	AME 3810	---
AME 3810	Fluid Mechanics	4(3,1,2)	AME 2710	---
AME 4730	Thermal-Fluid Systems	3(2,1,2)	AME 3720	---
Total			48	

Table 4B: ELECTRICAL ENGINEERING COURSE

Course Code	Course Title	Cr. Hr. T(X,Y,L)	Requisites	
			Pre-	Co-
AME 3620	Electrical Circuits and Machines	3(3,1,0)	PHYS 1220	---
Total			3	

2.2.4.3 Cooperative Training Requirements

The Cooperative Training (Table 4C) is divided into two parts:

- AME 4910 - Co-Op Training (Part I) : 0 credit hours
- AME 4920 - Co-Op Training (Part II) : 9 credit hours

The student is eligible to register for the Cooperative Training if he completes successfully at least 125 credit hours. Refer to section 2: (Industry Experience - Bachelor of Engineering in Applied Mechanical Engineering Program).

Table 4C: CO-OP TRAINING REQUIREMENTS

Course Code	Course Title	Cr. Hr. T(X,Y,L)	Requisites	
			Pre-	Co-
AME 4910	Cooperative Training (Part I : during summer session)	0	Completion 125 credit hours	---
AME 4920	Cooperative Training (Part II : during the semester next to summer session of part I)	9	AME 4910	---
Total			9	

2.2.4.4 Capstone Senior Design Project Requirements

The Student in this project is required to complete about 75 hours per semester in a related industry project (3 credit hours). The student is eligible to register for the capstone senior design project after submission of the proposal by the end of the summer training (Table 4D). The project can be taken in conjunction with the Co-Op training since it is highly recommended to be industry related.

Table 4D: CAPSTONE SENIOR DESIGN PROJECT REQUIREMENTS

Course Code	Course Title	Cr. Hr.	Requisites	
			Pre-	Co-
AME 4930	Capstone Senior Design Project	3(1,0,4)	AME 4910	—
Total		3		

2.2.4.5 Elective Courses

Elective courses are intended to provide depth in a certain specialty of the Applied Mechanical Engineering Program. These courses are expected to be project-oriented to cover engineering applications. Practical projects will be given to students to enhance their understanding of the theory presented. Each student is required to select 6 credits among a pool of elective courses listed below (Table 4E):

Table 4E: ELECTIVE COURSES OF SPECIALIZED AREAS*

Code Number	Course Title	Cr. Hr. (X,Y,L)	Requisites	
			Pre-	Co-
AME 4020	Finite Element Method	3(2,0,2)	AME 3010 AME 3720	---
AME 4030	Computer-Aided Design	3(3,1,0)	AME 3010	---
AME 4040	Conceptual Design	3(3,1,0)	AME 3010	---
AME 4050	Materials Selection in Design	3(3,1,0)	AME 3010	---
AME 4130	Metal Forming and Metal Cutting Analysis	3(3,1,0)	AME 2110	---
AME 4140	Manufacturing Systems	3(3,1,0)	AME 2110	---
AME 4150	CNC Machines	3(3,1,0)	AME 2110	---
AME 4420	Principles of Refrigeration	3(2,0,2)	AME 2710	---
AME 4430	Air Conditioning	3(3,1,0)	AME 3720	---
AME 4440	Internal Combustion Engines	3(2,0,2)	AME 2710	---
AME 4520	Introduction to Composite Materials	3(3,1,0)	AME 3010	---
AME 4530	Mechanical Behavior of Materials	3(3,1,0)	AME 3010	---
AME 4620	Introduction to Mechatronics	3(2,1,2)	AME 3330 AME 3610	---
AME 4630	Introduction to Robotics	3(3,1,0)	AME 3330 AME 3610	---
AME 4750	Renewable Energy	3(3,1,0)	AME 3720 AME 3810	---
AME 4760	Energy Conversion and Storage Systems	3(3,1,0)	AME 3720	---
AME 4770	Water Desalination	3(3,1,0)	AME 3720	---
AME 4820	Propulsion	3(2,0,2)	AME 3810	---

AME 4830	Power Plants	3(3,1,0)	AME 2710	---
AME 4840	Fluid Machinery	3(3,1,0)	AME 3810	---
AME 4940	Selected Topics in Mechanical Engineering I	3(2,1,2)	<i>Instructor and Program Approval</i>	
AME 4950	Selected Topics in Mechanical Engineering II	3(2,1,2)		
Total of 3 Elective Courses		6		

*All courses have a Pre-requisite of *AME 4920* in addition to other individual Pre-requisites.

2.3 Typical Study Plan

To take into consideration the logical flow of courses and the credit hours load-balance of different semesters, a typical plan for the Bachelor of Engineering in Applied Mechanical Engineering Program is proposed in Table 5.

Table 5: TYPICAL STUDY PLAN – APPLIED MECHANICAL ENGINEERING PROGRAM

Level 1			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
MATH 140	Introduction to Mathematics	2(2,1,0)	---
ENG 140	English Language I	8(20,0,0)	---
CHS 150	Health & Fitness	1(1,1,0)	---
CUR 140	Learning, Thinking and Research Skills	3(3,1,0)	---
ENT 101	Entrepreneurship	1(1,1,0)	---
Total		15	

Level 2			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
MATH 150	Differential Calculus	3(3,1,0)	---
ENG 150	English Language II	8(20,0,0)	---
IT 140	Computer Skills	3(0,0,6)	---
COM 140	Communication Skills	2(2,1,0)	---
Total		16	

Level 3			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
MATH 1110	Calculus For Engineers	3(3,2,0)	MATH 140 MATH 150
MATH 1120	Linear Algebra and Vector Analysis	3(3,2,0)	MATH 1110
PHYS 1210	Physics for Engineers I	4(3,0,2)	---
CHEM 1230	Chemistry for Engineers	4(3,0,2)	---
AGE 1510	Technical Writing	2(2,1,0)	---
IC I	Islamic Culture I	2(2,0,0)	---
Total		18	

Level 4			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
MATH 1130	Differential Equations	3(3,2,0)	MATH 1120
PHYS 1220	Physics for Engineers II	4(3,0,2)	PHYS 1210
AGE 1310	Basics of Engineering Drawing	3(1,0,4)	---
AGE 1320	Introduction to Manufacturing	2(1,1,2)	---
AGE 1150	Engineering Probability and Statistics	3(3,1,0)	---
IC II	Islamic Culture II	2(2,0,0)	---
Total		17	

Level 5			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
AME 2510	Engineering Materials Science	4(3,1,2)	PHYS 1220 CHEM 1230
MATH 2140	Numerical Methods	3(3,2,0)	MATH 1120 MATH 1130
AGE 2330	Engineering Mechanics	3(3,1,0)	MATH 1110 MATH 1120
AGE 2340	Basics of Engineering Measurements	2(1,1,2)	AGE 1150
AGE 2410	Computer Programming	3(2,1,2)	---
IC III	Islamic Culture III	2(2,0,0)	---
Total		17	

Level 6			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
AME 2110	Manufacturing Processes	4(3,1,2)	AME 2510
AME 2210	Mechanical Engineering Drawing	3(1,0,4)	AGE 1310
AME 2310	Mechanics of Materials I	3(3,1,0)	AGE 2330
AME 2710	Engineering Thermodynamics	4(3,1,2)	PHYS 1220
AGE 2520	Management Skills	2(2,1,0)	---
IC IV	Islamic Culture IV	2(2,0,0)	---
Total		18	

Level 7			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
AME 3320	Mechanics of Materials II	4(3,1,2)	AME 2310
AME 3330	Mechanics of Machinery	4(3,1,2)	AGE 2330
AME 3620	Electrical Circuits and Machines	3(3,1,0)	PHYS 1220
AME 3810	Fluid Mechanics	4(3,1,2)	AME 2710
Total		15	

Level 8			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
AME 3010	Mechanical Engineering Design	4(3,1,2)	AME 3320
AME 3120	Modern Production Management	3(3,1,0)	AME 2110
AME 3610	System Dynamics and Control	4(3,1,2)	AGE 2330 AME 3620
AME 3720	Heat Transfer	4(3,1,2)	AME 3810
AGE 3350	Introduction to Design	1(1,1,0)	AGE 1310
Total		16	

Summer Session: AME 4910 Cooperative Training – Part I (0 credit hours) Pre-requisite: Senior Standing, Completion of 125 credit hours

Level 9			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
AME 4920	Cooperative Training - Part II	9 credits	AME 4910
AME 4930	Capstone Senior Design Project	3(1,0,4)	AME 4910
Total		12	

Level 10			
Course Code	Course Title	Cr. Hr. T(X,Y,L)	Pre-requisite
AME 4930	Elective Course I	3 credits	Table 4E
AME 4940	Elective Course II	3 credits	Table 4E
AME 4730	Thermal-Fluid Systems	3(2,1,2)	AME 3720
AGE 4530	Engineering Economy	2(2,1,0)	---
AGE 4540	Seminar	1(0,1,2)	---
AGE 4550	Engineering Management	2(2,1,0)	---
AGE 4560	Industry and Environment	2(2,1,0)	---
Total		16	

3- APPENDIX A

COURSE CODE

Some course codes contain dedicated symbols such as MATH, PHYS and CHEM to represent Mathematics, Physics, and Chemistry accordingly. Other course codes consist of symbol (AGE, or AME) and a number and they are represented as follows:

For General Engineering: (AGE A B C D)

- A Year
- B Category:
 - 1 Math and Statistics
 - 2 Science
 - 3 Engineering
 - 4 Computer
 - 5 General
- C: Course Number
- D: Version

For Mechanical Engineering: (AME A B C D)

- A Year
- B Category:
 - 0 Mechanical Engineering Design
 - 1 Manufacturing Processes
 - 2 Experimentation and Labs
 - 3 Aerodynamics Engineering
 - 4 Air-conditioning Engineering
 - 5 Materials Engineering
 - 6 Dynamics, Vibration and Control of Mechanical Systems
 - 7 Thermal Sciences/Engineering
 - 8 Fluid Sciences/Engineering
 - 9 Senior Project, Selected Topics, and Summer Training
- C: Course Number
- D: Version