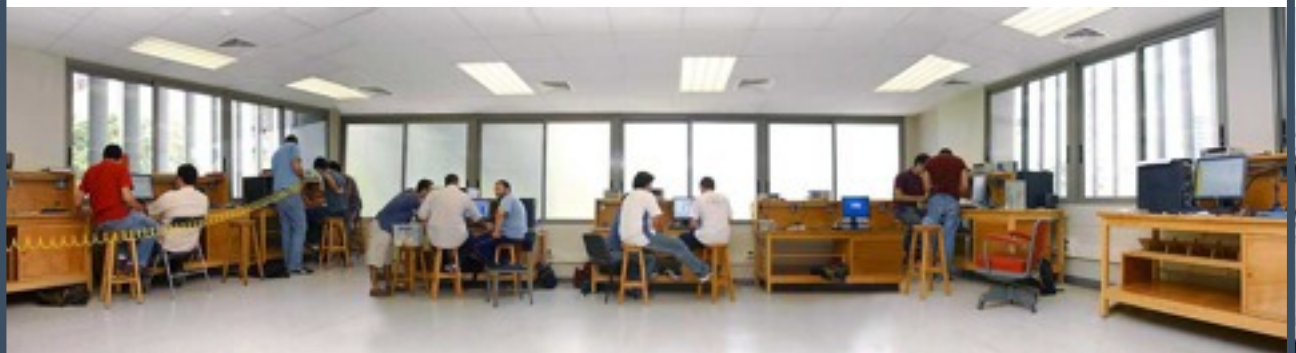


AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCHITECTURE

DEPARTMENT OF MECHANICAL ENGINEERING

UNDERGRADUATE STUDENT MANUAL

2009>>2010



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FACULTY OF ENGINEERING AND ARCHITECTURE
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2009-2010**

This guide is intended to provide information on most aspects of ME education at AUB

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Information in this guide is subject to change without notice. Students are responsible for checking their AUB email for announcements, information and updates.

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1>> INTRODUCTION

This year the FEA will start a new undergraduate program leading to the degree of Bachelor of Science, Major: Chemical Engineering. The program was prepared in compliance with the criteria for accrediting chemical engineering programs. A new section on the Chemical Engineering undergraduate program was added to this manual because the program will be initially housed within the ME Department,

2>> MECHANICAL ENGINEERING

2.1>> INTRODUCTION

OVERVIEW>

AUB provides a world-class education for its students. The success of this venture is based on the synergy between students, faculty and the administration of the university; between a faculty committed to excellence in teaching and research, an administration dedicated to a rich and diverse learning environment and students eager to make the most of this opportunity to grow into accomplished engineers and leaders in their society.

Engineering is a key profession in today's technological world, and design is an essential ingredient of the profession. Applications within Mechanical Engineering are diverse; consequently, the field encompasses many specialities. This is reflected in the broad scope of the ME undergraduate program and its emphasis on fundamentals. This is considered as essential for both the continuing education and progressive growth as a professional in the field of our graduates.

This document has been prepared to be a quick, basic reference for both faculty and students in the Mechanical Engineering Department. It is not intended to completely document all University policies and requirements. For detailed information about regulations and procedures students are referred to the AUB Student Handbook, the FEA Academic Manual, and the University Catalogue. It is the student's responsibly to study all curriculum requirements and University requirements.

MISSION>

The Mechanical Engineering Department at AUB has written a mission by which its activities are directed and for which the curriculum has been developed. The Mechanical Engineering faculty has agreed that the Undergraduate Program Mission is:

The Undergraduate Program in Mechanical Engineering seeks to empower students to pursue successful careers, and to create a learning environment in which they can develop their creative and critical thinking, their ability to grow into life-long learners in light of the ever-increasing challenges of modern technology, and their commitment to the ethical and professional responsibilities required in their calling at the global level while focusing on the needs of Lebanon and the region.

Approved June 6, 1998 and revised on October 19, 2000.

DEPARTMENT RESPONSIBILITY>

In support of this mission the department is committed to do all it can to under-gird the main purpose and to emphasise the essential responsibility to its stake-holders. The specific responsibilities of the department in service of the mission are to:

- 1> Provide quality undergraduate education within the context of a curriculum that would attain accreditation by the Accreditation Board for Engineering and Technology [ABET];
- 2> Provide quality education and research programs at the graduate level compatible with professional norms;
- 3> Maintain a faculty whose expertise encompass the facets of mechanical engineering and whose competence, dynamism, and practices of effective educational techniques motivate students to achieve what they are capable of;
- 4> Maintain an environment conducive to learning scholarly activities by acquiring and maintaining modern instructional tools and providing modern laboratory and computer facilities consistent with both instructional and research objectives;
- 5> Actively seek financial support from outside the University to sponsoring undergraduate and graduate research activities;

2» MECHANICAL ENGINEERING

- 6» Actively sponsor student organisations, support extra-curricular activities, and encourage student participation in various institutional and community activities which are congruent with institutional objectives;
- 7» Provide information on the various aspects of the Mechanical Engineering Department to all groups interested in the affairs of the University.
- 8» Foster an environment of highly ethical practices. [See the ASME Code of Ethics in Appendix V]

PROGRAM EDUCATIONAL OBJECTIVES»

While having the aptitude to contribute to the society, students who attain a BE [Bachelor of Engineering] degree possess a tool chest of technical and non-technical skills and knowledge that positions them either for successful professional practice as entry-level engineers in existing firms or to be graduate students in any mechanical engineering program in the world. This does not preclude other activities, such as volunteerism, self-employment, or academic study in another discipline. Graduates succeed in these goals because the ME program strives to:

- 1» Develop in students the ability to integrate mechanical engineering fundamentals with contemporary applications;
- 2» Equip students with the ability to use modern experimental and computational tools in design and engineering practices;
- 3» Motivate students to learn on their own, to think critically and creatively in order to allow them to evaluate new ideas, identify problems, and advance innovative solutions;
- 4» Instil in students the necessary interpersonal skills to perform professionally in a highly competitive and dynamically changing profession.

PROGRAM LEARNING OUTCOMES [ABET 2000 CRITERIA]»

The following program educational outcomes have been adopted from ABET EC-2000. Each student receiving a BE degree from the program will demonstrate:

- 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 multidisciplinary 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 life-long learning.
- J» A knowledge of contemporary issues
- K» An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice..

ME FACULTY AND STAFF» Full Time Faculty

» **Fadi Moukalled**, Professor and Associate Dean for Academic Affairs, Fellow of the Center of Advanced Mathematical Studies [CAMS], PhD from Louisiana State University. His field of interest is computational fluid dynamics. He joined the department in 1987.

[\[memouk@aub.edu.lb\]](mailto:memouk@aub.edu.lb)

» **Nesreen Ghaddar**, Qatar Chair in Energy Studies Professor, and Associate Provost, PhD from MIT. Her field of interest is computational fluid dynamics, heat transfer and energy conversion. She joined the department in 1991.

[\[farah@aub.edu.lb\]](mailto:farah@aub.edu.lb)

- › **Marwan Darwish**, Professor and Chairperson, PhD from Brunell University. His field of interest is engineering materials and computation method applied to engineering problems. He joined the department in 1992.
[\[darwish@aub.edu.lb\]](mailto:darwish@aub.edu.lb)
- › **Albert Kuran**, Associate Professor, MS from Yale . He joined the department in 1956.
[\[akuran@aub.edu.lb\]](mailto:akuran@aub.edu.lb)
- › **Ramsey Hamade**, Associate Professor, PhD from Virginia Polytechnic Institute. His field of interest is design, materials, and manufacturing. He joined the department in 2000.
[\[rh13@aub.edu.lb\]](mailto:rh13@aub.edu.lb)
- › **Alan Shihadeh**, Associate Professor, PhD from MIT. His field of interest is power engineering and combustion. He joined the department in 2000.
[\[as20@aub.edu.lb\]](mailto:as20@aub.edu.lb)
- › **Kamel Bou-Ghali**, Associate Professor, PhD from Kansas State University. His field of interest is heat and mass transfer, applied energy and thermal comfort. He joined the department in September 2009.
[\[kao4@aub.edu.lb\]](mailto:kao4@aub.edu.lb)
- › **Issam Lakkis**, Assistant Professor, PhD from MIT. His field is computational physics and micro-electromechanical systems. He joined the department in September, 2004.
[\[ilo1@aub.edu.lb\]](mailto:ilo1@aub.edu.lb)
- › **Ghanem Oweis**, Assistant Professor, PhD from University of Michigan, Ann Arbor. His field is experimental fluid dynamics. He joined the department in February 2005.
[\[goweis@aub.edu.lb\]](mailto:goweis@aub.edu.lb)
- › **Daniel Asmar**, Assistant Professor, PhD from University of Waterloo. His field is in Robotics, Computer Vision and Mechatronics. He joined the department in September 2007.
[\[da20@aub.edu.lb\]](mailto:da20@aub.edu.lb)
- › **Mutasem Shehadeh**, Assistant Professor, PhD from Washington State University. His field of interest is computational mechanics. He joined the department in September 2008.
[\[mutasem.shehadeh@aub.edu.lb\]](mailto:mutasem.shehadeh@aub.edu.lb)
- › **Matthias Liermann**, Assistant Professor, PhD from RWTH Aachen University, Germany. His field of interest is Automatic Control, Mechanical Design and Hydraulics. He joined the department in September 2009.
[\[matthias.liermann@aub.edu.lb\]](mailto:matthias.liermann@aub.edu.lb)

ME FACULTY AND STAFF› Part Time Faculty

- › **Pierre Azoury**, Professor, PhD from the University of London, Britain. [\[pao1@aub.edu.lb\]](mailto:pao1@aub.edu.lb)
- › **Mohamad Nassereddine**, Lecturer, PhD from François Rabelais University, Tours, France.
- › **Hadi Bou Chakra**, Lecturer, PhD from University of Surrey, Britain.
- › **Wajih Najm**, Lecturer, ME from AUB. [\[wnoo@aub.edu.lb\]](mailto:wnoo@aub.edu.lb)
- › **Jihad Kasamani**, Lecturer, ME from AUB.
- › **Cherbel Seif**, Instructor, ME from AUB.
- › **Elie Kfoury**, Assistant Instructor, BE from AUB.

Mechanical Engineering Department Secretary›

- › Najla Shaar [\[mefea@aub.edu.lb\]](mailto:mefea@aub.edu.lb)

Mechanical Engineering Lab Technical Manager›

- › Samir Berjaoui, MS from University of South Western Louisiana.

Mechanical Engineering Labs Personnel›

- › Hisham Ghalayini, ME Labs supervisor [\[hgo6@aub.edu.lb\]](mailto:hgo6@aub.edu.lb)
- › Dori Rouhana, Senior Technician [\[dro4@aub.edu.lb\]](mailto:dro4@aub.edu.lb)
- › Roger Said, Mechatronics Lab Master [\[rs37@aub.edu.lb\]](mailto:rs37@aub.edu.lb)

ENGINEERING SHOPS LAB PERSONNEL›

- › Joseph Nassif, Shops Supervisor [\[jno5@aub.edu.lb\]](mailto:jno5@aub.edu.lb)

- › Ramzi Safi, Senior Technician [rs48@aub.edu.lb]
- › George Jurdi, Senior Shop Master [gjo5@aub.edu.lb]
- › Joseph Zoulikian, Materials and Manufacturing Lab Master [jzo4@aub.edu.lb]
- › Joseph Khoury, Senior Technician [jk31@aub.edu.lb]

ADVISING»

Advising in the ME department is the responsibility of the faculty advisor assigned to the student. The advisor is responsible for monitoring the progress of each ME student from the first year in the ME program until graduation. The faculty advisor provides advice about course selection and the opportunity to discuss career plans, to understand what and why mechanical engineers do what they do, and to provide a supportive personal relationship. Table 1 lists advisors for the 2009-10 academic year [AY]. If questions arise that cannot be answered by the advisor, the student should check with the main ME department office. Students must meet with their advisors by appointment at least once per semester for pre-registration advising. To assure that this occurs, advisors are sent the personal identification numbers [PIN] of their advisees. A student will not be able to register unless he/she meets with the advisor and obtains a PIN.

In some cases, your advisor may not be able to answer specific academic questions or approve academic actions that are not described in the catalogue [course equivalence, exceeding permitted load, request for make up final ect.] In these cases, the student has to petition the Academic Committee of the Faculty using the form available at the Record’s Office of the Faculty. The form is also enclosed at the end of this guide. After filling out the form, the student must secure the signature and the comments of his/her advisor. The answer to the petition will at most take 10 working days.

Table 1: Mechanical Engineering Advisors

| CLASS | ADVISOR | OFFICE |
|-----------|------------------|---|
| 2013 | Prof. Lakkis | RGB 411; ext 3636; ilo1@aub.edu.lb |
| | Prof. Shehadeh | RGB 409; ext 3566; ms144@aub.edu.lb |
| 2012 | Prof. Asmar | RGB 410; ext 3427; da20@aub.edu.lb |
| | Prof. Liermann | |
| 2011 | Prof. Hamade | RGB 406; ext 3481; rh13@aub.edu.lb |
| | Prof. Kuran | Bechtel 313; ext 3473; akuran@aub.edu.lb |
| 2010 | Prof. Abou Ghali | Bechtel 2M3B; ext 3438; kao4@aub.edu.lb |
| | Prof. Oweis | RGB 407; ext 3596; goweis@aub.edu.lb |
| Graduates | Prof. Shihadeh | RGB 414; ext 3465; as20@aub.edu.lb |

REGISTRATION AND VALIDATION OF CREDITS»

Students register each academic semester via the web-based Banner System. Access to courses controlled by the FEA and other departments is automatically restricted to students who need these courses by virtue of their programs of enrolment. The faculty academic advisor is responsible for checking the student progress through the curriculum. At the beginning of each academic semester the program of each student is reviewed by the student’s faculty advisor to assure compliance with the continuation policy and to assure that prerequisites are satisfied. Ultimately, each student is responsible for understanding the curriculum and planning his/her progress through it.

2.2» UNDERGRADUATE MECHANICAL ENGINEERING PROGRAM

The undergraduate mechanical engineering program leads to the degree Bachelor of Engineering: Major, Mechanical Engineering.

The mechanical engineering program extends over a four-year period offered exclusively on a daytime on-campus basis. The program is offered in 11 terms, eight terms are 16-week fall and spring semesters given over four years and three terms are eight-week summer terms taken during the first three years of the program. In the summer term of the third year, students are required to participate in a practical training program with a local, regional, or international organisation. The entire program duration is equivalent to five academic years without the summer terms, but is completed in four calendar years.

The undergraduate program also provides students with the option to pursue minors in the following:

- › Information Technology offered by ECE Department
- › Biomedical Engineering offered by ECE Department
- › Engineering Management offered by EM Program
- › Chemical Engineering offered by ME Program
- › Petroleum Engineering offered by ME Program

Students may pursue other minors offered by the Faculty of Arts and Sciences and the Suliman Olayan School of Business.

The first two years in the ME curriculum are designed to emphasise the fundamentals in Mechanical Engineering upon which relevant applications in thermal and mechanical systems are based. The program requires that each student acquire a practical training experience with a local, regional, or international company during the summer after the third year. The third and fourth years are organised so that a student's program of study includes a set of technical elective courses that provide the opportunity for the student to strengthen his/her skills in a specific area of interest. The Final Year Project provides the platform upon which students put to work skills learned in their courses to create a meaningful project.

The curriculum is designed to comply with requirements of the Accrediting Board for Engineering and Technology [ABET], the Order of Engineers, the State of New York, and the AUB Board of Trustees. It includes courses in basic sciences and mathematics, engineering sciences, engineering design, English composition, the humanities, and the social sciences. Laboratory hands-on experiences and emphasis on design are important ingredients integrated throughout the engineering curriculum.

The undergraduate curriculum for the degree of Bachelor of Engineering - Major, Mechanical Engineering consists of 143 semester-hours of course work. The curriculum shown in Table 2 serves as an aid for planning schedules. Table 3 shows the courses that satisfy the various requirements of the curriculum. The curriculum requires twelve [12] semester hours of humanity courses, from art, music, literature, foreign language, philosophy, theatre, or history. Social science courses focus on individual relationships in and to society. The curriculum requires six [6] semester hours of social science courses, which are to be taken from economics, geography, history, political science, psychology, or sociology [see Appendix I]. Speech, technical writing, and religious dogma courses do not qualify for the humanities or social science course requirement.

The suggested course loads and timing allow degree completion in eight [8] fall and spring semesters and three summers. However, it is recognised that many students will choose not to follow this schedule precisely. Consequently, students should routinely examine their progress and map out a plan for their degree completion. In doing this, they should be aware of course prerequisites and when courses are typically offered. Course descriptions for mechanical engineering courses are given in Appendix II.

Table 2 Mechanical Engineering Curriculum

| | | | |
|--|-----------|--|---|
| Term I [Fall] 16-credits | MATH 201 | Calculus and Analytic Geometry III | 3 |
| | EECE 230 | Computers and Programming | 3 |
| | PHYS 211 | Electricity and Magnetism | 3 |
| | MECH 220 | Engineering Graphics | 1 |
| | ENGL 206 | Technical English | 3 |
| | CIVE 210 | Statics | 3 |
| Term II [Spring] 16-credits | MATH 202 | Differential Equations | 3 |
| | EECE 210 | Electric Circuits | 3 |
| | MECH 200 | Introduction to Mechanical Engineering | 3 |
| | PHYS 211L | Electricity and Magnetism Laboratory | 1 |
| | MECH 230 | Dynamics | 3 |
| | | English Elective | 3 |
| Term III [Summer] 8-credits | STAT 230 | Introduction to Probability and Random Variables | 3 |
| | CHEM 202 | Introduction to Environmental Chemistry | 3 |
| | CHEM 203 | Introduction Chemical Techniques | 2 |
| Term IV [Fall] 16-credits | EECE 312 | Electronics and Electronic Circuits | 3 |
| | EECE 312L | Circuits and Electronics Lab | 1 |
| | MECH 310 | Thermodynamics I | 3 |
| | MECH 340 | Engineering Materials | 3 |
| | MATH 212 | Vector Analysis, Fourier Series and PDE | 3 |
| | | Humanities Elective | 3 |
| Term V [Spring] 16-credits | MATH 218 | Linear Algebra | 3 |
| | MECH 314 | Introduction to Fluid Mechanics | 3 |
| | MECH 320 | Mechanics of Materials | 3 |
| | MECH 430 | Instrumentation and Measurements | 3 |
| | MECH 341 | Materials Lab | 1 |
| | | Biology Elective | 3 |
| Term VI [Summer] 9-credits | | Humanities Elective | 3 |
| | | Arabic Elective | 3 |
| | MECH 332 | Mechanics of Machines | 3 |
| Term VII [Fall] 16-credits | MATH 251 | Numerical Analysis | 3 |
| | MECH 410L | Thermal Fluid Laboratory | 1 |
| | MECH 414 | Thermodynamics II | 3 |
| | MECH 420 | Mechanical Design | 3 |
| | MECH 421 | Manufacturing Processes I | 3 |
| | | Social Sciences Elective | 3 |
| Term VIII [Spring] 16-credits | ENGM 400 | Engineering Economy | 3 |
| | MECH 412 | Heat Transfer | 3 |
| | MECH 431 | Control Systems | 3 |
| | MECH 431L | Control Systems Lab | 1 |

| | | | |
|--|----------|--|---|
| | | Restricted Design/Mechatronics Elective [MECH 520, MECH 522, or MECH 530] | 3 |
| | | Social Sciences Elective | 3 |
| Term IX [Summer] | MECH 500 | Approval Experience | |
| Term X [Fall] 16-credits | ENGM 504 | Engineering Ethics or any Ethics Course | 3 |
| | MECH 501 | Final Year Project I | 1 |
| | | Restricted Thermal Fluid Sciences Elective [MECH 510, MECH 511, OR MECH 513] | 3 |
| | | Technical Elective I | 3 |
| | | Technical Elective II | 3 |
| | | Humanities Elective | 3 |
| Term XI [Spring] 14-credits | MECH 502 | Final Year Project II | 5 |
| | | Technical Elective III | 3 |
| | | Technical Elective IV | 3 |
| | | Technical Elective V | 3 |

Table 3: Distribution of Credits in ME Curriculum for General Education, MATH and Sciences, Engineering and Mechanical Major

| COURSE CATEGORY | COURSES/TOPICS | CREDITS |
|--|--|---------|
| English Communication [6 cr.] | ENGL 206 | 3 |
| | English Elective | 3 |
| Arabic [3 cr.] | Elective | 3 |
| Humanities [12 CREDITS] | Three Humanities Electives | 9 |
| | ENGM 504 Engineering Ethics or an Ethics Course | 3 |
| Social Sciences PSPA, SBS OR ECON [6 cr.] | Two Social Science Electives | 6 |
| MATH and Sciences [27 cr. lectures and 3 cr. labs] | MATH 201, MATH 202, MATH 212, MATH 218, MATH 251, STAT 230, PHYS 211, PHYS 211L, CHEM 202, CHEM 203, Biology Elective | 30 |
| General Engineering [16 cr.] | CIVE 210 [3], EECE 210 [3], EECE 230 [3], EECE 312 [1], ENGM 400 [3] | 16 |
| Mechanical Engineering Major [70 cr.] | ME core courses: MECH 200 [3], MECH 220 [1], MECH 230 [3], MECH 310 [3], MECH 314 [3], MECH 320 [3], MECH 332 [3], MECH 412 [3], MECH 414 [3], MECH 340 [3], MECH 341 [1], MECH 410 [1], MECH 420 [3], MECH 421 [3], MECH 431 [3], MECH 431L [1], MECH 430 [3] | 43 |
| | Two Restricted Technical Electives: One Design/Mechatronics Elective: MECH 520 [3], MECH 522 [3] or MECH 530 [3]. One Thermal/Fluid Systems Elective: MECH 510 [3], MECH 511 [3] or MECH 513 [3] | 6 |
| | 5 Technical Elective Courses | 15 |
| | Final Year Project: MECH 501 [1] MECH 502 [5] | 6 |

total 143

PRACTICAL TRAINING/SUMMER INTERNSHIP»

All third year engineering students are required to fulfil a summer internship period of eight to twelve weeks. This is a graduation requirement so that each student gains practical training experience during the summer prior to graduation, with either a company or another academic institution.

Host companies/institutions for interns are identified through the following avenues:

- 1» IAESTE [International Association for Exchange Student in Technology and Engineering] offers opportunities abroad to FEA students. Offers are usually made known to the various departments in February for the summer training period. All placements are made outside Lebanon;
- 2» FEA Career Office acts as a link between companies/academic institutions and the summer interns. The FEA career counsellor seeks offers from companies and academic institutions requesting their acceptance of third year engineering students as interns.
- 3» Companies/institutions contact the FEA directly and request interns. This process is generally forwarded to and directed by the FEA Career Office as well.
- 4» Students' own contact.

The chronology of events leading to summer training is as follows:

- 1» At the beginning of the academic year, all 3rd year engineering students are required to complete an internship application and submit it to the Career Office. This application is made available on line.
- 2» The link to the online career centre is <http://webfea.fea.aub.edu.lb/career/>
- 3» The FEA Career Office seeks offers from companies and institutions. Students interested in specific companies can request that the FEA Career Office contact those companies on their behalf.
- 4» Offers are sent to the FEA Career Office
- 5» Students are matched and placed in companies/institutions according to major and desired field of training. The FEA Career Officer matches students with available positions based on the student's overall rank and interest in the field.
- 6» Changes are not possible once the student confirms his/her willingness to intern at a specific company/institution.
- 7» Offers from companies suggested by students need to be approved by the ME Department and by the FEA Career Office. Offers for future training sessions are solicited from companies in which past internships have been successful and rewarding.

For more information regarding training experience contact Ms. Nadia Moufarrej/FEA Career counsellor at ext. 3453 or the Dean's Office at ext. 3400, or visit the ME website at http://webfea.fea.aub.edu.lb/med/resources/summer_training.aspx

Summer training guidelines are given in Appendix III.

FINAL YEAR PROJECT»

Students normally in groups of three are supervised while working on a project worth six-credits, which extends over a full academic year. The project is an attempt to provide students with a transitional experience from the academic world to the professional world. It is designed to serve as a platform in which mechanical engineering students in teams engage in a comprehensive, integrative, meaningful design experience requiring the solution of open-ended problems that draw from knowledge acquired in the lead-up courses in order to better prepare them to enter the real world of engineering practice. The project experience forms a bridge between being a mechanical engineering student to becoming a technologically astute engineer practising in a world characterized by stiff competition, global market economy, rapid

2» MECHANICAL ENGINEERING

technological advancement, and customer driven engineering. Information on the types of projects offered can be found on the ME website. The guidelines for the FYP selection, expectations, deliverables, and assessment are compiled in a document and are posted on the ME website: <http://webfea.fea.aub.edu.lb/fea/med/resources/fyp.aspx>

WRITING CENTER AT AUB»

Everyone at all levels of study can improve their ability to write. Learning to express yourself clearly in writing is an important skill for an engineer. If you get stuck writing an essay or report or do not know how to start, the AUB Writing Center can help. Schedule an appointment with a tutor or drop by the center in West Hall. The AUB Writing Center was established in November 2004 and is open to all undergraduate and graduate students. The Writing Center is directed by Professor Amy Zenger. [azo7@aub.edu.lb – Fisk/204A]. The mission of the Writing Center is to enhance the quality of writing in the AUB community by providing a personal forum for students to engage in discussion about their texts. We respect each student's level of achievement and provide support and skills for analytical thinking, among many other textual-based processes.

2.3» MECHANICAL ENGINEERING OPTIONAL TRACKS»

The core courses of the Mechanical Engineering Program are offered in the following tracks:

- i» Thermal and Fluid Engineering
- ii» Design, Materials and Manufacturing
- iii» Mechatronics

The student may select any track and must complete at least four technical electives in the selected track. Normally, only one technical elective is allowed from outside the mechanical engineering department.

[TRACK I]» THERMAL AND FLUID ENGINEERING»

Core Courses»

- 1» MECH 310 Thermodynamics I [3 cr.]
- 2» MECH 314 Introduction to Fluid Mechanics [3 cr.]
- 3» MECH 414 Thermodynamics II [3 cr.]
- 4» MECH 410 Thermal/Fluid Systems Lab I [1 cr.]
- 5» MECH 412 Heat Transfer [3 cr.]
- 6» MECH 501 Final Year Project I and
MECH 502 Final Year Project II [5 cr.]
- 7» One Restricted Thermal/Fluid Systems Elective [3 cr.]
- » MECH 510 Modeling and Design of Thermal Systems
- » MECH 511 Intermediate Fluid Mechanics
- » MECH 513 Air Conditioning

Technical Elective Courses»

At least 3 technical electives are required

- MECH 510 Modeling and Design of Thermal Systems [3 cr.]
- MECH 511 Intermediate Fluid Mechanics [3 cr.]
- MECH 512 Internal Combustion Engine [3 cr.]
- MECH 513 Air Conditioning [3 cr.]
- MECH 514 Gas Turbines [3 cr.]
- MECH 515 Steam Turbines [3 cr.]
- MECH 516 Aerodynamics [3 cr.]
- MECH 517 Energy Efficient Buildings [3 cr.]
- MECH 602 Energy Conservation and Utilization [3 cr.]
- MECH 603 Solar Energy [3 cr.]
- MECH 604 Refrigeration [3 cr.]

2» MECHANICAL ENGINEERING

| | |
|---------------------------|---------|
| MECH 605 Micro Flows | [3 cr.] |
| MECH 606 Aerosol Dynamics | [3 cr.] |

[TRACK II]» DESIGN, MATERIALS AND MANUFACTURING»

Core Courses»

| | |
|---|---------|
| 1» cive 210 Statics | [3 cr.] |
| 2» MECH 200 Mechanical Tools | [3 cr.] |
| 3» MECH 220 Engineering Graphics | [1 cr.] |
| 4» MECH 332 Mechanics of Machines | [3 cr.] |
| 5» MECH 340 Engineering Materials | [3 cr.] |
| 6» MECH 341 Materials Lab | [1 cr.] |
| 7» MECH 320 Mechanics of Materials | [3 cr.] |
| 8» MECH 420 Mechanical Design | [3 cr.] |
| 9» MECH 421 Manufacturing Processes I | [3 cr.] |
| 10» MECH 501 Final Year Project I and | |
| » MECH 502 Final Year Project II | [6 cr.] |
| 11» One Restricted Design Elective | [3 cr.] |
| » MECH 520 Product Design and Development | |
| » MECH 522 Mechanical CAD/CAE/CAM | |

Technical Elective Courses»

At least 3 technical electives are required

| | | |
|--|---------|---------|
| MECH 520 Product Design and Development | [3 cr.] | |
| MECH 521 Manufacturing Processes II | [3 cr.] | |
| MECH 522 Mechanical CAD/CAE/CAM | [3 cr.] | |
| MECH 540 Selection of Properties of Materials | [3 cr.] | |
| MECH 550 Computer Applications in Mechanical Engineering | [3 cr.] | |
| MECH 622 Advanced Manufacturing Processes | [3 cr.] | |
| MECH 624 Mechanics of Composite Materials | [3 cr.] | [3 cr.] |
| MECH 625 Fatigue of Materials | [3 cr.] | |
| MECH 626 Metals and their Properties | [3 cr.] | |
| MECH 627 Polymers and their Properties | [3 cr.] | |
| MECH 628 Design of Mechanisms | [3 cr.] | |
| MECH 633 Biomechanics | [3 cr.] | |
| MECH 634 Biomaterials and Medical Devices | [3 cr.] | |

[TRACK III]» MECHATRONICS»

Core Courses in Mechatronics»

| | |
|--|---------|
| 1» MECH 230 Dynamics | [3 cr.] |
| 2» EECE 210 Electric Circuits | [3 cr.] |
| 3» EECE 312 Electronics | [3 cr.] |
| 4» EECE 312L Circuits and Electronics lab | [1 cr.] |
| 5» MECH 430 Instrumentation and Measurements | [3 cr.] |
| 6» MECH 431 Control Systems | [3 cr.] |
| 7» MECH 431L Control Systems Lab | [1 cr.] |
| 8» Restricted Mechatronics Elective | |
| » MECH 530 Mechatronics System Design | [3 cr.] |
| 9» MECH 501 Final Year Project I and | |
| » MECH 502 Final Year Project II | [6 cr.] |

Technical Elective Courses»

At least 3 technical electives are required

| | | |
|--|---------|---------|
| MECH 531 Mechanical Vibration | [3 cr.] | |
| MECH 641 Robotics | [3 cr.] | [3 cr.] |
| MECH 628 Design of Mechanisms | [3 cr.] | |
| MECH 631 Micro-Electro Mechanical Systems [MEMS] | [3 cr.] | [3 cr.] |

| | | |
|---|---------|---------|
| MECH 634 Biomaterials and Medical Devices | [3 cr.] | |
| MECH 642 Computer Vision | | [3 cr.] |
| MECH 643 Mechatronics and Intelligent Machines Engg. II | [3 cr.] | |
| MECH 644 Modal Analysis | [3 cr.] | |
| MECH 645 Noise and Vibration Control | [3 cr.] | |

3>> CHEMICAL ENGINEERING

3.1>> INTRODUCTION

MISSION>

The mission of the Chemical Engineering Program at AUB is to provide an innovative educational program that is both rigorous and challenging to equip students with the technological tools required for professional practice and research in the petroleum, chemical, and pharmaceutical industries located regionally and internationally. In addition, the educational program strives to encourage the development of communication, teamwork, and leadership skills; and to provide guidance on the application of technical and non-technical skills that will contribute to the engineering profession and to the well-being of society.

OBJECTIVES>

While having the aptitude to contribute to the society, students who attain a BSc [Bachelor of Science] degree possess a tool chest of technical and non-technical skills and knowledge that positions them either for successful professional practice as entry-level engineers in existing firms. This does not preclude other activities, such as volunteerism, self-employment, or academic study in another discipline. Graduates succeed in these goals because the Chemical Engineering program strives to:

- 1> produce graduates who can practice chemical engineering proficiently in a wide variety of contemporary industrial settings
- 2> produce graduates who have the basic competencies required to pursue advanced study and research in the chemical engineering and petrochemical domains, and other related disciplines
- 3> produce graduates with well-developed problem-solving skills and an understanding of current technical, economic, environmental, and safety issues, and their impact on local and global communities
- 4> produce graduates with the communication and leadership skills necessary to work in teams effectively and ethically
- 5> instil in the students the necessary interpersonal skills to perform professionally and make sound decisions under conditions of risk and uncertainty

CHEMICAL ENGINEERING FACULTY > Full Time

> **Renzo Di Fellici**, Professor, PhD from University College London, UK, 2988. Research interest in multiphase chemical reactor behaviour with particular reference to solid-fluid two and three phase suspensions.

[\[renzo.difellici@aub.edu.lb\]](mailto:renzo.difellici@aub.edu.lb)

> **Fouad Azizi**, Assistant Professor, PhD from Dalhousie University, Canada, 2009. Research interest in process Intensification, multiphase flows, Dynamic interfacial characteristics.

[\[fouad.azizi@aub.edu.lb\]](mailto:fouad.azizi@aub.edu.lb)

> **Mahmoud Al Hindi**, Assistant Professor, PhD from Imperial College, University of London, UK.

[\[MAHMOUD.ALHINDI@AUB.EDU.LB\]](mailto:MAHMOUD.ALHINDI@AUB.EDU.LB)

CHEMICAL ENGINEERING FACULTY > Part Time

> **Natalie Rouhana**, Lecturer, PhD from the University of Tennessee, 1996.

> **Talal Hassoun**, Lecturer, PhD from Texas Tech University, 2005.

ADVISING>

Advising is the responsibility of the faculty advisor assigned to the student. The advisor is responsible for monitoring the progress of each student from the first year in the Chemical

3>> CHEMICAL ENGINEERING

Engineering program until graduation. The faculty advisor provides advice about course selection and the opportunity to discuss career plans, to understand what and why mechanical engineers do what they do, and to provide a supportive personal relationship. Table 1 lists advisors for the 2009-10 academic year [AY]. If questions arise that cannot be answered by the advisor, the student should check with the main ME department office. Students must meet with their advisors by appointment at least once per semester for pre-registration advising. To assure that this occurs, advisors are sent the personal identification numbers [PIN] of their advisees. A student will not be able to register unless he/she meets with the advisor and obtains a PIN.

In some cases, your advisor may not be able to answer specific academic questions or approve academic actions that are not described in the catalogue [course equivalence, exceeding permitted load, request for make up final ect.] In these cases, the student has to petition the Academic Committee of the Faculty using the form available at the Record's Office of the Faculty. The form is also enclosed at the end of this guide. After filling out the form, the student must secure the signature and the comments of his/her advisor. The answer to the petition will at most take 10 working days.

Table 4 Mechanical Engineering Advisors

| CLASS | ADVISOR | OFFICE |
|-------|-------------|--------|
| 2013 | Prof. Azizi | |
| | Prof. Hindi | |

REGISTRATION AND VALIDATION OF CREDITS>

Students register each academic semester via the web-based Banner System. Access to courses controlled by the FEA and other departments is automatically restricted to students who need these courses by virtue of their programs of enrolment. The faculty academic advisor is responsible for checking the student progress through the curriculum. At the beginning of each academic semester the program of each student is reviewed by the student's faculty advisor to assure compliance with the continuation policy and to assure that prerequisites are satisfied. Ultimately, each student is responsible for understanding the curriculum and planning his/her progress through it.

PRACTICAL TRAINING/SUMMER INTERNSHIP>

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3>> CHEMICAL ENGINEERING

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FINAL YEAR PROJECT>

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3.2>> UNDERGRADUATE CHEMICAL ENGINEERING PROGRAM

The undergraduate curriculum for the degree of Bachelor of Science (BS), Major: Chemical Engineering is a four-year program. It consists of 140 semester credit hours of course work of which 30 credits are completed in the freshman year while the student is enrolled in the Faculty of Arts and Sciences and 110 credits are completed in three years while the student is enrolled at the Faculty of Engineering and Architecture. Students who are admitted at the sophomore level will be required to complete 110 credits in three years to earn the degree as outlined here:

Table 5 Chemical Engineering Curriculum

| | | | |
|-------------------------------------|-----------|---|---|
| Term I [Fall] 16-credits | MATH 201 | Calculus and Analytic Geometry III | 3 |
| | EECE 230 | Computers and Programming | 3 |
| | CIVE 210 | Statics | 3 |
| | MECH 220 | Engineering Graphics | 1 |
| | ENGL 206 | English Technical Writing | 3 |
| | | Humanities Elective | 3 |
| Term II [Spring] 15-credits | CHEN 200 | Introduction to Chemical Engineering | 3 |
| | MATH 202 | Differential Equations | 3 |
| | EECE 210 | Electric Circuits | 3 |
| | MECH 310 | Thermodynamics I | 3 |
| | ENGL | Elective | 3 |
| Term III [Summer] 9-credits | STAT 230 | Introduction to Probability and Random Variables | 3 |
| | CHEM 208E | Survey of Organic Chemistry and Petrochemicals | 4 |
| | CHEM 209 | Introductory Organic lab | 2 |
| Term IV [Fall] 17-credits | | Arabic Elective | 3 |
| | | Humanities Elective: Ethics course | 3 |
| | MATH 218 | Linear Algebra | 3 |
| | CHEM 217E | Physical Chemistry for Engineers | 3 |
| | CHEN 410 | Synthesis lab | 2 |
| | CHEN 414 | Chemical Engineering Thermodynamics II | 3 |
| Term V [Spring] 18-credits | CHEM 215E | Analytical and Instrumental Chemistry for Engineers | 3 |
| | CHEN 411 | Fluid Flow Operations | 3 |
| | CHEN 415 | Separation Processes | 3 |
| | MECH 340 | Engineering Materials | 3 |
| | MECH 430 | Instrumentation and Measurements | 3 |
| | | Social Science Elective | 3 |
| Term VI [Summer] | CHEN 500 | Approved Experience | 3 |
| Term VII [Fall] 18-credits | ECON 212 | Elementary Macroeconomics Theory | 3 |
| | CHEN 412 | Heat Transfer Operations | 3 |
| | CHEN 416 | Kinetics and Reactor Design | 3 |
| | CHEN 511 | Process Control | 2 |
| | CHEN 511L | Process Control Lab | 1 |
| | | Technical Elective I | 3 |
| | | Humanities Elective | 3 |
| Term VIII [Spring] 17-credits | CHEN 501 | Final Year Project | 3 |
| | CHEN 505 | Transport Phenomena and Unit Operation Lab | 2 |
| | CHEN 510 | Chemical Process Design | 3 |
| | | Technical Elective II | 3 |
| | | Technical Elective III | 3 |

3>> CHEMICAL ENGINEERING

| | | |
|--|---------------------|---|
| | Humanities Elective | 3 |
|--|---------------------|---|

Table 6 Distribution of Credits in CHEN Curriculum for General Education, MATH and Sciences, Engineering and Chemical Engineering Major

| COURSE CATEGORY | COURSES/TOPICS | CREDITS |
|--|---|---------|
| English Communication [6 cr.] | ENGL 206 | 3 |
| | English Elective | 3 |
| Arabic [3 cr.] | Elective | 3 |
| Humanities [12 CREDITS] | Three Humanities Electives | 9 |
| | ENGM 504 Engineering Ethics or an Ethics Course | 3 |
| Social Sciences PSPA, SBS OR ECON [6 cr.] | Two Social Science Electives | 6 |
| MATH and Sciences [27 cr. lectures and 3 cr. labs] | MATH 201, MATH 202, MATH 218, STAT 230, CHEM 208E, CHEM 209, CHEM 215E, CHEM 217E | 24 |
| General Engineering [16 cr.] | CIVE 210, EECE 210, EECE 230, MECH 220, MECH 310, MECH 340, MECH 430 | 19 |
| Chemical Engineering Major [70 cr.] | Core Courses: CHEN 200, CHEN 410, CHEN 414, CHEN 411, CHEN 412, CHEN 415, CHEN 416, CHEN 416, CHEN 505, CHEN 511, CHEN 511L, CHEN 510, CHEN 500, CHEN 501 | 31 |
| | Technical Electives: CHEN 523, CHEN 524, CHEN 525, CHEN 541, CHEN 602, CHEN 607, CHEN 611, CHEN 653, CHEN 654, CHEN 701, CHEN 709 | 9 |

total 110

3.3>> MINOR IN CHEMICAL ENGINEERING

The minor in chemical engineering is open to engineering students in majors other than chemical engineering .

Minor Program Requirements (20 credits)

The student taking the minor is required to complete 20 credits from the list given below. The student has to complete 14 credits of core courses and 6 credits of elective courses.

REQUIRED CORE COURSES (14 CREDITS)>>

- 1> CHEM 215E Analytical Chemistry and Instrumentation [3 cr.]
- 2> MECH 310 Thermodynamics I [3 cr.]
- 3> CHEN 411/MECH 314 Fluid Flow Operations [3 cr.]
- 4> CHEN 416 Kinetics and Reactor Design [3 cr.]
- 5> CHEN 505 Transport Phenomena and Unit Operation Lab [2 cr.]

ELECTIVE COURSES (6 CREDITS) SELECTED FROM THE FOLLOWING COURSES>>

- > CHEM 217E Physical Chemistry for Engineers [3 cr.]
- > CHEN 410 Synthesis Lab [2 cr.]
- > CHEN 412/MECH 412 Heat Transfer Operations [3 cr.]
- > CHEN 414 Chemical Engineering Thermodynamics II [3 cr.]
- > CHEN 415 Separation Processes [3 cr.]

3>> CHEMICAL ENGINEERING

- › CHEN 510 Chemical Process Design [3 cr.]
- › CHEN 511 Process Control [2 cr.]
- › CHEN 511L Process Control Lab [1 cr.]

4>> ACADEMIC REGULATIONS

4.1>> PETITIONS

There is a process whereby a student can petition for deviation from certain requirements. The student must submit a petition signed by the academic advisor to the FEA Records Office. The petition is then studied by the FEA Academic & Curriculum Committee. For more information on dealing with special or unique cases, the student and advisor should refer to details in the University Catalogue, the University Policy Manual, the Student Handbook and the Faculty Handbook, the Student Code of Conduct on the AUB website: <http://pnp.aub.edu.lb/general/conductcode/index.html>, and the University Faculty Advising Handbook.

4.2>> ATTENDANCE

CLASSES AND LABORATORIES>

- › Students are expected to attend all classes, laboratories, and required fieldwork. All missed laboratory or fieldwork must be made up. A student is responsible for the work that is done, and for any announcements that are made during his/her absence.
- › Students who, during a semester, miss more than one-fifth of the sessions of any course in the first ten weeks of the semester [five weeks in the case of the summer term] will be dropped from the course. A faculty member who drops a student from the course for this reason must have stated in the syllabus that attendance will be taken.
- › Students who withdraw or are forced to drop a course will receive a grade of “W.”
- › A student cannot withdraw or be withdrawn, from a course after the announced deadline unless approved by the FEA Academic & Curriculum Committee.
- › Students cannot withdraw, or be forced to withdraw, from a course at any time if this results in the student being registered for less than 12 credits without the prior approval of the FEA Academic & Curriculum Committee.

EXAMINATIONS AND QUIZZES>

Students who miss an announced examination or quiz must present an excuse considered valid by the instructor of the course. The course instructor should then require the student to take a make-up examination.

Medical reports and/or qualified professional opinions issued by an AUB employee, AUH doctor, or by the University Health Services will be accepted. Should there be a question about the validity of any excuse presented by the student, the matter should be referred by the faculty member to the FEA Academic & Curriculum Committee.

4.3>> CHEATING

Plagiarism, cheating, or other forms of academic dishonesty are prohibited. Students guilty of academic misconduct, either directly or indirectly through participation or assistance, are immediately reported to the instructor of the class. In addition to other possible disciplinary sanctions, which may be imposed through regular institutional procedures as a result of academic misconduct, the instructor has the authority to assign an “F” or a zero for the exercise or examination, or to assign an “F” in the course.

4.4>> ON-LINE PLAGIARISM TUTORIAL AND TEST

The Board of Deans has determined that all AUB students must complete an on-line plagiarism tutorial and test. Students can take the test as many times as necessary. The homepage of the Plagiarism Tutorial and Test is available at:

http://staff.aub.edu.lb/~eplagio/Tutorial-Test/home_Tutorial_Test.htm

The Tutorial & Test is divided into four sections:

- › **Overview:** when and how to give credit; recommendations; decision flowchart.

4>> ACADEMIC REGULATIONS

- › **Examples:** word-for-word and paraphrasing plagiarism: 5 examples each.
- › **Practice with Feedback:** identifying plagiarism: 10 items.
- › **Test**

When students pass the test a “Notification of Test Completion” [see sample at <http://staff.aub.edu.lb/~eplagio/Tutorial-Test/notification.htm>] appears and they click “submit” to have it sent to the Office of the Registrar. The Office of the Registrar will have in its database the information about the students who have passed the test, and the date when they did so. The system will also generate e-mails to the passing students giving them unique validation codes [to be used as a proof they passed the test-if needed].

4.5>> EXAMINATIONS

Final examinations are to be held at the end of each semester and are to be administered according to the schedule predetermined by the Office of the Registrar.

4.6>> COURSE LOAD

To be considered full-time, a student must be registered for a minimum load of 12 credits per semester. [See the required number of credits for summer full-time status under summer term for FEA.] A full-time student who wishes or is forced to reduce his/her load to less than 12 credits must first apply to the FEA Academic & Curriculum Committee for permission to do so. Students can normally register for up to 17 credits per semester and nine credits during the summer term. Students who wish to register for more than 17 credits must petition the FEA Academic & Curriculum Committee for permission to do so.

Students in the following categories must petition the appropriate faculty committee but will normally be granted permission to register for more than 17 credits:

- › Freshman students intending to go into medicine or engineering, and who have an average of at least 80 in the first semester, may take an additional course during the second semester.
- › Junior and senior students who have completed their English communication skills requirements at the level required by the department of their major may register for a maximum of 18 credits per semester.
- › If the program requires that a student registers for more than 17 credits in a particular semester.

4.7>> CHANGE OF MAJOR

All changes of major are subject to the approval of the department to which the change is requested. The receiving department determines the new study plan for a student accepted into the new major.

4.8>> DEAN’S HONOR LIST

To be placed on the Dean’s Honor List at the end of the semester, a student must:

- › be carrying at least 12 credits,
- › not be on probation,
- › have passed all courses and attained an overall average of 85 or be ranked in the top 10 percent of the class and have an overall average of 80,
- › not have been subjected to any disciplinary action within the university during the semester, and
- › be deemed worthy by the dean to be on the Honor List.

4.9>> DISMISSAL AND RE-ADMISSION

A student is dismissed from the Faculty for any of the following reasons:

- › If the student’s overall average is less than 60 at the end of the 2nd regular semester.
- › If the student fails to clear academic probation within two regular semesters, excluding the summer term, after being put on probation.

4>> ACADEMIC REGULATIONS

- › If the student is placed on academic probation for a total of four regular semesters. A student can be dropped for this reason even if he/she is in the final year at AUB.
- › If the student is deemed unworthy by the faculty to continue for professional or ethical reasons.

A student will normally be considered for readmission only if, after spending a year at another recognised institution of higher education, the student is able to present a satisfactory record and recommendation. Exceptions may be made for students who left the university for personal or health reasons. Transfer credit will be considered after departmental evaluation of a student's course work.

4.10>> INCOMPLETES

A student who receives an incomplete grade for a course must petition the FEA Academic & Curriculum Committee within two weeks from the date of the scheduled final exam for permission to complete the course. Coursework must be completed within one month from the beginning of the next regular semester. In exceptional circumstances, the FEA Academic & Curriculum Committee may decide to give the student additional time to complete a course. Incomplete course work will be reported as an "I" followed by a numerical grade reflecting the evaluation of the student available at the end of the semester. This evaluation is to be based on a grade of zero on all missed work and should be reported in units of five. If the work is not completed within the period specified, the "I" is dropped and the numerical grade becomes the final grade.

Normally a student with incomplete grades on good academic standing will not be permitted to register for more than 16 credits during a regular semester.

4.11>> PROBATION

PLACEMENT ON ACADEMIC PROBATION>

A student is placed on academic probation if the student's overall average is less than 68 at the end of the 2nd regular semester, if the semester average is less than 69 at the end of the 3rd or 4th regular semester, or if the semester average is less than 70 in any subsequent semester, excluding the summer term.

For evaluation purposes, the minimum number of credits at the end of the 2nd regular semester should be 24, and 12 in each subsequent fall or spring semester.

Courses/credits taken during a summer term are counted towards the semester average of the next regular semester. If the number of credits taken in any one regular semester is less than 12 [for approved reasons], courses/credits taken during that semester are counted towards the semester average of the next regular semester.

Credit for incomplete courses will be included in the semester in which the incomplete courses were taken. The evaluation for that semester will be carried out as soon as the grades for the incomplete courses have been finalised.

During a regular semester, a student will not be permitted to register for more than 16 credits if s/he is on academic probation (P1), and no more than 13 credits if s/he is on academic probation P2 or higher. A student on probation will not be permitted to register for more than 7 credits during a summer term.

A student who is on academic probation and has incomplete grades will not be permitted to register for more than 13 credits.

Students with incomplete grades will be forced to drop courses to comply with the above mentioned rules.

REMOVAL OF PROBATION>

Probation is removed when the student attains a semester average of 69 or more in the 3rd or 4th regular semester, or a semester average of 70 or more in any subsequent regular semester.

4>> ACADEMIC REGULATIONS

Probation should be removed within two regular semesters, excluding summer, after the student is placed on probation, or when the student completes his or her graduation requirements [see Graduation Requirements].

4.12>> REPEATING COURSES

A student may repeat any course for which he/she received a grade of less than 70. A student who fails a required course must repeat the course at the earliest opportunity. No course may be taken more than three times. When a course is repeated, the highest grade will be considered in the calculation of the cumulative average. All course grades will remain a part of a student's permanent record.

4.13>> WITHDRAWAL FROM COURSES [ALSO SEE ATTENDANCE]

A student can withdraw from only one required course per semester. Students who wish to withdraw from more than one required course in any given semester must petition the appropriate faculty committee for permission to do so. A student may withdraw from elective courses, down to a minimum of 12 credits, not later than 10 weeks [five weeks in the summer term] from the beginning of the semester. A student will receive a grade of "W" for the course.

4.14>> CHANGE OF GRADE>

- 1> Once grades are posted on the AUB Student Information System [AUBSIS], a change of grade is not allowed unless a demonstrable mistake was made in the correction of the final examination or in the calculation of the grade. In particular, if a change of grade would result in a change of the academic status of the student, the supporting evidence for the changes of grade must be presented to the chairperson of the department and the Dean.
- 2> A student may petition the Dean's Office to request that a course teacher review the correction of the student's final examination paper, in a case in which the student has reason to believe that some oversight may have been made in the correction, or that a mistake may have been made in calculating the course grade. Such petitions must be submitted within one week from the date of the posting of course grades. The Dean's Office will transmit the petition to the teacher concerned.
- 3> To change a course grade, the teacher must complete a Change Of Grade form available in the Records Office and submit it to the chairperson of the department, with the supporting evidence, if required in accordance with paragraph 1 above. If the chairperson of the department approves the change of grade, s/he will sign the form and transmit it to the Dean for final approval.

4.15>> GRADUATION

Students can graduate at the end of any academic semester. Satisfactory completion of the full BE curriculum is assured by a two-step process. The chairperson of the department in coordination with the faculty advisor of the fourth year students submit to the office of the Registrar at the American University of Beirut a list with the names of students who will be completing the BE degree requirement at the end of a given term. At the end of the term, the Registrar's Office will render a student eligible to receive the degree if that student has met all program requirements, which are:

- 1> Passed all the required courses and the approved experience;
- 2> Attained a minimum cumulative course average of 70 excluding freshman level courses and courses taken prior to admission to the FEA;
- 3> Attained a cumulative average of 70 or more in major courses. Major courses are specified as all engineering courses that are scheduled in the ME curriculum to be taken in terms VI to XI including courses approved as technical electives.
- 4> Met the residence requirements.

4 >> ACADEMIC REGULATIONS

4.16 >> GRADUATE STUDIES

Students who plan to pursue graduate studies at AUB should have attained an average of at least 80 or an equivalent grade.

4>> PROFESSIONAL SOCIETIES AND AWARDS

4.1>> PROFESSIONAL SOCIETIES

All Mechanical Engineering students have immediate access to student chapters of ASME [American Society of Mechanical Engineers] and ASHRAE [American Society of Heating, Refrigeration and Ventilating Engineers]. A chapter for Society of Manufacturing Engineers was established in 2004. [website: webfea.fea.aub.edu.lb/asme].

These societies offer leadership opportunities as well as frequent outside speaker programs and field trips.

4.2>> AWARDS

DEAN'S AWARD FOR CREATIVE ACHIEVEMENT>

The Dean's Award For Creative Achievement, was initiated in the Faculty of Engineering and Architecture in December 1991. The objective of this award is to recognize and reward creativity among students of the Faculty in their approach to academic work.

- > **Nature of Award:** The award consists of a certificate in testimony of creative achievement as well as the inscription of the recipient's name on a special board placed in FEA. A student who receives the award three times will be presented with a \$500 prize.
- > **Number of Awards:** One award may be presented yearly, depending on eligibility, to a student in each of the following programs: Architecture, Graphic Design, Civil Engineering, Computer and Communications Engineering, Electrical and Computer Engineering, and Mechanical Engineering.
- > **Eligibility:** Undergraduate students from all classes in the Faculty of Engineering and Architecture who have demonstrated creativity in their approach to academic work as applied to projects, problem solving, laboratory, shop work, etc. are eligible without restriction. If the work in question is a group activity, the award may be given to each member of the group.
- > **Procedure for Nomination and Selection:** Faculty members shall submit to the chairperson of the department concerned, just after the final examinations of the spring semester, the names of candidates for the award with justification and supporting material. Selection of the candidate from each program shall be made by the respective department and communicated to the dean for voting by the faculty at the time of voting of degrees at the end of the academic year.

DISTINGUISHED GRADUATE AWARD>

The Distinguished Graduate Award, first announced in June 1998, is given to the graduating senior student who demonstrates high academic achievement, outstanding character, and contribution to the department.

- > **Number of Awards:** One award may be presented yearly, depending on eligibility, to a student in each of the following programs: Architecture, Graphic Design, Civil Engineering, Computer and Communications Engineering, Electrical and Computer Engineering, and Mechanical Engineering.
- > **Nomination:** The candidate should be nominated by at least three faculty members. The nomination should come in the form of a letter that addresses academic performance, character and contribution to the department.
- > **Academic Performance:** The candidate for the award should have been placed on the Dean's Honour List for Terms VII, VIII, X and XI and should have been nominated for graduation with distinction or high distinction.
- > **Character:** The nomination letter for the student should include a section addressing the student's character and should include examples that demonstrate it vis-à-vis his/her

4 >> PROFESSIONAL SOCIETIES AND AWARDS

classmates and teachers. Emphasis should be given to evidence of exemplary, ethical, and responsible conduct inside and outside the classroom setting.

› **Contribution to the Department:** The nomination brief should address and evaluate the contributions that the student made to the learning environment in his/her classes and to the department as a whole. This section should include supporting examples.

› **Voting:** The successful candidate for the award should acquire the vote of at least two thirds of the voting faculty members of the department.

› **Award:** The award will consist of an engraved plaque and a certificate signed by the chairperson of the department and the dean of the school.

PENROSE AWARD›

In 1955 Mrs. Stephen Penrose initiated the Penrose Award in honor of her late husband, President Penrose.

› **Basis for Award:** This award is made on the basis of the best combination of scholarship, character, leadership, and contribution to the university as a whole.

› **Nature of the Award:** The award consists of engraving the recipient's name on a plaque that is kept on display in Jafet Library.

› **Nomination and Selection Procedures:**

1› Each member of the faculty is entitled to nominate one student. The nominee for the Penrose Award must have attained a cumulative average of not less than 75 based on terms VI, VII, VIII, and X for Engineering students, and terms VIII, X, XI, and XIII for Architecture students and have not repeated any of the above-mentioned terms.

2› Upon receiving the nominations made by the individual faculty members, the Students Affairs Committee will study and appraise each nominee, and will then prepare a selected list of three names, or a list of all nominated if less than three, for presentation to the faculty for final vote.

3› A faculty meeting will be called and the list mentioned in '2' will be distributed. Final voting and selection, by the "voting faculty" will be made at this meeting. The name of the nominee who obtains a simple majority of the votes will be transmitted to the Board of Academic Deans for final approval. The above mentioned actions of the faculty will be final and will not be subject to any subsequent considerations.

Students in the engineering majors are expected to satisfy the following distribution of requirements for Humanity/Social Science courses:

› Two English courses, one of them English 206 [6 credits]

› One Arabic course as determined by the Arabic Placement Test [3 credits].

Students who are exempt from Arabic should normally replace this requirement by taking arab 200, 203, or any other 3-credit course in Humanities.

› One course on ethics [3 credits] For ME students, engm 504 is recommended.

› Three humanities courses [9 credits]

› Two social sciences courses [6 credits]

5>> FREQUENTLY ASKED QUESTIONS [FAQ]

› *Q1: If I missed my registration time slot or the entire registration period what should I do?*

A1: Speak with the FEA Student Services Officer, Alia Kazma Serhal. Her office is located in the main FEA Dean's Office.

› *Q2: Who is my advisor?*

A2: You can find the name of your advisor by logging onto SIS.

› *Q3: My advisor is not present; to whom should I go for advice?*

A3: First read through the FAQ list to see if you can find an answer to your question. If you do not find an answer to your question go to the chairperson of your department. S/he will answer your question or tell you who to see.

An advisor's office hours sometimes do not coincide with a student's registration time. All faculty members have their office hours posted outside their door.

› *Q4: Can I change my advisor?*

A4: (If you are in ECE you may change your advisor with the permission of your current advisor and the new advisor. You must complete the appropriate form in the ECE office.)

› *Q5: How can I get my alternate PIN?*

A5: Your advisor has your alternate PIN number.

› *Q6: My advisor does not have my alternate PIN, who can give me this information?*

A6: Speak with the FEA Student Services Officer, Alia Kazma Serha. Her office is located in the main FEA office.

› *Q7: How do I use the alternate pin?*

A7: After you log on to SIS you will be asked to give your PIN.

› *Q8: How do I find out the English level I am placed in?*

A8: If you are a new student check with the Admissions Office to find which English class you must take. If you are a continuing student the English department should be able to answer your question.

› *Q9: I took ENGL 204 do I need to take ENGL 206?*

A9: If you took ENGL 204 before joining the FEA you do not need to take ENGL 206.

If ENGL 204 was counted toward your freshman requirements a substitute English course should be taken.

› *Q10: I was placed in English 204 do I take it or 206 instead?*

A10: If you are in engineering or the architecture program you should take ENGL 206. If you are a graphic design major you should take ENGL 204.

› *Q11: How do I find out when an Arabic placement test will be given, and where can I find the results after I take the test?*

A11: This information is available in the Department of Arabic and Near Eastern Languages located in College Hall on the 4th floor. Check the website of the Arabic Department: <http://staff.aub.edu.lb/~webarab/apt.htm>

› *Q12: What Arabic course should I take?*

A12: The course that you are placed in is dependent upon the results of your Arabic placement test. Those students who are exempt from taking Arabic must take an elective course in the humanities.

› *Q13: Should I follow the required course list exactly? Which courses have prerequisites? Which courses can I delay taking?*

A13: You do not have to strictly follow the course list; however there are sequences of courses with prerequisites in all the programs. Check the AUB undergraduate catalogue or the course syllabus for the specific prerequisites. If there are no prerequisites for a course you may postpone taking it; it is advisable to check with your advisor.

› *Q14: What are the humanities courses or the social sciences course I am permitted to take?*

5 >> FREQUENTLY ASKED QUESTIONS [FAQ]

A14: First check the FEA section of the most recent catalogue for a complete list of the acceptable electives. <http://www.aub.edu.lb> if you still have questions see your advisor.

› Q15: *May I take my humanity electives in business or engineering management?*

A15: Business and engineering management courses are not considered humanity courses.

› Q16: *How do I register for a minor in engineering management?*

A16: First check the EM minor program requirements in the catalogue. Then you must complete an Engineering Management Course Plan form which is available in the FEA Dean's Office. The form requires the signature of the program coordinator.

› Q17: *How do I apply for a minor in bio-medical engineering?*

A17: Check the AUB Undergraduate Catalogue for the requirements then complete the form on the ECE home page.

› Q18: *Can I take a graduate course as an elective?*

A18: Undergraduate students may take graduate courses as electives if the class has not reached capacity. However, some programs limit the number of electives a student may take outside the department.

› Q19: *What are the ethics courses?*

A19: Check the FEA section of the most current catalogue.

› Q20: *Where can I find the list of science electives?*

A20: Check the departmental section for your major in the most recent catalogue for a complete list of the approved science electives.

› Q21: *What should I do when I can not register in my core course?*

A21: Contact your department.

› Q22: *I am a fourth year student, I cannot register in a course that is required what should I do? I need the course.*

A22: Contact the Student Services Officer for difficulties registering in courses outside the FEA.

› Q23: *If while trying to register for a course I get a prerequisite or a test score error, what should I do?*

A23: First go to the secretary of your department, and if s/he is not able to solve the problem go to the Student Services Officer. The Student Services Officer can help resolve problems with courses offered outside the FEA.

› Q24: *Should I go to the Registrar to have restrictions removed?*

A24: No, you should go to the department offering the course.

› Q25: *Why are there restrictions on courses for majors?*

A25: Registration restrictions are put on some courses to give priority to students who need the course to complete the requirements in their major.

› Q26: *If the capacity in an FEA class needs to be increased in order for me to register, what should I do?*

A26: You should first talk to the department concerned; you will need the instructor's permission. If the problem persists you should contact the Student Services Officer.

› Q27: *Why must I ask permission from a chair or coordinator to open capacity if there is space?*

A27: Some courses have restrictions placed on them to ensure that students who require the course for their major will be able to register.

› Q28: *If the capacity of a course outside the FEA must be increased in order for me to register, what should I do?*

A28: You should see the Student Services Officer who will assist you by contacting the appropriate department.

› Q29: *Can capacity in lab class be opened if I bring my own laptop?*

A29: No, the space in a lab class is strictly limited.

› Q30: *Can I switch sections if the section is open?*

A30: Yes, you may switch sections but it can be done only during the drop and add period.

› Q31: *Why can't my department open capacity in other Faculties?*

5 >> FREQUENTLY ASKED QUESTIONS [FAQ]

A31: Each Faculty has control over the courses that they offer. It is difficult to predict the number of sections that will be required especially for first year courses. Opening a new section requires assigning instructors and rooms; this is done within the Faculty.

› Q32: *Do I have to wait until drop and add day to change my registration?*

A32: To make changes in your registration you must wait until the drop and add period. The system is used for many functions (grades, fees etc.) and for logistical reasons caused by load on the system you must wait.

› Q33: *What is the course load that I am required or permitted to take during the summer?*

A33: Nine credits is the standard course load during the summer term. If you are doing a summer internship and wish to register for an additional course you must submit a petition to the FEA Academic Committee. The course can only be taken if it is scheduled after or before regular work hours.

› Q34: *How do I request an overload?*

A34: If the overload will involve 19 or less credits it can be approved at the departmental level. If the overload will result in more than 19 credits a petition must be filed with the FEA Academic Committee. The committee's approval will depend upon your GPA and if any of the courses are being repeated.

Normally first year students are not granted overload permission. Students may petition the FEA Academic Committee for overload permission. (The ECE will not approve an overload for a student in their first year.)

› Q35: *What is the minimum grade that I need to clear probation?*

A35: The minimum grade required to remove probation is dependent upon your previous grades. Probation is removed when a student attains a semester average of 69 or more in the third or fourth regular semester, or a semester average of 70 or more in any subsequent regular semester. "Probation should be removed within two regular semesters, excluding summer, after the student is placed on probation, or when the student completes his/her graduation requirements." (See: AUB Undergraduate Catalogue: Removal of Probation and Graduation Requirements)

› Q36: *How and when can I transfer out of, or into a department?*

A36: Usually you may transfer after completing two regular terms in a department. You must complete the change of major form on the FEA website (click on Student Resources and then Petitions and Forms).

› Q37: *What is the minimum grade average needed to transfer?*

A37: All changes of major are subject to the approval of the department to which the change is requested. The average required depends on the department and the availability of space; check the catalogue for specific requirements.

› Q38: *If I am going to transfer from one major to another within the FEA what courses should I take so as not to waste a whole semester? What courses are required?*

A38: Check the catalogue and see your advisor. The introduction to engineering courses (MECH 200, EECE 200, and CIVE 200) will be accepted by all the engineering departments for students who transfer.

› Q39: *Can I use the courses that I took courses abroad as an exchange student as part of my graduation requirements?*

A39: Yes, if the courses are pre-approved through a petition to the FEA Academic Committee.

› Q40: *What must I do concerning my summer training internship?*

A40: Check with the FEA Career Center and remember you must register for the Approved Experience course in your major.

› Q41: *What is my class rank?*

A41: The FEA does not provide any ranking beyond the honor list.

› Q42: *What forms do I need to complete before, during and after my internship?*

A42: All engineering programs require:

1- Proposal of Approved Experience form

5 >> FREQUENTLY ASKED QUESTIONS [FAQ]

2- Notice of Arrival form

3 Interim Training Report

4- Letter from Employer

5- Final Training Report

For more information see your departmental undergraduate guide.

› *Q43: How many students can be in an FYP group?*

A43: Check with your department.

› *Q44: I am a fourth year student what courses do I need to graduate?*

A44: Check with your advisor. There is a degree evaluation on SIS and on the WEB

› *Q45: What do I do to get a clearance for graduation?*

A45: Go to the Registrar on line and click on Forms.

› *Q46: What forms should I complete before my graduation?*

A46: You must complete the following forms:

Graduation Forms in the Registrar's Office,

Departmental Exit Survey,

Career Office Exit Survey,

FEA Dean's Office updated records form, and

You must have passed the online Plagiarism Test.

› *Q47: How can I know that I have taken all my required courses and that I am eligible for graduation?*

A47: Check with your advisor. There is a degree evaluation on SIS and on the WEB

› *Q48: What is my GPA? How do I translate this to the 4.0 scale?*

A48: Your GPA is on your transcript. You can get a conversion table at the Registrar's Office.

› *Q49: How can I know my graduation GPA?*

A49: You must wait until all your final grades are posted on the web. Your final average will be included on your transcript.

› *Q50: When I apply to graduate school, what courses are used to calculate my GPA?*

A50: If you are applying to a graduate program at AUB the last two years of grades are considered. If you are applying elsewhere the entire transcript may be considered.

APPENDIX I >> DISTRIBUTION OF REQUIREMENTS IN HUMANITIES/SOCIAL SCIENCES

The following courses are approved Humanity/Social Science courses, subject to confirmation by the department offering the course:

AI.1 >> HUMANITIES

- › AMST 215, 220, 230, 275/276, 299
- › ARAB 229 through 241; 243 through 247; 249
- › AROL 201 through 231; 235; 236
- › CVSP 201 through 208; 230; 250; 251
- CVSP/Fine Arts: 213; 214; 217; 224; 225
- CVSP/French: 215; 216
- CVSP/Music: 240; 241; 247; 248; 260; 261
- CVSP/Theater: 265; 270
- › ENGL: 210 through 215; 219; 221 through 226; 229; 240 through 243
- › HIST All 200 level courses up to 274
- › PHIL 201; 206; 209; 210; 213 through 219; 221 through 224; 230 through 232; 249
- › ARCH 020 through 029; 121; 122; 223; 224; 325
- › GRDS 325

AI.2 >> SOCIAL SCIENCES

- › ECON All 200 level courses [excluding ECON 203 and 213]
- › EDUC 211; 212; 213; 215; 216; 218; 221; 222; 223; 225; 226
- › PSPA All 200 level courses up to 278
- › SOAN All 200 level courses up to 242
[sociology-anthropology]
- › PSYC All 200 level courses up to 251 [psychology]

AI.3 >> BIOLOGY

- › BIOL 210 or BIOL 290

APPENDIX II >> MECHANICAL ENGINEERING COURSE DESCRIPTIONS

AI.1 >> UNDERGRADUATE COURSES

MECH 200 Mechanical Engineering Tools [3 cr.] >

The course seeks to introduce students to the mechanical engineering discipline, build the student's interpersonal and communication skills, and give them insight about engineering concepts and creative design principles and an overview of mechanical engineering as a profession, and ethics in engineering. Teamwork experience is highly stressed. Prerequisites: None

MECH 220 Engineering Graphics [1 cr.] >

The course aims at preparing the future engineer to be able to understand and create technical drawings. The course seeks to develop the student effective utilization of computer-aided drafting (CAD) skills in order to create engineering drawings. Orthogonal projection, exploded and auxiliary views, sectioning and sectional views, dimensioning and tolerance schemes, standard drawing formats, and detailing. Introduction to the use of CAD packages (AutoCAD).

MECH 230 Dynamics [3 cr.] >

A basic course in engineering mechanics covering dynamics of particles and planar rigid bodies. This course introduces Newton's law of motion, the principle of work and energy, and the principle of impulse and momentum. Diagrammatic representation of the basic laws are applied on motion of particles, systems of particles, and rigid bodies.

MECH 310 Thermodynamics I [3 cr.] >

This course seeks to provide a methodology by which student's view objects in the physical universe as "systems" and apply to them the basic laws of conservation of mass, energy and the entropy balance. The course covers the thermodynamic state and properties of a pure substance, energy and mass conservation, entropy and the second law. Applications are to closed setups and flow devices. Simple vapor and gas cycles applications.

MECH 314 Introduction to Fluids Engineering [3 cr.] >

An introductory course on fluid behavior emphasizing conservation of mass, momentum, and energy and dimensional analysis, study of fluid motion in terms of the velocity field, fluid acceleration, the pressure field, and the viscous effects; applications of Bernoulli's equation, Navier-Stokes, and modeling; flow in ducts, potential flows, and boundary layer flows. Prerequisite: MECH 310.

MECH 320 Mechanics of Materials [3 cr.] >

A course that deals with the mechanization of motion, kinematics analysis of linkage mechanisms, synthesis of cam-follower mechanisms, gear terminology and types of gears, analysis and synthesis of gear trains, force analysis, and introduction to linkage synthesis; computer aided project. Prerequisite: MECH 230.

MECH 332 Mechanics of Machines [3 cr.] >

A course that deals with the mechanization of motion, kinematics analysis of linkage mechanisms, synthesis of cam-follower mechanisms, gear terminology and types of gears, analysis and synthesis of gear trains, force analysis, and introduction to linkage synthesis; computer aided project. Prerequisite: MECH 230. Annually.

MECH 340 Engineering Materials [3 cr.] >

The course introduces fundamental concepts in materials science as applied to engineering materials: crystalline structures, imperfections, dislocations, and strengthening mechanisms, diffusion, phase diagrams and transformations, ferrous and non-ferrous metal alloys, ceramics, and polymers, structure-property relationships, Material selection case studies.

MECH 341 Materials Lab [1 cr.] >

The course seeks to accompany and compliment MECH 340: Engineering Materials. The laboratory sessions are designed to impart a qualitative & quantitative understanding of the mechanical properties of engineering materials. The laboratory sessions will also examine topics related to the microstructure of materials. Co-requisite: MECH 340 Engineering Materials.

MECH 410 Thermal/Fluid Systems Laboratory [1 cr.] >

A series of experiments in basic thermodynamic cycles, psychrometry, combustion and elementary fluid mechanics. Special emphasis on the use of the computer as a laboratory tool for data acquisition, reduction, analysis, and report preparation.

MECH 412 Heat Transfer [3 cr.] >

The course seeks to impart a understanding of fundamental concepts and laws of conduction, convection and radiation heat transfer and their application to the solution of engineering thermal problems. The course covers steady and transient heat conduction. Extended surfaces. Numerical simulations of conduction in one and two-dimensional problems. External and internal forced convection of laminar and turbulent flows. Natural convection. Heat exchanger principles. Thermal radiation, view factors and radiation exchange between diffuse and gray surfaces. The use of Matlab is integrated into the homework assignments.

MECH 414 Thermodynamics II [3 cr.] >

A course investigating the availability and work potential of systems; irreversibility; second law efficiency; availability; gas mixtures; air conditioning; chemical reactions; high speed flow; nozzles and diffusers; environmental, economic, and social implications.

MECH 420 Mechanical Design [3 cr.] >

This is an introductory course in machine design in which one learns how to determine the structural integrity of common machine components and to apply this knowledge within the context of machine design problems. Mechanical elements such as shafts, bearings, springs, welding joints and fasteners are studied with emphasis on their behavior under both static and fatigue loading.
Prerequisites:
MECH 320 and MECH 340.

MECH 421 Manufacturing Processes I [2.1, 3 cr.] >

A course covering traditional material removal processes (machining and abrasion), CNC machining, as well as non-traditional material removal processes (EDM, ECM, thermal cutting, etc.); the science behind these technologies; assembly processes such as welding, brazing, soldering, and fastening are also covered. The course emphasizes process capabilities and limitations, relative cost, and guidelines for process selection; and design for manufacturing

guidelines. This course contains hands-on exercises in a machine shop environment.
Prerequisite: MECH 320 and MECH 340.

MECH 430 Instrumentation and Measurements [2.1; 3 cr.] >

A course on the general concepts of measurement systems; classification of sensors and sensor types; interfacing concepts; data acquisition, manipulation, transmission, and recording; introduction to LabVIEW; application; team project on design, and implementation of a measuring device.

MECH 431 Control Systems [3 cr.] >

A course that involves modeling of mechanical, electrical, and magnetic systems; Laplace transform; transfer function and block diagrams, time domain analyses; root-locus, frequency-domain methods; stability analysis; sensitivity analysis; design of PID controllers and dynamic compensators via the root locus and frequency methods; state-space design methods; hands-on applications.

MECH 431L Control Systems Laboratory [1 cr.] >

This course involves a series of hands-on experiments on modeling and design of control systems using Matlab, Simulink and Labview. The course also includes a team project.
Prerequisite: MECH 430.

MECH 500 Approved Experience [0 cr.] >

An eight week professional training course in mechanical engineering.

MECH 501 Final Year Project I [1 cr.] >

A supervised project in groups of normally three students aimed at providing practical experience in some design aspects of mechanical engineering. Students are expected to complete a literature survey, to critically analyze the design, and to acquire the necessary material needed for their intended end product. Prerequisite: discretion of advisor. Annually.

MECH 502 Final Year Project II [5 cr.] >

A course in which the student integrates his/her acquired knowledge to deliver the product researched and planned in MECH 501. Prerequisite: MECH 501. Annually.

MECH 503 Special Topics in Mechanical Engineering [3 cr.]**MECH 510 Modeling and Design of Thermal Systems [2.1; 3 cr.] >**

The course seeks to develop in students the ability to integrate rate mechanisms (h.k., heat transfer and fluid dynamics) into thermodynamic system modeling and analyses and provide design opportunities through open-ended problems with explicit considerations of engineering economics, optimization, environmental impact, ethical concerns, manufacturability and sustainability. Teamwork experience and communication skills are highly stressed. The students will gain some hands-on experience with the tools of investigation used for thermal and fluid systems and learn how to approach and solve problems typically encountered in engineering experimental work. Prerequisites: MECH 310, MECH 311, MECH 411 and MECH 412

MECH 511 Intermediate Fluid Mechanics [3 cr.] >

A course that deals with potential flow and boundary layer analysis, lift and drag, flow separation, the use of computational techniques to solve boundary layer problems, viscous internal channel flow and lubrication theory, one-dimensional compressible flow in nozzles and ducts, normal shock waves and channel flow with friction or heat transfer, fluid machinery including pumps and hydraulic turbines. Prerequisites: MECH 314 and MECH 412.

MECH 512 Internal Combustion Engines [2.1; 3 cr.] >

A course that examines the fundamentals of internal combustion engine design and operation, with emphasis on fluid/thermal processes. Topics include analysis of the respiration, combustion, and pollutant formation processes, heat transfer and friction phenomena, engine types and performance parameters, thermo-chemistry of fuel-air mixtures, the use of engine cycle models for performance predictions, and social implications of motorization. Pre- or co-requisites: CHEM 202, MECH 414, and MECH 430.

MECH 513 Air Conditioning [3 cr.] >

A course on human thermal comfort and indoor air quality; solar radiation; heating and cooling load calculations in buildings; air conditioning systems; air and water distribution systems; computer-based calculations. Prerequisite: MECH 412.

MECH 514 Gas Turbines [3 cr.] >

A course that introduces the thermodynamic and aerodynamic theory forming the basis of gas turbine design: shaft power cycles, gas turbine cycles for aircraft propulsion, turbofan and turbojet engines, design and analysis of centrifugal and axial flow compressors and turbines. Prerequisites: MECH 314 and MECH 414.

MECH 515 Steam Turbines [3 cr.] >

A course that deals with impulse and reaction steam turbines, steam turbine cycles, flow of steam in nozzles, design aspects of turbines stage losses and efficiency, velocity diagrams, and impulse and reaction blading velocities, nucleation, condensation, and two-phase phenomena in flowing steam, boiler room and its various equipment, the complete steam power plants, governors, electric generator, and power transmission lines. Pre- or co-requisites: MECH 314 and MECH 414.

MECH 516 Aerodynamics [3 cr.] >

A course on theoretical and empirical methods for calculating the loads on airfoils and finite wings by application of classical potential theory, thin airfoil approximations, lifting line theory, and panel methods, wings and airplanes, application of linearized supersonic flow to supersonic airfoils, performance and constraint analysis, longitudinal stability and control. Pre- or co-requisites: MECH 314 and MECH 414.

MECH 517 Energy Efficient Buildings [3 cr.] >

A course on integrated design process for low energy buildings. The course introduces mechanical and architecture students to an integrated design approach to low energy buildings, and to consideration of energy efficiency at all stages of design. The course defines and correlates the function of various building elements which effect low energy sustainability and make an environmentally friendly building. It also introduces participants to ecological criteria to impart an understanding of the building's role within the ecosystem. Students are exposed to hands-on experience in energy audit, interpretation of energy audit data, and performance of life cycle analysis for new and existing buildings. Pre- or co-requisites: MECH 310 or PHYS 210 or consent of instructor. Annually.

MECH 518 Environmental Challenges in Managing Ozone Depleting Substances [3 cr.]

Introduction to environmental issues related to engineering. Review of selected multilateral agreements and, in particular, review of the Montreal Protocol with emphasis on compliance strategies and discussion of the current status of ozone depleting substances [ODS]. Available technologies that work best now and a look to future technologies and alternatives. Applications are related to fire fighting, aerosols, solvents, foams and pesticides.

Management of ODS programs, good practices and safety issues. Prerequisite: MECH 310 or equivalent.

MECH 519 Compressible Flow [3 cr.]

The objective of the course is to impart an understanding of the fundamental principles of steady and unsteady one-dimensional gas flow. The course covers the behavior of homenergetic and homentropic flow, develops an understanding of normal shock waves and homenergetic flow in nozzles, shows how to analyze frictional homenergetic flow in a constant-area duct and frictionless diabatic flow in a constant-area duct, discusses the fundamental behavior of one-dimensional unsteady flow of a perfect gas, and shows how to draw skeleton wave diagrams of wave processes. Prerequisite: MECH 310, MECH 314

MECH 520 Mechanical Design II 3 cr [3 cr.]>

This is an advanced course in mechanical design. Students taking this course are expected to have a firm grasp in the fundamentals of failure theories. This course proposes the methods for designing and selecting components such as gears, belts, clutches, brakes, flywheels, and journal bearings. A design project using a finite element package is emphasized. Prerequisites: MECH 332 and MECH 420.

MECH 521 Manufacturing Processes II [2.1; 3 cr.]>

A course on heat treatments, deformation, phase-change, and particulate consolidation processing of metals; fabrication processing of non-metallic engineering materials such as ceramics, polymers, and composites; emphasis on process capabilities and limitations, relative cost, and guidelines for process selection; the behavior of materials under processing conditions; design for manufacturing guidelines. This course emphasizes hands-on training exercises. . Prerequisite: MECH 340, MECH 421.

MECH 522 Mechanical CAD/CAE/CAM [3 cr.]>

The course gives students exposure to the realm of computer-aided design (CAD), computer-aided engineering (CAE), and computer-aided manufacturing (CAM). The course teaches the students to harness the power of these powerful tools in the solution of various problems of mechanical engineering. The course utilizes several commercially available software packages but the emphasis is placed on Pro/Engineer. Prerequisites: MECH 320, MECH 420.

MECH 530 Mechatronics System Design [2.1; 3 cr.]>

A course that discusses mechatronics, data, numbering systems, architecture of the 8-bit Motorola MC68HC11 microcontroller, assembly language programming, A/D and D/A conversion, parallel I/O, programmable timer operation, interfacing sensors and actuators, applications, a team project on design and implementation of a mechatronic system. Prerequisites: EECE 312 and MECH 430.

MECH 531 Mechanical Vibrations [3 cr.]>

A course on free and forced response of non-damped and damped system; damping vibration absorption; response of discrete multi-degree of freedom systems; modal analysis; vibration measurement, case studies, vibration analysis with Matlab and Simulink. Prerequisite: MECH 230.

MECH 532 Dynamics and Applications [3 cr.]>

This course examines the dynamics of particles and rigid bodies moving in three dimensions. Topics include Lagrange's equations of motion for particles, rotations of rigid bodies, Euler angles and parameters, kinematics of rigid bodies, and the Newton-Euler equations of motion for rigid bodies. The course material will be illustrated with real-world examples such as

APPENDIX II >> COURSE DESCRIPTIONS

gyroscopes, spinning tops, vehicles, and satellites. Applications of the material range from vehicle navigation to celestial mechanics, numerical simulations, and animations. Prerequisites: MECH 230 an elementary course on Newtonian dynamics or consent of instructor.

MECH 540 Selection and Properties of Materials [3 cr.] >

A course that reviews the mechanical behavior of materials. Topics covered include structure-property relationships in materials, continuum mechanics and tensor notation, theorems of elastic, plastic, viscoelastic behavior of materials, elements of creep, fatigue, and fracture mechanics. Prerequisite: MECH 340. Annually.

MECH 550 Computer Applications in Mechanical Engineering [3 cr.] >

A course dealing with the application of numerical techniques to the solution of a variety of mechanical engineering problems involving systems of linear or non-linear algebraic equations, systems of ordinary differential equations of the initial and boundary value types, systems of ordinary differential equations, and partial differential equations of the parabolic, elliptic, and hyperbolic types. Engineering applications are introduced through a number of case study problems. Prerequisite: MATH 202.

All.2 >> GRADUATE COURSES

MECH 600 Applied Reservoir Engineering [3 cr.] >

This course introduces the concepts and principles needed to understand and to analyze hydrocarbon reservoir fluid systems; defines (with the help of geological and petrophysical principles) the size and contents of petroleum accumulations. Students will learn to organize programs for systematically collecting, recording, and analyzing data describing fundamental characteristics of individual well and reservoir performance (h.k. pressure, production, PVT data). The course covers topics on: fundamental concepts of fluid distribution, porosity distribution, trapping conditions; nature and type of primary drive mechanisms; production rates, ultimate recoveries, and reserves of reservoirs; supplementary recovery schemes to augment and improve primary recovery; economics analysis of developing and producing reservoirs and conducting supplementary recovery operations. Pre-require: MECH 314 or CIVE 340.

MECH 602 Energy Conservation and Utilization [3 cr.] >

A course that deals with methods for reduction of losses and gains from a building envelope, energy conservation in cooling, heating, air-handling, and plumbing systems, energy management program. Prerequisite: MECH 310, MECH 412. Alternate years.

MECH 603 Solar Energy [3 cr.] >

A course discussing the fundamentals of solar radiation, collectors and concentrators, energy storage, estimation and conversion formulas for solar radiation. Prerequisite: MECH 412. Alternate years.

MECH 604 Refrigeration [3 cr.] >

A course on fundamental concepts and principles, cold storage; functions and specifications of refrigeration equipment, applications. Prerequisite: MECH 412.

MECH 606 Aerosol Dynamics [3 cr.] >

This course covers the physical and chemical principles that underlie the behavior of aerosols—collections of solid or liquid particles suspended in gases, such as clouds, smoke, and dust—and the instruments used to measure them. Topics include: aerosol particle characterization, transport properties and phenomena in quiescent, laminar, and turbulent flows, gas- and particle-particle interactions, and applications to human respiratory tract deposition and

atmospheric pollution. Prerequisite: MECH 314, MECH 414, MECH 412, or consent of instructor. Alternate years.

MECH 607 Micro Flows Fundamentals and Applications [3 cr.]>

A course on theory and applications of micro flows, the continuum hypothesis and the various flow regimes, shear and pressure driven micro flows, electrokinetically driven liquid micro flows, compressibility effects of micro flow of gases, particulate flows in bio-applications, modeling techniques, hybrid continuum-molecular methods, reduced order modeling of micro flows in multi-physics micro flow applications, case studies in BioMEMS. Prerequisite: MECH 310, MECH 314, and MECH 412, or equivalent. Alternate years.

MECH 608 Applied Reservoir Engineering II [3 cr.]

This course introduces the advance concepts and principles needed to analyze hydrocarbon reservoir fluid systems, and defines the size and contents of petroleum accumulation. Students will learn to organize programs for collecting, recording, and analyze data describing the advanced characteristics of individual well and reservoir performance. This course of advanced reservoir engineering topics covers the concepts of fluid flow in porous medium, fluid distribution, fluid displacement, fractional flow equation and Buckley-Leverete equation, pressure draw-down and pressure buildup analysis, nature and type of primary, secondary and tertiary recovery, water influx and prediction of water-flood behavior, and reservoir model simulation and history matching. Pre-requisite: MECH 600, MECH 314 or cive 340

MECH 609 Experimental Methods in Fluid Dynamics [3 cr.]>

This course is aimed at introducing students to experimental methods used to measure fluid flow quantities such as pressures, forces, and velocities. The course will start with an introduction to what and why we measure, and to uncertainty analysis and measurement error estimation. Some basic techniques for data reduction and data post-processing will be introduced. The available fluid measurement methods will be surveyed briefly, with selected applications. Emphasis will be on advance optical diagnostic techniques, namely particle image velocimetry [PIV], and laser induced fluorescence [LIF]. The theoretical foundations of these techniques will be established, and the discussion will extend to practical considerations including software and hardware components. A few laboratory sessions will be incorporated into the course to supplement the lectures, and will make use of the instruments available in the ME department including the open circuit wind tunnel, and the PIV system. In addition to the lectures and lab sessions, emphasis will be also on the available literature. Prior knowledge of the basic principles of fluid mechanics and fluid systems is required. MATLAB will be needed for course work. Pre-requisite: MECH 314.

MECH 619 Quality Control in Manufacturing Systems [3 cr.]>

The course covers the foundations of modern methods of quality control and improvement that may be applied to manufacturing industries. It aims is to introduce students to the tools and techniques of quality control used in industrial applications, and develop their ability to apply the tools and techniques to develop solutions to industrial problems. Emphasis is given to the application of quality management techniques to solve industrial case problems. The course emphasizes the philosophy and fundamentals of quality control, the statistics foundations of quality control, statistical process control, acceptance sampling, and product and process design.

MECH 622 Advanced Manufacturing Processes [3 cr.]>

A course that deals with the underlying principles of material fabrication; metal machining; mechanics of cutting, materials, technology [tooling, CNC machining]; phase change

processes; deformation processes; Non-traditional processes. Prerequisite: MECH 421. Alternate years.

MECH 624 Mechanics of Composite Materials [3 cr.] >

A course on anisotropic elasticity and laminate theory, analysis of various members of composite materials, energy methods, failure theories, and micromechanics. Materials and fabrication processes are introduced. Prerequisites: MECH 320 or CIVE 310 and MECH 340 or equivalents.

MECH 625 Fatigue of Materials [3 cr.] >

A course that deals with high cycle fatigue, low cycle fatigue, S-N curves, notched members, fatigue crack growth, cycling loading, Manson-Coffin curves, damage estimation, creep and damping. Prerequisite: MECH 320 or cive 310. Alternate years.

MECH 626 Metals and their Properties [3 cr.] >

A course that investigates ferrous and non-ferrous alloys, industrial equilibrium diagrams, heat treatment of metals, surface properties of metals, plastic deformation of metals, elements of fracture mechanics, process-structure-properties relations. Prerequisite: MECH 340. Alternate years.

MECH 627 Polymers and their Properties [3 cr.] >

A course on chemistry and nomenclature, polymerization and synthesis, characterization techniques, physical properties of polymers, viscoelasticity and mechanical properties, applications. Prerequisite: MECH 440. Alternate years.

MECH 628 Design of Mechanisms [3 cr.] >

A course involving graphical and analytical synthesis of single- and multi-loop linkage mechanisms for motion, path, and function generation through 2-3-4- and 5 precision positions, optimum synthesis of linkage mechanisms, synthesis of cam-follower mechanisms, synthesis of gear trains. Prerequisite: MECH 332. Alternate years.

MECH 630 Finite Element Methods in Mechanical Engineering [3 cr.] >

A course on the classification of machine components, displacement-based formulation, line elements and their applications in design of mechanical systems, isoparametric formulation, plane stress, plane strain, axi-symmetric, and solid elements and their applications, modeling considerations and error analysis, introduction to ALGOR general formulation and Galerkin approach, analysis of field problems. Prerequisites: MECH 431 and MECH 420. Alternate years.

MECH 631 Micro Electro Mechanical Systems [MEMS] [3 cr.] >

A course that deals with materials for micro-sensors and micro-actuators, materials for micro-structures, microfabrication techniques and processes for micromachining, computer-aided design and development of MEMS, commercial MEMS structures and systems, packaging for MEMS, future trends, and team project. Prerequisite: MECH 430.

MECH 633 Biomechanics [3 cr.] >

A course on the study of the biomechanical principles underlying the kinetics and kinematics of normal and abnormal human motion. Emphasis is placed on the interaction between biomechanical and physiologic factors (bone, joint, connective tissue, and muscle physiology and structure) in skeleto-motor function and the application of such in testing and practice in rehabilitation. The course is designed for senior level undergraduate/graduate engineering students with no previous anatomy/physiology.

MECH 634 Biomaterial and Medical Devices [3 cr.] >

Course that examines the structure-property relationships for biomaterials and the medical applications of biomaterials and devices. The first part of the course focuses on the main classes of biomaterials, metal, ceramic, polymeric, and composite implant materials, as well as their interactions with the human body (biocompatibility). The second part of the course examines the various applications of biomaterials and devices in different tissue and organ systems such as orthopedic, cardiovascular, dermatology, and dental applications. Experts from the medical community will also be invited to discuss the various applications.

Prerequisite: MECH 340 or consent of instructor.

MECH 641/EECE 661 Robotics [3 cr.] >

A course discussing concepts and sub-systems; robot architecture; mechanics of robots: kinematics and kinetics; sensors and intelligence; actuators; trajectory planning or end effector motion; motion and force control of manipulators; robot languages. Prerequisites: MECH 431.

MECH 642 Computer Vision [3 cr.] >

An introductory course on the problems and solutions of modern computer vision. Topics covered include image acquisition, sampling and quantisation; image segmentation; geometric framework for vision: single view and two-views; camera calibration; stereopsis; motion and optical flow; recognition; pose estimation in perspective images. Prerequisites: MATH 202 and EECE 230. Alternate years.

MECH 643 Mechatronics and Intelligent Machines Engineering II [3 cr.] >

A course on sensors, sensor noise and sensor fusion, actuators, system models and automated computer simulation, information, perception, and cognition, planning and control, architecture, design, and development, team project. Prerequisites: MECH 340 and MECH 530. Alternate years.

MECH 644 Modal Analysis [3 cr.] >

A course reviewing MDOF system vibrations, frequency response functions, damping, mobility measurement, curve fitting and modal parameter extraction, derivation of mathematical models, laboratory experiments, and projects. Prerequisite: MECH 531. Alternate years.

MECH 645 Noise and Vibration Control [3 cr.] > A course on fundamental concepts in noise and vibration, passive and active damping strategies, damping materials, control methods, applications. Prerequisites: MECH 230, MATH 212, and MECH 531. Alternate years.

MECH 648 Nonlinear Systems: Analysis, Stability and Control [3 cr.] >

This course presents a comprehensive exposition of the theory of nonlinear dynamical systems and its control with particular emphasis on techniques applicable to mechanical systems. The course will be punctuated by a rich set of mechanical systems examples, ranging from violin strings vibration to jet engines, from heart beats to vehicle control, and from population growth to nonlinear flight control. Prerequisite: MECH 433 Control Systems or equivalent. Alternate years.

MECH 663 Computational Fluid Dynamics [3 cr.] >

A course that deals with discretization process in fluid dynamics, numerical approaches and applications, interactive and direct matrix methods, numerical implementation of turbulence models. Prerequisites: MECH 314 and MECH 412. Alternate years.

MECH 665 Unsteady Gas Flow [3 cr.] >

A course examining equations of unsteady continuous adiabatic multidimensional flows, unsteady continuous one-dimensional flow of a perfect gas with and without discontinuities, applications, pressure exchangers. Prerequisite: MECH 414. Alternate years.

MECH 673 Energy Efficient Buildings with Good Indoor Air Quality [3 cr.] >

The course covers energy consumption standards and codes in buildings; energy conservation measures in built in environment to enhance the building's energy efficiency while maintaining space thermal comfort and indoor air quality requirement; fundamental ventilation, indoor-air-quality, infiltration natural and mechanical ventilation, importance and impact of indoor air quality on human health and energy performance of the building air conditioning system; and ASHRAE requirement for ventilation. Particular focus will be given to green energy alternative measures. An overview of the different heating, ventilation and air conditioning system designs is covered. Performance and energy consumption of the conventional air conditioning system (constant and variable air volume) as well as the hybrid integrated air conditioning systems will be discussed and compared. The course will include several demonstrations of concept experiments. Prerequisite: MECH 310.

APPENDIX III >> CHEMICAL ENGINEERING COURSE DESCRIPTIONS

AIII.1 >> CHEMICAL ENGINEERING REQUIRED COURSES

CHEN 200 Introduction to Chemical Engineering [3 cr.] >

This course is an introduction to the most important processes employed by the chemical industries, such as plastics, pharmaceutical, chemical, petrochemical and biochemical. Major emphasis is on formulating and solving material and energy balances for simple and complex systems. Equilibrium concepts for chemical process systems are developed and applied. Computer software is utilised extensively. The course activities include guest speakers and plant trips.

CHEN 410 Synthesis Lab [2 cr.] >

This lab includes experimentation in thermodynamics and heat, mass, and momentum transport on a bench scale; and measurement error estimation and analysis.

CHEN 411/ MECH 314 Fluid Flow Operations [3 cr.] >

The course covers an exploration of the important concepts of fluids (gases and liquids) for all sub-disciplines within chemical engineering including the underlying principles and practical applications; the application of appropriate computer methods to solving fluids problems. The topics included are hydrostatics, mass and energy balances in fluid flow, laminar and turbulent flows, fluid friction, and basic approaches to designing flow systems. Prerequisites: MECH 310, CHEN 200 and MATH 202.

CHEN 412/ MECH 412 Heat Transfer Operations [3 cr.] >

The course covers heat conduction, convection, and radiation; general differential equations for energy transfer; conductive and convective heat transfer; equipment and radiation heat transfer; molecular, convective and interface mass transfer; the differential equation for mass transfer; steady state molecular diffusion and film theory; convective mass transfer correlations; and mass transfer equipment. Prerequisite: CHEN 411.

CHEN 414 Chemical Engineering Thermodynamics II [3 cr.] >

This course covers the applications of thermodynamics to pure and mixed fluids; and to phase equilibria and chemical reaction equilibria. Prerequisite: MECH 310.

CHEN 415 Separation Processes [3 cr.] >

This course includes the design of industrial separation equipment using both analytical and graphical methods; equilibrium based design techniques for single and multiple stages in distillation, absorption/stripping, and liquid-liquid extraction are employed; and an introduction to gas-solid and solid-liquid systems is presented as well. Mass transfer considerations are included in efficiency calculations and design procedures for packed absorption towers, membrane separations, and adsorption. Ion exchange and chromatography are discussed. The role of solution thermodynamics and the methods of estimating or calculating thermodynamic properties are also studied. Degrees of freedom analyses are threaded throughout the course as well as the appropriate use of software. Prerequisites: CHEN 310 and MATH 202.

CHEN 416 Kinetics and Reactor Design [3 cr.] >

APPENDIX III >> CHEMICAL ENGINEERING COURSE DESCRIPTIONS

This course covers the fundamentals of chemical reaction engineering; rate laws, kinetics, and mechanisms of homogeneous and heterogeneous reaction; analysis of rate data; diffusion limitations; and the design of industrial reactors. Prerequisite: approval of instructor

CHEN 500 Approved Experience

CHEN 501 Final Year Project [3 cr.] >

The Final Year Project provides collaborative design experiences with a problem of industrial or societal significance. Projects can originate with an industrial sponsor, from an engineering project on campus, or from other industrial or academic sources. In all cases, a project is a capstone experience that draws extensively from the students' engineering and scientific background and requires independent judgements and actions. The projects generally involve a number of unit operations, a detailed economic analysis, simulation, use of industrial economic and process software packages, and experimentation and/or prototype construction. Prerequisite: approval of instructor.

CHEN 505 Transport Phenomena and Unit Operation lab [3 cr.] >

This laboratory introduces students to basic concepts, experimental techniques and calculation procedures in unit operations. Experiments include fluid dynamics, heat exchange (pilot-scale units designed to study air-solid, steam-water, water-water heat transfer), cooling towers, gas absorption, solvent extraction, ultrafiltration of hemoglobin solutions in water, chemical reactions (to study stoichiometry and kinetics of batch reactions in the liquid phase), drying of solid materials, and distillation. Some reaction kinetics experiments and flow pattern in industrial process equipment are also included. Prerequisite: approval of instructor.

CHEN 510 Chemical Process Design [3 cr.] >

This course is an integration of material from other chemical engineering courses with applications to the design of plants and processes representative of the chemical and related process industries; basic concepts and methodology for making rational decisions; and the implementation of real engineering projects and comparing alternatives. Prerequisite: approval of instructor.

CHEN 511 Process Control [2 cr.] >

This course covers the development of deterministic and non-deterministic models for physical systems, engineering applications, and simulation tools for case studies and projects. Prerequisite: CHEN 415.

CHEN 511L Process Control Lab [1 cr.] >

Laboratory experiments demonstrating the principles covered in the process dynamic and control course CHEN 511. These include temperature, temperature flow, and concentration measuring devices, and process control simulation for typical chemical plants. Prerequisite: CHEN 415.

AIII.2 >> CHEMICAL ENGINEERING TECHNICAL ELECTIVES

CHEN 522 Polymer Science [3 cr.] >

This course is a broad technical overview of the nature of synthetic macromolecules, including the formation of polymers and their structure, structure-property relationships, polymer characterization and processing, and applications of polymers. The course tends to focus on thermoplastic polymers and elastomers. Prerequisite: MECH 340.

CHEN 523 Physical Properties of Polymers [3 cr.] >

This course is a survey of high performance thermoset resins, including types of thermosets, chemistry, processing, properties, cost, suppliers and applications. Characterization techniques and typical properties will also be reviewed. The course will involve a fundamental discussion of cross-linked polymer structure-processing-property relationships, the glassy state, rubber elasticity, time-temperature superposition and cure kinetics. Prerequisite: MECH 340, or approval of instructor.

CHEN 524 Principles of Corrosion [3 cr.] >

This course includes the application of electrochemical principles, corrosion reactions, passivation, cathodic and anodic protection, stress corrosion, and high-temperature oxidation. Prerequisite: MECH 340.

CHEN 525 Colloid and Interface Science [3 cr.] >

This is a first course in colloid and interface science. The repulsive and attractive forces at interfaces are described along with the dynamics of the interfaces. Topics include the stability of macroemulsions, the formulation and properties of microemulsions, and surface metal-support interactions of catalysts. Prerequisites: CHEN 415 and CHEN 416.

CHEN 541 Process Dynamics [3 cr.] >

This course covers the mathematical modeling and computer simulation of process dynamics and control for chemical engineering processes. Prerequisite: approval of instructor.

CHEN 598 Special Topics in Chemical Engineering [3 cr.] >**CHEN 601 Advanced Transport Phenomena [3 cr.] >**

This course covers the applications of the principles of momentum, heat and mass transfer to steady state and transient problems; molecular concepts; transport in turbulent flow; boundary layer theory; and numerical applications. Prerequisite: CHEN 411, or equivalent.

CHEN 602 Fundamentals and Applications of Fuel Cells [3 cr.] >

The course will cover fundamental as well as engineering aspects of fuel cell technology. Specifically, the course will cover basic principles of electrochemistry, electrical conductivity (electronic and ionic) of solids and development/design of major fuel cells (alkaline, polymer electrolyte, phosphoric acid, molten carbonate and solid oxide). A major part of the course will focus on solid oxide fuel cells (SOFC), as it is emerging to be dominant among various fuel cell technologies. The SOFC can readily and safely use many common hydrocarbon fuels such as natural gas, diesel, gasoline, alcohol and coal gas. Prerequisite: CHEN 414 or approval of instructor.

CHEN 607 Chemical Engineering Kinetics [3 cr.] >

This course covers reaction kinetics; heterogeneous catalytic reactions; transport processes with fluid-solid heterogeneous reactions; noncatalytic gas-solid reactions; catalyst deactivation; gas-liquid reactions. Prerequisite: CHEN 416 or equivalent.

CHEN 611 Chemical Reactor Analysis and Design [3 cr.] >

This course covers design for optimum selectivity; stability and transient behavior of the mixed flow reactor; non ideal flow and balance models; fixed and fluidized bed reactors; and multiphase flow reactors. Prerequisite: CHEN 416 or equivalent.

CHEN 612 Chemical Product Design [3 cr.] >

This course covers the application of the design process to products based on chemical technology. It covers the entire design process from initial identification of product needs, to

APPENDIX III >> CHEMICAL ENGINEERING COURSE DESCRIPTIONS

the generation and selection of product ideas, and culminates in the manufacture of a new product. Prerequisite: CHEN 510 or equivalent.

CHEN 653/cive 753 Environmental Engineering Separation Processes [3 cr.] >

This course includes a discussion of the unit operations associated with environmental engineering separation processes of solid-liquid, liquid-liquid, and gas-liquid systems; general use, principles of operation and design procedures for specific types of equipment.

Prerequisite: approval of instructor.

CHEN 654/cive 654 Solid Waste Engineering [3 cr.] >

The course includes characterizing solid waste; managing solid waste collection, transport, minimization, and recycling; and the design of solid waste disposal and resource recovery facilities.

Prerequisite: approval of instructor.

CHEN 661 Advanced Chemical Engineering Computations [3 cr.] >

This course covers applications of ordinary and partial differential equations to engineering problems and classical methods of solution. Prerequisite: CHEN 416 or approval of instructor.

CHEN 662/ensc 620 Physical and Chemical Wastewater Treatment Processes [3 cr.] >

The course includes designing physical and chemical unit processes to treat wastewater originating primarily from industrial sources; and industry pretreatment technologies and the basis for their development. Prerequisite: approval of instructor.

CHEN 663/cive 658 Hazardous Waste Engineering [3 cr.] >

This course covers the fundamental principles of the design and operation of hazardous waste remediation processes; characterizing contaminated sites; and conducting treatability studies to select remediation strategies. Prerequisite: approval of instructor.

APPENDIX IV >> REQUIREMENTS AND PROCEDURES FOR MECH 500 APPROVED EXPERIENCE

The information and guidelines described in this section pertain to the Summer Training Internship program [MECH 500 Approved Experience] which you must undergo and pass, normally in the summer preceding your last year, in partial fulfilment of the graduation requirements. You are required to abide strictly by the regulations and deadlines indicated in this document, in order to successfully pass the course. This document and relevant training forms are available on the website of the department under resources [www.aub.edu.lb/fea/me].

AIV.1 >> GENERAL

To qualify for the degree of Bachelor of Engineering, you are expected to work eight full weeks at a recognized firm, in Lebanon or abroad, in a capacity which ensures that you apply your knowledge and acquire professional experience in the field of mechanical engineering.

AIV.2 >> SECURING A TRAINING

It is your responsibility to ensure that you have secured a training offer. The department and faculty will assist you to find an internship, mainly through the FEA Career Centre, with which you should stay in close contact. The Centre is well connected with employers and keeps track of job and training offers. It also handles the IAESTE training exchange program through which selected international offers are obtained and assigned to students on a competitive basis. You should report any problems related to finding an internship to your academic advisor as soon as it arises.

AIV.3 >> REGISTRATION

You must register and pay tuition for MECH 500 Approved Experience [no credit]. Your statement of fees must be withdrawn and tuition paid in accordance with the schedule announced for the summer term by the University Registrar.

AIV.4 >> AFTER YOU BEGIN YOUR INTERNSHIP

You should maintain a highly professional attitude and behavior at work. Punctuality and attendance at the required working hours are essential. Good relations with your supervisors, as well as with people working with you, should be one of your major concerns. Consideration for fellow workers, and for materials around you, is important in projecting the proper attitude toward others. Always remember that you are representing AUB, FEA, and your department during the training and it is expected that you will carry your duties responsibly. Also, make sure to keep notes regularly on all information relating to your training, preferably using a daily log book, which you will use as a basis for writing the reports required, as described later. In the event that, for unfortunate reasons, any problem arises during the training, you will need to contact the department promptly and explain. If the type of work assigned to you does not meet the training objectives, you should report to the department for advice and resolution.

AIV.5 >> TRAINING FILE AND DELIVERABLES

Each student is responsible for maintaining an individual training file at the department and completing it in order for the evaluation of your Approved Experience to be performed. Your file will be considered complete only after submission of the Final Training Report. Deliverables and timeline for submissions are outlined below:

- 1> Proposal of Approved Experience form, to be completed after you secure a summer training offer and before the end of the preceding spring term. [Form AE Appendix III]

- 2> Notice of Arrival form, to be sent promptly during the first week of your training [Form AE Appendix III]
- 3> Interim Training Report, to be sent at the end of the fourth week of training, and should include a progress account of your work. A minimum of a four-page double-spaced report is expected.
- 4> Letter from Employer, to be attached or included in the Final Training Report. It is the student's responsibility to request this letter of evaluation from his/her employer at the end of the training.
- 5> Final Training Report, to be submitted to the department no later than the end of second week of classes of the fall term following the training.

You are requested to send the Notice of Arrival and Interim Training Report by hand, by regular mail or by e-mail to the department address. You are also requested to keep duplicates of all your training file documents and any relevant communication with the department.

AIV.6 >> PRESENTATION

Soon after the training files are completed, sessions will be scheduled for students to present their work. The presentation should be concise [10 minutes maximum], and briefly describe the experience gained, using visual multi-media tools. An electronic copy of the presentation will be kept with the department for future reference.

AIV.7 >> EVALUATION

Your Approved Experience will be evaluated with a Pass or Fail grade based on the following criteria:

- 1> Completion of the training file as described above.
- 2> Evaluation of the quality and relevance of the professional experience acquired.
- 3> Satisfactory Interim and Final Training Reports. You may be requested to revise or repeat your reports in cases where they do not meet department expectations. The Final Training Report content and format are described later.
- 4> An acceptable Letter from the Employer. The letter should reflect a performance and attitude deemed worthy by the employer.
- 5> Suitable presentation with proper verbal communication and organisation.

Outstanding reports and presentations will be acknowledged and made available as exemplar sample models for future years.

AIV.8 >> FINAL TRAINING REPORT

GENERAL >

The Final Training Report should cover all your Approved Experience activities.

It must clearly reflect the type of work and activities actually carried out by you, and must describe the technical experience gained. The report should be professional in style and content. You should do your best to organize the relevant material, to write concisely, and to support your statements. You are also urged to check layout consistency, grammar, and spelling. The report must be written independently, even if two or more students are assigned to the same job.

STYLE AND FORMAT >

- 1> The report should be typed in double-space format, with proper set-backs and margins. All pages should be numbered. Only design and calculation sheets may be hand-written, with samples included in an appendix.
- 2> All sources of information should be referenced in the text of the report, with references listed in a dedicated section at the end.
- 3> Personalisation and story telling should be avoided. Incidents or happenings in the firm should not be reported unless strictly relevant to the training experience.

- 4> Tables, figures, and pictures should be properly labelled.

CONTENT AND ORGANIZATION >

- 1> Cover page with course name and number, author, training term, and report date.
- 2> Summary sheet including relevant training information. [Form AE Appendix III]
- 3> Letter from the employer, to be attached or included.
- 4> Table of content.
- 5> List of tables, figures, and pictures.
- 6> Introduction section outlining the various projects and the position and type of work that you were entrusted to carry out.
- 7> Core content detailing the various stages of the training on a project basis. The report should describe all the technical and administrative activities performed. This section should not normally exceed 20 pages in length. Relevant tables and descriptive figures or pictures are encouraged, but should not be excessive. Samples of the plans or design and calculation sheets can only be included in an appendix section and must be properly referenced in the text. Materials photocopied or duplicated from the company's previous proposals or reports should not be included.
- 8> Conclusion section discussing the benefits acquired from the training experience and the ways in which it enriched the knowledge of the trainee. Any deficiencies of the trainee in his/her education and suggestions for improvements of the training program should also be mentioned.
- 9> List of references.
- 10> Appendices listing all support material such as: a brief introduction about the hosting firm, its management and administrative structure; sample plans or drawings; technical documents and literature; design and calculation sheets; and other relevant material. This section should not normally exceed 20 pages in length.

AIV.9 >> CONTACT ADDRESS

All correspondence, forms, and reports should be addressed to:

Chairperson, Department of Mechanical Engineering
Faculty of Engineering and Architecture
American University of Beirut
P.O. Box 11-0236
Beirut, Republic of Lebanon
E-mail: mefea@aub.edu.lb

APPENDIX V >> REFERENCE PHONE NUMBERS

| | | | |
|---------------------------|-----------|-------------------------------|-----------|
| > Prof. Marwan Darwish | 3595 | > ME Department | 3590/1 |
| > Prof. Nesreen Ghaddar | 3594/2513 | > FEA Dean's Office | 3400 |
| > Prof. Fadl Moukalled | 3406 | > Mechanical Engineering Labs | 3626 |
| > Prof. Kamel Boughali | 3438 | > Engineering Shops | 3650 |
| > Prof. Ramsey Hamade | 3481 | > Engineering Library | 2630/2633 |
| > Prof. Albert Kuran | 3473 | > Registrar | 2570 |
| > Prof. Alan Shihadeh | 3465 | > Admissions | 2590 |
| > Prof. Daniel Asmar | 3427 | > Protection | 2400 |
| > Prof. Issam Lakkis | 3636 | > Student Affairs | 3170 |
| > Prof. Matthias Liermann | | | |
| > Prof. Ghanem Oweis | 3596 | | |
| > Prof. Mutassem Shehadeh | 3484 | | |

APPENDIX VI >> ASME CODE OF ETHICS

The following is the American Society of Mechanical Engineers [ASME] Code of Ethics of Engineers:

AIV.1 >> THE FUNDAMENTAL PRINCIPLES

Engineers uphold and advance the integrity, honour, and dignity of the engineering profession by:

- i > Using their knowledge and skill for the enhancement of human welfare;
- ii > Being honest and impartial, and serving with fidelity the public, their employers and clients; and
- iii > Striving to increase the competence and prestige of the engineering profession.

AIV.2 >> THE FUNDAMENTAL CANONS

- 1 > Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
- 2 > Engineers shall perform services only in areas of their competence.
- 3 > Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.
- 4 > Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
- 5 > Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
- 6 > Engineers shall associate only with reputable persons or organisations.
- 7 > Engineers shall issue public statements only in an objective and truthful manner.
- 8 > Engineers shall consider environmental impact in the performance of their professional duties.

**AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCHITECTURE
DEPARTMENT OF MECHANICAL ENGINEERING
MECH 500 - APPROVED EXPERIENCE**

PROPOSAL OF APPROVED EXPERIENCE

Form to be completed and submitted to the department after securing a training offer, and before the end of the Spring Term. The form is part of the training file.

1> Name of student: _____

2> Department and Class: _____

3> Name and address of proposed firm: _____

4> Name and address of contact person in firm who offered the training position: _____

5> Proposed period of training: From: _____ Till: _____

STUDENT'S SIGNATURE

DATE

**AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCHITECTURE
DEPARTMENT OF MECHANICAL ENGINEERING
MECH 500 - APPROVED EXPERIENCE**

NOTICE ON ARRIVAL

Form to be completed and sent by student to the department upon reporting to work, during the first week of training. The form is part of the student's training file.

1> Name of student: _____

2> Department and Class: _____

3> Date of starting work: _____

4> Proposed date of completing work: _____

5> Name and address of firm: _____

6> Name and address of responsible supervisor: _____

7> Student's business address: _____

8> Student's residence address: _____

NOTE: Any changes in the above information should be promptly communicated to the department

STUDENT'S SIGNATURE

DATE

**AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCHITECTURE
DEPARTMENT OF MECHANICAL ENGINEERING
MECH 500 - APPROVED EXPERIENCE**

SUMMARY SHEET

Form to be completed and included in the Final Training Report.

STUDENT INFORMATION

Name: _____

Department: _____

Class: _____

Training Position: _____

TRAINING FIRMS[S] INFORMATION

Name: _____

Specialty: _____

Location: _____

SUPERVISOR[S] INFORMATION

Name: _____

Position: _____

EXACT DURATION OF TRAINING

Arrival date: _____

Departure date: _____

ADDITIONAL INFORMATION OR COMMENTS [OPTIONAL]

STUDENT'S SIGNATURE

DATE



UNDERGRADUATE STUDENT MANUAL
2009>>>2010