MECHANICAL ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

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FACULTY

- Afzal, Muhammad, BScEng (UAF, Pakistan), MEng (AIT, Thailand), PhD (Ehime, Japan), PEng, Assoc Prof (Joint Faculty of Forestry & Environmental Management) – 2008
- Bance, Manohar, BSc, MB, ChB (Manchester), MSc (UofT), FRCSC, Adjunct Prof – 2009
- Biden, Edmund N., BScE (UNB), DPhil (Oxf), Prof and Dean of Graduate Studies - 1987
- Bonham, David J., BSc (Qu), MEng, PhD (McM), PEng, Prof. Emeritus – 1974
- Boudreau, Roger, BEng, MEng (Ecole Polytechnique), PhD (UNB), PEng, Adjunct Prof - 2003
- Carretero, Juan A., BEng (UNAM), MASc, PhD (Victoria), PEng, Assoc Prof - 2002
- Chen, Zengtao, BEng (Nanjing UST), MEng, Dr. Eng. (Harbin IT), PhD (Wat), PEng, Assoc Prof - 2004
- Davies, Huw G., BSc, PhD (Imperial), PEng., Prof. Emeritus - 1975
- Dubay, Rickey, BSc Mech, MSc Mech (UWI), PhD (DalTech), PEng, Prof - 1998
- Gagnon, Yves, Beng (Sherbrooke), MSc (MIT), Doctorat (U. Paul Sabatier), PEng, Adj Prof - 2007
- Gerber, Andrew G., BScE, PhD (UNB), BA (Ambassador), PEng, Prof and Chair - 2000
- Hall, Joseph W., BEng, MASc, PhD (McM), Asst Prof - 2007
- Hassan, Marwan, BSc (Helwan), MSc (Tuskegee), PhD (McM), PEng, Assoc Prof - 2001
- Holloway, Gordon, BSc (UNB), MASc, PhD (Ott), PEng, Prof- 1989
- Hussein, Esam M.A., BSc, MSc (Alexandria), PhD (McM), PEng, Prof and Assoc Dean of Engineering - 1984
- Kember, Guy, HBSc, MSc, PhD (W.Ont), Adjunct Prof - 2003
- Lyon, Donald E., BS, MS, PhD (Purdue), PEng, Prof - 1991
- Mohany, Atef, BSc, MSc (Cairo), PhD (McM), PEng, Asst Prof – 2009
- Nokleby, Scott, BEng, MASc, PhD (Victoria), PEng, Adjunct Prof – 2009
- Rogers, Robert J., BSc (Calgary), MASc, PhD (Wat), PEng, Hon Res Prof - 1977
- Simoneau, Andy, BEng, MEng, PhD (McM), PEng, Asst Prof - 2009
General Information

The Department of Mechanical Engineering provides instruction leading to the degree Bachelor of Science in Engineering (BScE). The program of instruction presents a curriculum suitable to the education of engineers in the art and science of Mechanical Engineering.

The curriculum includes a core of basic Mathematics, Science, Business and Humanities subjects, and is structured around a sequence of essential Mechanical Engineering subjects and design instruction. All this provides for the academic requirements of university graduates qualified to practice Mechanical Engineering professionally; it prepares the student for a career in the profession whether involved in the design, production, or operation of mechanical equipment, industrial or power plant, or the pursuit of post-graduate study.

The central theme behind an education in Mechanical Engineering is the engineered production, transformation, conversion, transmission and control of "mechanical" energy and materials. This may involve any or all aspects of the design, manufacture, fabrication, alteration, installation, selection, specification, testing, maintenance, operation, and control of single components and machines or complete and complex systems. The Department offers some specialization in order to match these extremely broad demands to the interests of its students. In particular there are three program options: Mechatronics, Nuclear and Power Plant Engineering, and Biomedical Engineering. These Options are described in detail below.

Curriculum

Core Courses

Students should note the specific academic regulations in the section "General Regulations" as outlined earlier under "Engineering". In addition to the core courses required of all Engineering students, additional required courses are provided in the areas of applied mechanics, materials, thermodynamics, heat transfer, fluid mechanics, manufacturing engineering and system dynamics, as well as the application of these courses to engineering design. The program is designed to be completed in eight academic terms, however the student may arrange for a program that spans a longer time period. Typical term-by-term course sequences may be seen on the web site:

http://www.me.unb.ca.
The complete requirements for the degree, including the core courses recommended for the first and second terms, are listed below. A list of Technical Electives follows the program outline. All courses must be passed with a grade of C or better.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 2501</td>
<td>General Materials Science</td>
</tr>
<tr>
<td>CHE 2506</td>
<td>Materials Science Laboratory</td>
</tr>
<tr>
<td>CHEM 1982</td>
<td>* General Applied Chemistry</td>
</tr>
<tr>
<td>CHEM 1987</td>
<td>* General Applied Chemistry Laboratory</td>
</tr>
<tr>
<td>CS 1003</td>
<td>Intro to Computer Programming</td>
</tr>
<tr>
<td>CS 3113</td>
<td>Intro to Numerical Methods (or CE 3933 or CHE 2418)</td>
</tr>
<tr>
<td>ECON 1073</td>
<td>* Economics for Engineers (or ECON 1013 and ECON 1023)</td>
</tr>
<tr>
<td>EE 1813</td>
<td>* Electricity and Magnetism</td>
</tr>
<tr>
<td>EE 2683</td>
<td>Electric Circuits and Machines (for non-electricals)</td>
</tr>
<tr>
<td>EE 2701</td>
<td>Electric Circuits and Electronics (for non-electricals) (or EE 2711)</td>
</tr>
<tr>
<td>ENGG 1001</td>
<td>* Engineering Practice Lecture Series</td>
</tr>
<tr>
<td>ENGG 1003</td>
<td>* Engineering Technical Communications</td>
</tr>
<tr>
<td>ENGG 1015</td>
<td>* Introduction to Engineering Design and Problem Solving</td>
</tr>
<tr>
<td>ENGG 1082</td>
<td>* Mechanics for Engineers</td>
</tr>
<tr>
<td>ENGG 4013</td>
<td>Law and Ethics for Engineers</td>
</tr>
<tr>
<td>MATH 1003</td>
<td>* Introduction to Calculus I</td>
</tr>
<tr>
<td>MATH 1013</td>
<td>* Introduction to Calculus II</td>
</tr>
<tr>
<td>MATH 1503</td>
<td>* Introduction to Linear Algebra (or MATH 2213)</td>
</tr>
<tr>
<td>MATH 2513</td>
<td>Multivariable Calculus for Engineers</td>
</tr>
<tr>
<td>MATH 3503</td>
<td>Differential Equations for Engineers</td>
</tr>
<tr>
<td>ME 1312</td>
<td>Computer Aided Design</td>
</tr>
<tr>
<td>ME 2003</td>
<td>* Dynamics for Engineers</td>
</tr>
<tr>
<td>ME 2111</td>
<td>Mechanics of Materials I (or CE 2023)</td>
</tr>
<tr>
<td>ME 2122</td>
<td>Mechanics of Materials II</td>
</tr>
<tr>
<td>ME 2125</td>
<td>Mechanics of Materials Design Project</td>
</tr>
<tr>
<td>ME 2143</td>
<td>Kinematics and Dynamics of Machines</td>
</tr>
<tr>
<td>ME 2145</td>
<td>Kinematics and Dynamics Design Project</td>
</tr>
<tr>
<td>ME 2222</td>
<td>Manufacturing Engineering I</td>
</tr>
<tr>
<td>ME 3232</td>
<td>Engineering Economics (or CE 3963)</td>
</tr>
<tr>
<td>ME 3341</td>
<td>Machine Design</td>
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<tr>
<td>ME 3345</td>
<td>Machine Design Project</td>
</tr>
<tr>
<td>ME 3352</td>
<td>Design Optimization</td>
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<tr>
<td>ME 3413</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>ME 3415</td>
<td>Thermodynamics Lab</td>
</tr>
</tbody>
</table>
ME 3433  Heat Transfer I (or CHE 3304)
ME 3435  Heat Transfer I Lab
ME 3511  Fluid Mechanics
ME 3515  Fluid Mechanics Lab
ME 3522  Applied Fluid Mechanics
ME 3524  Fluid Systems and Design
ME 3613  System Dynamics
ME 3623  Automatic Controls I
ME 4283  Manufacturing Engineering II
ME 4421  Applied Thermodynamics
ME 4424  Thermal Systems Design
ME 4613  Mechanical Vibration
ME 4860  Senior Design Project
PHYS 1081 *  Physics for Engineers
STAT 2593  Probability and Statistics for Engineers (or STAT 2264)

Total credit hours of core courses: 144 ch
Complementary Studies Electives: 9 ch
Technical Electives (see section below): 10 ch
TOTAL CREDIT HOURS FOR DEGREE: 163 ch

* These are first year courses, most of which are accepted for credit by other engineering departments.

Electives

Technical Elective Courses

In addition to the core courses, the students select at least 10 credit hours of Technical Elective courses appropriate to their interests. Courses may be selected, as available, from the following list, or any other approved technical course offered outside the Department. The availability of specific technical electives varies; students should see list of planned offerings on web site: http://www.me.unb.ca. At least 7 ch must be Mechanical Engineering electives. Courses below the 3000 level are not normally considered as suitable technical electives.

ME 4173  Robot Kinematics
ME 4243  Advanced Manufacturing Methods
ME 4263  Mech & Electrical Equipment for Buildings
ME 4553  Flight Mechanics
ME 4633  Numerical Control of Machines
ME 5153  Noise Analysis and Control
Complementary Studies Electives

In addition to the core courses and technical electives, students select three courses for at least 9 credit hours of Complementary Studies Elective courses. One of the courses has to be either HIST 3925 or SOCI 2534 or equivalent with approval from the Department. At least 3 ch must be “humanities”. A very wide range of elective courses is available. Students are encouraged to take a sequence of courses in one area rather than just entry-level courses. See the Faculty of Engineering General Regulations for restrictions in the selection of Complementary Studies Electives. A list of suggested Complementary Studies Elective courses, as well as their regulations, is available on the web site: [http://www.me.unb.ca](http://www.me.unb.ca).

Mechatronics Option in Mechanical Engineering

Mechatronics is an integrated approach to mechanical, electronic and computer engineering for the design of “smart” products and “intelligent” manufacturing systems. This option permits
interested students to increase their understanding of these subjects by a selection of core and elective courses in mechanical and electrical engineering. The option normally begins in second year but may be started later.

In order to enter this option, students must meet the following qualifications:

1. Successful completion of 35 ch of the regular program in Mechanical Engineering.
2. Approval of the Department. Applications to the Mechatronics Option are normally considered in August each year. Application forms are available from the Department.

Core Courses for Mechatronics Option:

Compared to the standard Mechanical Engineering Program, the following core courses are not required for the Mechatronics option: the project courses in Fluid Mechanics (ME 3524) and Thermodynamics (ME 4424), and two technical electives. For the Mechatronics option, EE 2711 (Electric Circuits) replaces EE 2701 (Electric Circuits and Electronics for Non-electricals). Also required are: CMPE 2213 (Digital Systems), EE 3111 (Electronics I), ME 4673 (Introduction to Mechatronics) and ME 4683 (Mechatronics Applications). The work for the senior design project course, ME 4860, will provide appropriate experience to suit the option.

The complete list of core courses for the Mechatronics Option follows:

- **CHEM 1982** * General Applied Chemistry
- **CHEM 1987** * General Applied Chemistry Laboratory
- **CHE 2501** General Materials Science
- **CHE 2506** Materials Science Laboratory
- **CS 1003** Introduction to Computer Programming (or **CS 1073**)
- **CS 3113** Intro to Numerical Methods (or **CE 3933** or **CHE 2418**)
- **ECON 1073** * Economics for Engineers (or **ECON 1013** and **ECON 1023**)
- **EE 1813** * Electricity and Magnetism
- **CMPE 2213** Digital Systems
- **EE 2683** Electric Circuits and Machines (for non-electricals)
- **EE 2711** Electric Circuits
- **EE 3111** Electronics I
- **ENGG 1001** * Engineering Practice Lecture Series
- **ENGG 1003** * Engineering Technical Communications
- **ENGG 1015** * Introduction to Engineering Design and Problem Solving
- **ENGG 1082** * Mechanics for Engineers
- **ENGG 4013** Law and Ethics for Engineers
- **MATH 1003** * Introduction to Calculus I
- **MATH 1013** * Introduction to Calculus II
- **MATH 1503** * Introduction to Linear Algebra (or **MATH 2213**)
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MATH 2513  Multivariable Calculus for Engineers
MATH 3503  Differential Equations for Engineers
ME 1312 *  Computer Aided Design
ME 2003 *  Dynamics for Engineers
ME 2111  Mechanics of Materials I (or CE 2023)
ME 2122  Mechanics of Materials II
ME 2125  Mechanics of Materials Design Project
ME 2143  Kinematics and Dynamics of Machines
ME 2145  Kinematics and Dynamics Design Project
ME 2222  Manufacturing Engineering I
ME 3232  Engineering Economics (or CE 3963)
ME 3341  Machine Design
ME 3345  Machine Design Project
ME 3352  Design Optimization
ME 3413  Thermodynamics
ME 3415  Thermodynamics Lab
ME 3433  Heat Transfer I (or CHE 3304)
ME 3435  Heat Transfer I Lab
ME 3511  Fluid Mechanics I
ME 3515  Fluid Mechanics I Lab
ME 3522  Applied Fluid Mechanics
ME 3524  Fluid Systems and Design
ME 3613  System Dynamics
ME 3623  Automatic Controls I
ME 4283  Manufacturing Engineering II
ME 4421  Applied Thermodynamics
ME 4424  Thermal Systems Design
ME 4613  Mechanical Vibration
ME 4673  Introduction to Mechatronics
ME 4683  Mechatronics Applications
ME 4860  Senior Design Project
PHYS 1081*  Physics for Engineers
STAT 2593  Probability and Statistics for Engineers (or STAT 2264)

* These are first year courses, most of which are accepted for credit by other engineering departments.

**Technical Electives for Mechatronics Option:**

The normal choice of technical electives is replaced by a directed choice of one elective from the list below.

CMPE 3221  Computer Organization  (4 ch)
EE 4323  Industrial Control Systems  (4 ch)
Other technical elective courses may be selected with the permission of the Chair of the Department or the Director of Undergraduate Studies.

**Nuclear and Power Plant Engineering Option in Mechanical Engineering**

This option program is available to all students from the Departments of Chemical and Mechanical Engineering. In order to enter the option program, Mechanical Engineering students must meet the following qualifications:

1. Successful completion of 80 ch of the regular program in Mechanical Engineering.
2. Approval of the Department. Letters of application to the Nuclear and Power Plant option are considered in August each year.

**Required Courses:**

Either ME 5373, Nuclear Reactor Engineering (3 ch), or CHE 5834 / ME 5834, Nuclear Engineering (3 ch), is an additional required course. The work in the senior design project course, ME 4860, will be coordinated to provide appropriate experience to suit the option.

**Technical Electives:**
The normal choice of technical electives is replaced by a more directed choice from the two lists below:

A. **Choose any two of:**

- **CHE 5744 / ME 5744** Steam Supply Systems (3/4 ch)
- **CHE 5754 / ME 5754** Steam and Gas Turbines (3/4 ch)
- **CHE 5834 / ME 5834** or **ME 5373** Nuclear Engineering or Nuclear Reactor Engineering (3 ch)
- **ME 5483** Cogeneration and Combined Cycle Power Generation (4 ch)
B. Choose one of:

- CHE 5313 Energy and the Environment (3 ch)
- CHE 5344 Combustion (3 ch)
- CHE 5824 Corrosion Processes (3 ch)
- CHE 5854 Nuclear Heat Removal (3 ch)
- ME 5193 Introduction to Flow-Induced Vibrations (4 ch)
- ME 5463 Heat Transfer II (4 ch)
- ME 5473 Energy Management (4 ch)
- ME 5493 Internal Combustion Engines (4 ch)
- ME 5713 Nondestructive Testing (4 ch)

Any of the courses in list A may also be added to list B. Other courses may be added with permission of the Department. Additional technical electives may be selected from lists A or B, as necessary to bring the total of technical electives up to at least 10 ch, with at least 7 ch of Mechanical Engineering technical elective courses.

**Biomedical Engineering Option in Mechanical Engineering**

The Biomedical Engineering Option program is available to all students in Mechanical Engineering who are approved by the Department. This option will help to prepare students for careers in Biomedical Engineering or Medicine. Students interested in pursuing a career in Medicine should consult with the Assistant Dean in the Faculty of Science about what other courses, such as Biology and Chemistry, would be required in order to apply for admission to a medical school; an appropriate individual study program would then be prepared in consultation with the Director of Undergraduate Studies in the Mechanical Engineering Dept. and the Option Coordinator.

**Required Courses:** APSC 3953, Basis of Biomedical Engineering (3 ch) (or equivalent), is an additional required course. The work in the senior design project course, ME 4860, will be coordinated to provide appropriate experience to suit the option; students must obtain approval for their project using a form for this purpose.

**Elective Courses:** The normal choice of technical electives is replaced by a more directed choice from the two lists below:

A. Choose one of:

- ME 4173 Robot Kinematics (4 ch)
- ME 5713 Nondestructive Testing (4 ch)
- ME 5913 Biomechanics I (4 ch)

B. Choose two of:
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 3003</td>
<td>Biocomputing in Drug Design I</td>
<td>(5 ch)</td>
</tr>
<tr>
<td>CS 4965</td>
<td>Computational Biology</td>
<td>(4 ch)</td>
</tr>
<tr>
<td>EE 4923</td>
<td>Introduction to Biomedical Engineering</td>
<td>(4 ch)</td>
</tr>
<tr>
<td>FE 5622</td>
<td>Human Factors Engineering</td>
<td>(3 ch)</td>
</tr>
<tr>
<td>KIN 3061</td>
<td>Advanced Biomechanics</td>
<td>(4 ch)</td>
</tr>
<tr>
<td>KIN 4063</td>
<td>Biomechanical Instrumentation and Data Acquisition</td>
<td>(3 ch)</td>
</tr>
<tr>
<td>KIN 4161</td>
<td>Occupational Biomechanics</td>
<td>(3 ch)</td>
</tr>
<tr>
<td>KIN 4163</td>
<td>Workplace Ergonomic Design and Analysis</td>
<td>(3 ch)</td>
</tr>
<tr>
<td>PHYS 5143</td>
<td>Magnetic Resonance Imaging</td>
<td>(4 ch)</td>
</tr>
</tbody>
</table>

The courses not selected from list A could be added to list B. Some electives may require additional prerequisite courses to be taken. Other courses may be selected with the permission of the Chair of the Department or the Director of Undergraduate Studies.

**Minor in Forest Engineering**

Mechanical engineering students may take a minor in Forest Engineering. Generally, the minor would be structured with a concentration in Forest Operations Management, Production Systems in Forests and Wood Processing, or Forest Transportation and Structures. It is also possible to create a customized minor in FE, individually designed in consultation with the student and academic advisors from both faculties. All minors must include 24 credit hours and the approval of the appropriate representative from Mechanical Engineering and Forest Engineering. For course details, see the Forest Engineering section of the calendar.