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# DEPARTMENT OF MECHANICAL, INDUSTRIAL AND AEROSPACE ENGINEERING

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Section 71.40

## Faculty

### *Chair*

MARTIN D. PUGH, PhD *University of Leeds*, PEng; *Professor, Provost's Distinction*

### *Associate Chair*

MING YUAN CHEN, PhD *University of Manitoba*, APEGS; *Professor*

### *Professors*

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ALI AKGUNDUZ, PhD *University of Illinois at Chicago*, PEng  
RAMA B. BHAT, PhD *Indian Institute of Technology, Madras*, ing.; *Provost's Distinction*  
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ZEZHONG CHEN, PhD *University of Victoria*, PEng  
JAVAD DARGAHI, PhD *Caledonian University (U.K.)*, PEng  
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CHRISTIAN MOREAU, PhD *Université Laval*  
SIVAKUMAR R. NARAYANSWAMY, PhD *Nanyang Technological University*, PEng  
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MARIUS PARASCHIVOIU, PhD *Massachusetts Institute of Technology*, ing.; *Provost's Distinction*  
SUBHASH RAKHEJA, PhD *Concordia University*; *Provost's Distinction*  
RAMIN SEDAGHATI, PhD *University of Victoria*, PEng; *Provost's Distinction*  
ION STIHARU, PhD *Polytechnic Institute of Bucharest*, PEng; *Provost's Distinction*  
CHUN-YI SU, PhD *South China University of Technology*  
GEORGIOS H. VATISTAS, PhD *Concordia University*; *Provost's Distinction*  
WENFANG XIE, PhD *Hong Kong Polytechnic University*, PEng  
YOU MIN ZHANG, PhD *Northwestern Polytechnical University*

### *Distinguished Professors Emeriti*

RICHARD M.H. CHENG, PhD *University of Birmingham*  
SUI LIN, Dring *University of Karlsruhe*  
MOHAMED O.M. OSMAN, DrScTech, *Swiss Federal Institute of Technology*

### *Professors Emeriti*

WAHID S. GHALY, PhD *Massachusetts Institute of Technology*, ing.  
VOJISLAV N. LATINOVIC, DEng *Concordia University*

### *Associate Professors*

IVAN CONTRERAS, PhD *Technical University of Catalonia, Spain*  
BRANDON W. GORDON, PhD *Massachusetts Institute of Technology*, APEGGA  
MEHDI HOJJATI, PhD *Concordia University*, PEng  
HENRY HONG, PhD *Concordia University*, ing.  
AYHAN INCE, PhD *University of Waterloo*, PEng  
LYES KADEM, PhD *Université d'Aix-Marseille II/Université Laval*, ing.

ONUR KUZGUNKAYA, PhD *University of Windsor*, PEng  
SUSAN LISCOUËT-HANKE, PhD *Université de Toulouse (INSA)*  
ROLF WÜTHRICH, DSc *École Polytechnique Fédérale de Lausanne*  
MASOUMEH KAZEMI ZANJANI, PhD *Université Laval*, ing.

*Associate Professors Emeriti*

KALMAN I. KRAKOW, MS *California Institute of Technology*  
RAFIK A. NEEMEH, PhD *McGill University*

*Assistant Professors*

IDA KARIMFAZLI, PhD *University of British Columbia*  
MOJTABA KHEIRI, PhD *McGill University*  
CHARLES BASENGA KIYANDA, PhD *University of Illinois at Urbana-Champaign*, ing.  
TSZ HO KWOK, PhD *Chinese University of Hong Kong*  
DARIA TEREKHOV, PhD *University of Toronto*  
BRIAN VERMEIRE, PhD *McGill University*

*Extended Term Appointments*

JOHN CHEUNG, PhD *Cranfield University*, PEng  
ASHOK KAUSHAL, PhD *Concordia University*, PEng

*Affiliate Professors*

FARHAD AGHILI, PhD *McGill University*  
PAUL-ÉMILE BOILEAU, PhD *Concordia University*  
ELMAR BONACCURSO, PhD *University of Mainz and University of Siegen*  
DOMINIQUE DEROME, PhD *Concordia University*  
CAMILLE-ALAIN RABBATH, PhD *McGill University*

*Affiliate Associate Professor*

PIERRE MARCOTTE, PhD *Virginia Polytechnic Institute and State University*

*Affiliate Assistant Professor*

HAMID AIT ADDERRAHMANE, PhD *Concordia University*

*For the complete list of faculty members, please consult the Department website.*

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## Location

*Sir George Williams Campus*  
Engineering, Computer Science and Visual Arts Complex, Room: EV 004.139  
514-848-2424, ext. 3125

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## Department Objectives

The Department of Mechanical, Industrial and Aerospace Engineering offers three distinct undergraduate programs: BEng in **Mechanical Engineering**, BEng in **Industrial Engineering** and BEng in **Aerospace Engineering**.

Mechanical Engineering is concerned with all forms of power generation (hydro-electric, steam, internal combustion, nuclear, jet rocket, and fuel cells), the design of mechanisms and machines, transportation systems, controls and automation, vibration analysis, environmental control (heating, ventilation, and refrigeration), materials handling, and precision measurement. The Mechanical Engineering curriculum consists of a combination of core courses with a series of technical electives that allow students to obtain some specialization in a particular area of the field depending on their interests and expected future professional activity. Current groups of electives include: Aerospace, Design and Manufacturing, Systems and Mechatronics, Thermo-Fluids and Propulsion, Vehicle Systems and Stress Analysis.

Industrial Engineering is concerned with the design, organization, analysis, and integration of people and industrial systems components in order to achieve or enhance effectiveness. These components include whole machines, transportation and conveyance elements, physical plant, organizational frameworks, schedules, and budgets. The Industrial Engineering curriculum is therefore designed to give students the background needed to define and solve problems related to the conception, improvement, integration, and implementation of industrial systems.

The Aerospace Engineering program is offered jointly with the Department of Electrical and Computer Engineering. The detailed description of this program can be found in §71.55.

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## 71.40.1 Course Requirements (BEng in Mechanical Engineering)

The program in Mechanical Engineering consists of the Engineering Core, the Mechanical Engineering Core, and elective credits as shown below. The minimum length of the program is 120 credits.

### Engineering Core (27 credits)

See §71.20.5.

| <b>Mechanical Engineering Core</b> |   | <i>Credits</i> |
|------------------------------------|---|----------------|
| ENGR 242                           | Statics   | 3.00           |
| ENGR 243                           | Dynamics  | 3.00           |
| ENGR 244                           | Mechanics of Materials                                | 3.75           |
| ENGR 251                           | Thermodynamics I                                      | 3.00           |
| ENGR 311                           | Transform Calculus and Partial Differential Equations | 3.00           |
| ENGR 361                           | Fluid Mechanics I                                     | 3.00           |
| MECH 211                           | Mechanical Engineering Drawing                        | 3.50           |
| MECH 215                           | Programming for Mechanical and Industrial Engineers   | 3.50           |
| MECH 221                           | Materials Science                                     | 3.00           |
| MECH 311                           | Manufacturing Processes                               | 3.75           |
| MECH 313                           | Machine Drawing and Design                            | 3.50           |
| MECH 321                           | Properties and Failure of Materials                   | 3.50           |
| MECH 343                           | Theory of Machines                                    | 3.50           |
| MECH 344                           | Machine Element Design                                | 3.00           |
| MECH 351                           | Thermodynamics II                                     | 3.50           |
| MECH 352                           | Heat Transfer I                                       | 3.50           |
| MECH 361                           | Fluid Mechanics II                                    | 3.50           |
| MECH 368                           | Electronics for Mechanical Engineers                  | 3.50           |
| MECH 370                           | Modelling and Analysis of Dynamic Systems             | 3.50           |
| MECH 371                           | Analysis and Design of Control Systems                | 3.75           |
| MECH 375                           | Mechanical Vibrations                                 | 3.50           |
| MECH 390                           | Mechanical Engineering Design Project                 | 3.00           |
| MECH 490                           | Capstone Mechanical Engineering Design Project        | 4.00           |
|                                    |   | 77.75          |

### Electives

Students in the Mechanical Engineering program must complete at least 15.25 elective credits from the list of courses below. Courses are listed in groups to facilitate the selection of courses in a particular area of the field.

| <b>A. Aerospace</b>                |   | <i>Credits</i> |
|------------------------------------|---|----------------|
| AERO 462                           | Turbomachinery and Propulsion                       | 3.00           |
| AERO 464                           | Aerodynamics  | 3.00           |
| AERO 465                           | Gas Turbine Design                                  | 3.50           |
| AERO 480                           | Flight Control Systems                              | 3.50           |
| AERO 482                           | Avionic Navigation Systems                          | 3.00           |
| AERO 485                           | Introduction to Space Systems                       | 3.00           |
| AERO 486                           | Aircraft Stress Analysis                            | 3.00           |
| AERO 487                           | Design of Aircraft Structures                       | 3.00           |
| ENGR 411                           | Special Technical Report                            | 1.00           |
| ENGR 412                           | Honours Research Project                            | 3.00           |
| MECH 498                           | Topics in Mechanical Engineering                    | 3.00           |
| <b>B. Design and Manufacturing</b> |   | <i>Credits</i> |
| ENGR 411                           | Special Technical Report                            | 1.00           |
| ENGR 412                           | Honours Research Project                            | 3.00           |
| INDU 372                           | Quality Control and Reliability                     | 3.00           |
| INDU 411                           | Computer Integrated Manufacturing                   | 3.50           |
| INDU 440                           | Product Design and Development                      | 3.00           |
| MECH 412                           | Computer-Aided Mechanical Design                    | 3.50           |
| MECH 414                           | Computer Numerically Controlled Machining           | 3.50           |
| MECH 421                           | Mechanical Shaping of Metals and Plastics           | 3.50           |
| MECH 422                           | Mechanical Behaviour of Polymer Composite Materials | 3.00           |

|  |  |                |
|--|--|----------------|
| MECH 423                               | Casting, Welding, Heat Treating, and Non-Destructive Testing | 3.50           |
| MECH 424                               | MEMS – Design and Fabrication                                | 3.50           |
| MECH 425                               | Manufacturing of Composites                                  | 3.50           |
| MECH 462                               | Wind Turbine Engineering                                     | 3.00           |
| MECH 476                               | Generative Design and Manufacturing in Engineering           | 3.00           |
| MECH 498                               | Topics in Mechanical Engineering                             | 3.00           |
| <b>C. Systems and Mechatronics</b>     |  | <i>Credits</i> |
| AERO 480                               | Flight Control Systems                                       | 3.50           |
| AERO 482                               | Avionic Navigation Systems                                   | 3.00           |
| ENGR 411                               | Special Technical Report                                     | 1.00           |
| ENGR 412                               | Honours Research Project                                     | 3.00           |
| MECH 411                               | Instrumentation and Measurements                             | 3.50           |
| MECH 415                               | Advanced Programming for Mechanical and Industrial Engineers | 3.00           |
| MECH 463                               | Fluid Power Control  | 3.50           |
| MECH 471                               | Microcontrollers for Mechatronics                            | 3.50           |
| MECH 472                               | Mechatronics and Automation                                  | 3.50           |
| MECH 473                               | Control System Design  | 3.50           |
| MECH 474                               | Mechatronics   | 3.75           |
| MECH 498                               | Topics in Mechanical Engineering                             | 3.00           |
| <b>D. Thermo-Fluids and Propulsion</b> |  | <i>Credits</i> |
| AERO 462                               | Turbomachinery and Propulsion                                | 3.00           |
| AERO 465                               | Gas Turbine Design   | 3.50           |
| ENGR 411                               | Special Technical Report                                     | 1.00           |
| ENGR 412                               | Honours Research Project                                     | 3.00           |
| MECH 411                               | Instrumentation and Measurements                             | 3.50           |
| MECH 415                               | Advanced Programming for Mechanical and Industrial Engineers | 3.00           |
| MECH 452                               | Heat Transfer II   | 3.50           |
| MECH 453                               | Heating, Ventilation and Air Conditioning Systems            | 3.00           |
| MECH 461                               | Gas Dynamics   | 3.50           |
| MECH 462                               | Wind Turbine Engineering                                     | 3.00           |
| MECH 463                               | Fluid Power Control  | 3.50           |
| MECH 498                               | Topics in Mechanical Engineering                             | 3.00           |
| <b>E. Vehicle Systems</b>              |  | <i>Credits</i> |
| ENGR 411                               | Special Technical Report                                     | 1.00           |
| ENGR 412                               | Honours Research Project                                     | 3.00           |
| MECH 411                               | Instrumentation and Measurements                             | 3.50           |
| MECH 415                               | Advanced Programming for Mechanical and Industrial Engineers | 3.00           |
| MECH 444                               | Guided Vehicle Systems                                       | 3.00           |
| MECH 447                               | Fundamentals of Vehicle System Design                        | 3.50           |
| MECH 448                               | Vehicle Dynamics   | 3.00           |
| MECH 454                               | Vehicular Internal Combustion Engines                        | 3.00           |
| MECH 473                               | Control System Design  | 3.50           |
| MECH 498                               | Topics in Mechanical Engineering                             | 3.00           |
| <b>F. Stress Analysis</b>              |  | <i>Credits</i> |
| AERO 431                               | Principles of Aeroelasticity                                 | 3.00           |
| AERO 486                               | Aircraft Stress Analysis                                     | 3.00           |
| ENGR 411                               | Special Technical Report                                     | 1.00           |
| ENGR 412                               | Honours Research Project                                     | 3.00           |
| MECH 411                               | Instrumentation and Measurements                             | 3.50           |
| MECH 412                               | Computer-Aided Mechanical Design                             | 3.50           |
| MECH 415                               | Advanced Programming for Mechanical and Industrial Engineers | 3.00           |
| MECH 422                               | Mechanical Behaviour of Polymer Composite Materials          | 3.00           |
| MECH 426                               | Stress and Failure Analysis of Machinery                     | 3.00           |
| MECH 460                               | Finite Element Analysis                                      | 3.75           |
| MECH 498                               | Topics in Mechanical Engineering                             | 3.00           |

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## 71.40.2 Course Requirements (BEng in Industrial Engineering)

The program in Industrial Engineering consists of the Engineering Core, the Industrial Engineering Core, and elective credits as shown below. The minimum length of the program is 120 credits.

### Engineering Core (27 credits)

See §71.20.5.

| Industrial Engineering Core |   | Credits |
|-----------------------------|---|---------|
| ENGR 245                    | Mechanical Analysis                                   | 3.00    |
| ENGR 251                    | Thermodynamics I                                      | 3.00    |
| ENGR 311                    | Transform Calculus and Partial Differential Equations | 3.00    |
| INDU 211                    | Introduction to Production and Manufacturing Systems  | 3.00    |
| INDU 311                    | Simulation of Industrial Systems                      | 3.50    |
| INDU 320                    | Production Engineering                                | 3.00    |
| INDU 321                    | Lean Manufacturing                                    | 3.00    |
| INDU 323                    | Operations Research I                                 | 3.50    |
| INDU 324                    | Operations Research II                                | 3.50    |
| INDU 330                    | Engineering Management                                | 3.00    |
| INDU 342                    | Logistics Network Models                              | 3.00    |
| INDU 371                    | Stochastic Models in Industrial Engineering           | 3.00    |
| INDU 372                    | Quality Control and Reliability                       | 3.00    |
| INDU 411                    | Computer Integrated Manufacturing                     | 3.50    |
| INDU 412                    | Human Factors Engineering                             | 3.50    |
| INDU 421                    | Facilities Design and Material Handling Systems       | 3.50    |
| INDU 423                    | Inventory Control                                     | 3.50    |
| INDU 490                    | Capstone Industrial Engineering Design Project        | 4.00    |
| MECH 211                    | Mechanical Engineering Drawing                        | 3.50    |
| MECH 215                    | Programming for Mechanical and Industrial Engineers   | 3.50    |
| MECH 221                    | Materials Science                                     | 3.00    |
| MECH 311                    | Manufacturing Processes                               | 3.75    |
| MECH 313                    | Machine Drawing and Design                            | 3.50    |
|                             |   | <hr/>   |
|                             |   | 75.75   |

### Electives

Students must complete a minimum of 17.25 credits from the following courses, including at least three INDU courses and with no more than two of the courses marked \*. With permission of the Department, students may take one technical elective course from another program or Faculty.

|           |   | Credits |
|-----------|---|---------|
| BSTA 478* | Data Mining Techniques  | 3.00    |
| BTM 430*  | Enterprise Resource Planning and Information Technology Integration | 3.00    |
| BTM 480*  | Project Management  | 3.00    |
| ENGR 361  | Fluid Mechanics I   | 3.00    |
| ENGR 411  | Special Technical Report  | 1.00    |
| ENGR 412  | Honours Research Project  | 3.00    |
| INDU 410  | Safety Engineering  | 3.00    |
| INDU 440  | Product Design and Development                                      | 3.00    |
| INDU 441  | Introduction to Six Sigma   | 3.00    |
| INDU 466  | Decision Models in Service Sector                                   | 3.00    |
| INDU 475  | Advanced Concepts in Quality Improvement                            | 3.00    |
| INDU 480  | Cases in Industrial Engineering                                     | 3.00    |
| INDU 498  | Topics in Industrial Engineering                                    | 3.00    |
| MANA 300* | Entrepreneurship: Launching Your Business                           | 3.00    |
| MECH 321  | Properties and Failure of Materials                                 | 3.50    |
| MECH 370  | Modelling and Analysis of Dynamic Systems                           | 3.50    |
| MECH 371  | Analysis and Design of Control Systems                              | 3.75    |
| MECH 412  | Computer-Aided Mechanical Design                                    | 3.50    |
| MECH 415  | Advanced Programming for Mechanical and Industrial Engineers        | 3.00    |
| MECH 421  | Mechanical Shaping of Metals and Plastics                           | 3.50    |
| MECH 423  | Casting, Welding, Heat Treating and Non-Destructive Testing         | 3.50    |
| MECH 425  | Manufacturing of Composites   | 3.50    |

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