# *AEROSPACE ENGINEERING* *Section 71.55*

## Faculty

*Undergraduate Program Director*
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*The Aerospace Engineering program is offered jointly by the Department of Mechanical, Industrial and Aerospace Engineering and the Department of Electrical and Computer Engineering. For a complete list of faculty members, please consult the Departments' websites.*

## Location

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

## Program Objectives

**Aerospace Engineering** is concerned with the engineering science governing flight and the design and construction of aircraft and spacecraft. This includes the mechanisms behind flight and propulsion in the atmosphere and space including aerodynamics, lift and drag as well as the design and control of aircraft such as airplanes, helicopters, unmanned aerial vehicles (UAVs) and rockets. The Aerospace Engineering curriculum comprises fundamental engineering courses followed by technical electives which allow students to obtain some specialization in a particular area of the field depending on their interests and expected future professional activity. Three options are available: Aerodynamics and Propulsion; Aerospace Structures and Materials; and Avionics and Aerospace Systems.
Aerodynamics and Propulsion is strongly related to the "flying" aspect of aircraft and includes topics such as aerodynamics, gas dynamics, aerospace vehicle performance, turbo-machinery and propulsion. Aerospace Structures and Materials is related to the design and manufacture of aircraft and spacecraft and includes topics such as aircraft stress analysis, aeroelasticity and vibrations, composite materials and aircraft design. Avionics and Aerospace Systems has significant electrical and computer engineering content in order to provide the necessary background for the avionics and systems engineering required to control modern aircraft and includes topics such as avionic navigation systems, communication networks, spacecraft mission design and flight control systems.

## Course Requirements (BEng in Aerospace Engineering)

The program in Aerospace Engineering consists of the Engineering Core, the Aerospace Engineering Core, and option requirements as shown below. The minimum length of the program is 120 credits.

**Engineering Core** (27 credits)
See §71.20.5.

| **Aerospace Engineering Core** | | *Credits* |
|---|---|---|
| AERO 201 | Introduction to Flight and Aerospace Systems | 4.00 |
| AERO 290 | Introduction to Aircraft Design | 3.00 |
| AERO 371 | Modelling and Control Systems | 3.50 |
| AERO 390 | Aerospace Engineering Design Project | 3.00 |
| AERO 417 | Standards, Regulations and Certification | 3.00 |
| AERO 490 | Capstone Aerospace Engineering Design Project* | 4.00 |
| ENGR 242 | Statics | 3.00 |
| ENGR 243 | Dynamics | 3.00 |
| ENGR 244 | Mechanics of Materials | 3.75 |
| ENGR 251 | Thermodynamics I | 3.00 |
| ENGR 361 | Fluid Mechanics I | 3.00 |
| | | 36.25 |

*Note: Students may replace AERO 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

**Option Requirements**
Students in the Aerospace Engineering program must complete at least 56.75 elective credits from within one of options A, B, or C.

**1. Option A — Aerodynamics and Propulsion**
Students must complete the following compulsory courses from the Option Core and at least 6.5 credits from the Option Electives, with no more than one of the courses marked *. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

| **Option A Core** | | *Credits* |
|---|---|---|
| AERO 446 | Aerospace Vehicle Performance | 3.00 |
| AERO 455 | Computational Fluid Dynamics for Aerospace Applications | 3.75 |
| AERO 462 | Turbomachinery and Propulsion | 3.00 |
| AERO 464 | Aerodynamics | 3.00 |
| AERO 465 | Gas Turbine Design | 3.50 |
| AERO 481 | Materials Engineering for Aerospace | 3.50 |
| ENGR 311 | Transform Calculus and Partial Differential Equations | 3.00 |
| MECH 343 | Theory of Machines | 3.50 |
| MECH 351 | Thermodynamics II | 3.50 |
| MECH 352 | Heat Transfer I | 3.50 |
| MECH 361 | Fluid Mechanics II | 3.50 |
| MECH 461 | Gas Dynamics | 3.50 |
| MIAE 211 | Mechanical Engineering Drawing | 3.50 |
| MIAE 215 | Programming for Mechanical and Industrial Engineers | 3.50 |
| MIAE 221 | Materials Science | 3.00 |
| | | 50.25 |

| **Option A Electives** | | *Credits* |
|---|---|---|
| AERO 431 | Principles of Aeroelasticity | 3.00 |
| AERO 471 | Aircraft Hydro-Mechanical and Fuel Systems | 3.50 |
| AERO 472 | Aircraft Pneumatic and Electrical Power Systems | 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 |
| ENGR 411 | Special Technical Report | 1.00 |
| ENGR 412 | Honours Research Project | 3.00 |
| INDU 372 | Quality Control and Reliability | 3.00 |
| MECH 368 | Electronics for Mechanical Engineers | 3.50 |
| MECH 375* | Mechanical Vibrations | 3.50 |
| MECH 411 | Instrumentation and Measurements | 3.50 |
| MECH 426* | Stress and Failure Analysis of Machinery | 3.00 |
| MECH 452 | Heat Transfer II | 3.50 |
| MECH 453 | Heating, Ventilation and Air Conditioning Systems | 3.00 |
| MECH 460* | Finite Element Analysis | 3.75 |
| MECH 498 | Topics in Mechanical Engineering | 3.00 |

**2. Option B — Aerospace Structures and Materials**
Students must complete the following compulsory courses from the Option Core and at least 2.75 credits from the Option Electives. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

| **Option B Core** | | *Credits* |
|---|---|---|
| AERO 431 | Principles of Aeroelasticity | 3.00 |
| AERO 481 | Materials Engineering for Aerospace | 3.50 |
| AERO 486 | Aircraft Stress Analysis | 3.00 |
| AERO 487 | Design of Aircraft Structures | 3.00 |
| ENGR 311 | Transform Calculus and Partial Differential Equations | 3.00 |
| MECH 343 | Theory of Machines | 3.50 |
| MECH 352 | Heat Transfer I | 3.50 |
| MECH 375 | Mechanical Vibrations | 3.50 |
| MECH 411 | Instrumentation and Measurements | 3.50 |
| MECH 412 | Computer-Aided Mechanical Design | 3.50 |

| | | |
|---|---|---|
| MECH 460 | Finite Element Analysis | 3.75 |
| MIAE 211 | Mechanical Engineering Drawing | 3.50 |
| MIAE 215 | Programming for Mechanical and Industrial Engineers | 3.50 |
| MIAE 221 | Materials Science | 3.00 |
| MIAE 311 | Manufacturing Processes | 3.75 |
| MIAE 313 | Machine Drawing and Design | 3.50 |
| | | 54.00 |

**Option B Electives** *Credits*

| | | |
|---|---|---|
| AERO 455* | Computational Fluid Dynamics for Aerospace Applications | 3.75 |
| AERO 471 | Aircraft Hydro-Mechanical and Fuel Systems | 3.50 |
| AERO 472 | Aircraft Pneumatic and Electrical Power Systems | 3.50 |
| 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 |
| INDU 372 | Quality Control and Reliability | 3.00 |
| MECH 344 | Machine Element Design | 3.00 |
| MECH 351* | Thermodynamics II | 3.50 |
| MECH 361* | Fluid Mechanics II | 3.50 |
| MECH 368 | Electronics for Mechanical Engineers | 3.50 |
| MECH 422 | Mechanical Behaviour of Polymer Composite Materials | 3.00 |
| MECH 425 | Manufacturing of Composites | 3.50 |
| MECH 426 | Stress and Failure Analysis of Machinery | 3.00 |
| MECH 476 | Generative Design and Manufacturing in Engineering | 3.00 |
| MECH 498 | Topics in Mechanical Engineering | 3.00 |

**3. Option C — Avionics and Aerospace Systems**

Students must complete the following compulsory courses from the Option Core and at least 15.25 credits from the Option Electives. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

**Option C Core** *Credits*

| | | |
|---|---|---|
| AERO 482 | Avionics Navigation Systems | 3.00 |
| AERO 483 | Integration of Avionics Systems | 3.00 |
| COEN 212 | Digital Systems Design I | 3.50 |
| COEN 231 | Introduction to Discrete Mathematics | 3.00 |
| COEN 243 | Programming Methodology I | 3.00 |
| COEN 244 | Programming Methodology II | 3.00 |
| COEN 311 | Computer Organization and Software | 3.50 |
| COEN 352 | Data Structures and Algorithms | 3.00 |
| ELEC 242 | Continuous-Time Signals and Systems | 3.00 |
| ELEC 273 | Basic Circuit Analysis | 3.50 |
| ELEC 342 | Discrete-Time Signals and Systems | 3.50 |
| ELEC 483 | Real-Time Computer Control Systems | 3.50 |
| SOEN 341 | Software Process and Practices | 3.00 |
| | | 41.50 |

**Option C Electives** *Credits*

| | | |
|---|---|---|
| AERO 471 | Aircraft Hydro-Mechanical and Fuel Systems | 3.50 |
| AERO 472 | Aircraft Pneumatic and Electrical Power Systems | 3.50 |
| AERO 480 | Flight Control Systems | 3.50 |
| COEN 313 | Digital Systems Design II | 3.50 |
| COEN 317 | Microprocessor-Based Systems | 3.50 |
| COEN 320 | Introduction to Real-Time Systems | 3.00 |
| COEN 346 | Operating Systems | 3.50 |
| COEN 413 | Hardware Functional Verification | 3.00 |
| COEN 421 | Embedded Systems Design | 4.00 |
| COEN 445 | Communication Networks and Protocols | 3.50 |
| COEN 498 | Topics in Computer Engineering | 3.00 |

| | | |
|---|---|---|
| ELEC 251 | Fundamentals of Applied Electromagnetics | 3.00 |
| ELEC 311 | Electronics I | 3.50 |
| ELEC 331 | Fundamentals of Electrical Power Engineering | 3.50 |
| ELEC 351 | Electromagnetic Waves and Guiding Structures | 3.00 |
| ELEC 367 | Introduction to Digital Communications | 3.50 |
| ELEC 433 | Power Electronics | 3.50 |
| ELEC 442 | Digital Signal Processing | 3.50 |
| ELEC 458 | Techniques in Electromagnetic Compatibility | 3.00 |
| ELEC 464 | Wireless Communications | 3.00 |
| ELEC 481 | Linear Systems | 3.50 |
| ELEC 482 | System Optimization | 3.50 |
| ELEC 498 | Topics in Electrical Engineering | 3.00 |
| ENGR 411 | Special Technical Report | 1.00 |
| SOEN 342 | Software Requirements and Deployment | 3.00 |
| SOEN 343 | Software Architecture and Design | 3.00 |