

# BASC BIOMEDICAL MECHANICAL ENGINEERING

The purpose of the Biomedical Mechanical Engineering program is to graduate engineers proficient in the areas of biomedical engineering related to mechanical engineering. These include the design of medical devices such as artificial hearts, implants and prostheses, the development and selection of bio-compatible metallic and non-metallic materials for implants and medical equipment, robotics for medical applications, biomechanics and rehabilitation engineering.

The program structure parallels that of the regular Mechanical Engineering program, replacing eight courses in the regular program with biomedically-oriented courses.

This program has a broad scope, so that graduates may have a wide range of career choices, not only in the biomedical field but also in conventional mechanical engineering. Biomedical systems are among the most complex of mechanical systems; therefore, a strong and comprehensive education in standard mechanical engineering principles is provided, with emphasis on their application in biomedical systems.

This program is offered in English and in French.

## Program Requirements

Co-operative education is available with this program.

Requirements for this program have been modified. Please consult the 2024-2025 calendars (<http://catalogue.uottawa.ca/en/archives/>) for the previous requirements.

### Compulsory First-Year Courses:

|          |                                         |         |
|----------|-----------------------------------------|---------|
| ANP 1106 | Human Anatomy and Physiology II         | 3 Units |
| CHM 1311 | Principles of Chemistry                 | 3 Units |
| ENG 1112 | Technical Report Writing                | 3 Units |
| GNG 1105 | Engineering Mechanics                   | 3 Units |
| GNG 1106 | Fundamentals of Engineering Computation | 3 Units |
| MAT 1320 | Calculus I                              | 3 Units |
| MAT 1322 | Calculus II                             | 3 Units |
| MAT 1341 | Introduction to Linear Algebra          | 3 Units |
| MCG 1101 | Fundamentals of Mechanical Engineering  | 1 Unit  |
| MCG 1102 | Mechanical Drafting                     | 2 Units |
| PHY 1122 | Fundamentals of Physics II              | 3 Units |

### Compulsory Second-Year Courses:

|          |                                                           |         |
|----------|-----------------------------------------------------------|---------|
| GNG 1103 | Introduction to Engineering Design                        | 3 Units |
| CVG 2140 | Mechanics of Materials I                                  | 3 Units |
| ELG 2336 | Electric Circuits and Machines for Mechanical Engineering | 3 Units |
| MAT 2322 | Calculus III for Engineers                                | 3 Units |
| MAT 2377 | Probability and Statistics for Engineers                  | 3 Units |
| MAT 2384 | Ordinary Differential Equations and Numerical Methods     | 3 Units |
| MCG 2101 | Introduction to Design of Mechanical Systems              | 3 Units |
| MCG 2108 | Dynamics                                                  | 3 Units |
| MCG 2130 | Thermodynamics I                                          | 3 Units |

|          |                                         |         |
|----------|-----------------------------------------|---------|
| MCG 2131 | Thermodynamics II                       | 3 Units |
| MCG 2142 | Biological and Engineering Materials II | 3 Units |
| MCG 2360 | Engineering Materials I                 | 3 Units |

### Compulsory Third-Year Courses:

|          |                                                                           |         |
|----------|---------------------------------------------------------------------------|---------|
| ELG 3336 | Electronics for Mechanical Engineers                                      | 3 Units |
| GNG 2101 | Introduction to Product Development for Engineers and Computer Scientists | 3 Units |
| MAT 3320 | Mathematics for Engineers                                                 | 3 Units |
| MCG 3110 | Heat Transfer                                                             | 3 Units |
| MCG 3130 | Dynamics of Machinery                                                     | 3 Units |
| MCG 3131 | Machine Design                                                            | 3 Units |
| MCG 3141 | Advanced Strength of Materials and Applications to Biomechanical Systems  | 3 Units |
| MCG 3143 | Biofluid Mechanics                                                        | 3 Units |
| MCG 3305 | Biomedical System Dynamics                                                | 3 Units |
| MCG 3307 | Control Systems                                                           | 3 Units |
| MCG 3340 | Fluid Mechanics I                                                         | 3 Units |

### Compulsory Fourth-Year Courses:

|                                                                                                                                                                          |                                                                           |         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------|
| 3 course units from:                                                                                                                                                     |                                                                           | 3 Units |
| GNG 4120                                                                                                                                                                 | Technology Entrepreneurship for Engineers and Computer Scientists         |         |
| GNG 4930                                                                                                                                                                 | Internship in Mechanical Engineering or Biomedical Mechanical Engineering |         |
| HIS 2129                                                                                                                                                                 | Technology, Society and Environment Since 1850                            |         |
| PHI 2394                                                                                                                                                                 | Scientific Thought and Social Values                                      |         |
| GNG 4170                                                                                                                                                                 | Engineering Law                                                           | 3 Units |
| MCG 4151                                                                                                                                                                 | Design of Artificial Joint Prostheses and Implants                        | 3 Units |
| MCG 4152                                                                                                                                                                 | Design of Artificial Organs                                               | 3 Units |
| MCG 4308                                                                                                                                                                 | Mechanical Vibration Analysis                                             | 3 Units |
| MCG 4328                                                                                                                                                                 | Manufacturing                                                             | 3 Units |
| MCG 4340                                                                                                                                                                 | Mechanical Engineering Laboratory                                         | 3 Units |
| MCG 4366                                                                                                                                                                 | Biomedical Mechanical Engineering Capstone Project                        | 6 Units |
| PHI 2396                                                                                                                                                                 | Bioethics                                                                 | 3 Units |
| 3 technical electives units in mechanical engineering (MCG) at the 4000 level selected from the optional courses listed under the BASc in Mechanical Engineering program |                                                                           | 3 Units |

**Total:** **132 Units**

## List of Optional Courses

### Stream A: Fluid Mechanics - Heat Transfer:

|          |                                                  |         |
|----------|--------------------------------------------------|---------|
| MCG 4104 | Building Energy Systems                          | 3 Units |
| MCG 4110 | Fluid Machinery                                  | 3 Units |
| MCG 4111 | Internal Combustion Engines                      | 3 Units |
| MCG 4126 | Energy Conversion                                | 3 Units |
| MCG 4128 | Basic Nuclear Engineering                        | 3 Units |
| MCG 4139 | Computational Methods in Fluid and Heat Transfer | 3 Units |
| MCG 4325 | Gas Dynamics                                     | 3 Units |
| MCG 4345 | Aerodynamics                                     | 3 Units |

### Stream B: Solid Mechanics - Design and Synthesis:

|                                                    |                                                       |         |
|----------------------------------------------------|-------------------------------------------------------|---------|
| MCG 4102                                           | Finite Element Analysis                               | 3 Units |
| MCG 4107                                           | Dynamics II                                           | 3 Units |
| MCG 4127                                           | Computational Methods in Mechanical Engineering       | 3 Units |
| MCG 4155                                           | Advanced Engineering Materials                        | 3 Units |
| MCG 4329                                           | Reliability and Maintainability in Engineering Design | 3 Units |
| <b>Stream C: CAD/CAM - Industrial Engineering:</b> |                                                       |         |
| MCG 4130                                           | Industrial Planning                                   | 3 Units |
| MCG 4132                                           | Robot Mechanics                                       | 3 Units |
| MCG 4133                                           | Automation Design and Control                         | 3 Units |
| MCG 4134                                           | Robot Design and Control                              | 3 Units |
| MCG 4136                                           | Mechatronics                                          | 3 Units |
| <b>Stream D: Biomedical</b>                        |                                                       |         |
| MCG 4112                                           | Introduction to Microfluidics                         | 3 Units |
| MCG 4150                                           | Bioinstrumentation                                    | 3 Units |
| MCG 4153                                           | Biomechanics of Movement                              | 3 Units |
| MCG 4154                                           | Introduction to Biomaterials and Tissue Engineering   | 3 Units |
| <b>Other Technical Electives:</b>                  |                                                       |         |
| MCG 4100                                           | Thesis                                                | 6 Units |
| MCG 4142                                           | Corrosion: Principles, Prevention and Control         | 3 Units |
| MCG 4143                                           | Product Design and Development                        | 3 Units |
| MCG 4144                                           | Introduction to Composite Materials                   | 3 Units |
| MCG 4190                                           | Selected Topics I                                     | 3 Units |
| MCG 4191                                           | Selected Topics II                                    | 3 Units |
| MCG 4192                                           | Selected Topics III                                   | 3 Units |
| MCG 4193                                           | Selected Topics IV                                    | 3 Units |
| MCG 4220                                           | Thesis                                                | 6 Units |