Mathematical Science (MSCI)

Department of Mathematics & Statistics, College of Engineering and Physical Sciences

Major (Honours Program)

Knowledge of Mathematics and Statistics is crucial for understanding our world. This unique program provides a core of both mathematics and statistics with a choice of a Mathematics stream or a Statistics stream. This major also requires the completion of an area of emphasis as listed. Students are encouraged to speak with a Program Counsellor when choosing courses for the selected stream and area of emphasis.

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major may wish to consult the Faculty Advisor. A total of 20.00 credits is required to complete the Major which includes at least 10.00 credits in Mathematics & Statistics, 0.50 credits in Computing and Information Science, and an additional 2.50 credits in an area of emphasis.

Note: A major in Mathematical Science cannot be combined with a minor in Mathematical Science, Mathematics, or Statistics.

Students lacking Grade 12 or 4U Biology, Chemistry or Physics should follow the revised schedule of study for this major found at: https://www.uoguelph.ca/bsc/revised_SS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH*1160</td>
<td>Linear Algebra I</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1070</td>
<td>Discovering Biodiversity</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1080</td>
<td>Biological Concepts of Health</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1090</td>
<td>Introduction to Molecular and Cellular Biology</td>
<td>0.50</td>
</tr>
<tr>
<td>IPS*1500</td>
<td>Integrated Mathematics and Physics I</td>
<td>1.00</td>
</tr>
<tr>
<td>MATH*1080</td>
<td>Elements of Calculus I</td>
<td>1.00</td>
</tr>
<tr>
<td>MATH*1200</td>
<td>Calculus I</td>
<td>1.00</td>
</tr>
<tr>
<td>STAT*2040</td>
<td>Statistics I</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1070</td>
<td>Discovering Biodiversity</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1080</td>
<td>Biological Concepts of Health</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1090</td>
<td>Introduction to Molecular and Cellular Biology</td>
<td>0.50</td>
</tr>
<tr>
<td>IPS*1510</td>
<td>Integrated Mathematics and Physics II</td>
<td>1.00</td>
</tr>
<tr>
<td>MATH*1090</td>
<td>Elements of Calculus II</td>
<td>1.00</td>
</tr>
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</table>

Semester 2

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM*1040</td>
<td>General Chemistry I</td>
<td>0.50</td>
</tr>
<tr>
<td>STAT*2040</td>
<td>Statistics I</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1070</td>
<td>Discovering Biodiversity</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1080</td>
<td>Biological Concepts of Health</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*1090</td>
<td>Introduction to Molecular and Cellular Biology</td>
<td>0.50</td>
</tr>
<tr>
<td>IPS*1510</td>
<td>Integrated Mathematics and Physics II</td>
<td>1.00</td>
</tr>
<tr>
<td>MATH*1090</td>
<td>Elements of Calculus II</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Restricted Electives

1. A minimum of 1.00 credits of Liberal Education electives is required. The list of Liberal Education electives for B.Sc. students can be found at: https://www.uoguelph.ca/bsc/
2. 5.50 credits from either the Mathematics Stream or the Statistics Stream as follows:
3. 2.50 credits from an Area of Emphasis

Mathematics Stream

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH*2000</td>
<td>Proofs, Sets, and Numbers</td>
<td>0.50</td>
</tr>
<tr>
<td>MATH*2210</td>
<td>Advanced Calculus II</td>
<td>0.50</td>
</tr>
<tr>
<td>MATH*2270</td>
<td>Applied Differential Equations</td>
<td>0.50</td>
</tr>
<tr>
<td>MATH*3160</td>
<td>Linear Algebra II</td>
<td>0.50</td>
</tr>
</tbody>
</table>
MATH*3200 Real Analysis 0.50
3.00 additional credits in MATH or STAT at the 3000 level or above of which at least 1.50 credits must be MATH at the 4000 level

Statistics and Data Science Stream

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT*3110</td>
<td>Introductory Mathematical Statistics II</td>
<td>0.50</td>
</tr>
<tr>
<td>STAT*3240</td>
<td>Applied Regression Analysis</td>
<td>0.50</td>
</tr>
<tr>
<td>0.50 additional credits in MATH at 2000 level or above</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>1.00 additional credits in MATH or STAT at the 2000 level or above</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>3.00 additional credits in MATH or STAT at the 3000 level or above of which at least 1.50 credits must be STAT at the 4000 level</td>
<td>3.00</td>
<td></td>
</tr>
</tbody>
</table>

Areas of Emphasis

Students are required to complete one of the following Areas of Emphasis. Each Area of Emphasis is 2.50 credits from a single field of study.

Bioinformatics (BINF)
The following credits must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL*2400</td>
<td>Evolution</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*3020</td>
<td>Population Genetics</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*3040</td>
<td>Methods in Evolutionary Biology</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*3300</td>
<td>Applied Bioinformatics</td>
<td>0.50</td>
</tr>
<tr>
<td>MBG*2040</td>
<td>Foundations in Molecular Biology and Genetics</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Biomathematical or Biostatistical Modelling (BBM)
The following credits must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL*2060</td>
<td>Ecology</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*2400</td>
<td>Evolution</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*3060</td>
<td>Populations, Communities and Ecosystems</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*3130</td>
<td>Conservation Biology</td>
<td>0.50</td>
</tr>
<tr>
<td>BIOL*4150</td>
<td>Wildlife Conservation and Management</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Computer Science (CS)
The following credits must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS*2430</td>
<td>Object Oriented Programming</td>
<td>0.50</td>
</tr>
<tr>
<td>CIS*2500</td>
<td>Intermediate Programming</td>
<td>0.50</td>
</tr>
<tr>
<td>CIS*2520</td>
<td>Data Structures</td>
<td>0.50</td>
</tr>
<tr>
<td>Select at least 1.00 credits from the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIS*3110</td>
<td>Operating Systems I</td>
<td>0.50</td>
</tr>
<tr>
<td>CIS*3190</td>
<td>Software for Legacy Systems</td>
<td>0.50</td>
</tr>
<tr>
<td>CIS*3490</td>
<td>The Analysis and Design of Computer Algorithms</td>
<td>0.50</td>
</tr>
<tr>
<td>CIS*3530</td>
<td>Data Base Systems and Concepts</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Note: CIS*2750 Software Systems Development and Integration is recommended in addition to the Area of Emphasis requirements for students interested in Computer Science

Economics (ECON)
The following credits must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON*1050</td>
<td>Introductory Microeconomics</td>
<td>0.50</td>
</tr>
<tr>
<td>ECON*1100</td>
<td>Introductory Macroeconomics</td>
<td>0.50</td>
</tr>
<tr>
<td>ECON*2310</td>
<td>Intermediate Microeconomics</td>
<td>0.50</td>
</tr>
<tr>
<td>Select at least 1.00 credits from the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECON*3100</td>
<td>Game Theory</td>
<td>0.50</td>
</tr>
<tr>
<td>ECON*3710</td>
<td>Advanced Microeconomics</td>
<td>0.50</td>
</tr>
<tr>
<td>ECON*4710</td>
<td>Advanced Topics in Microeconomics</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Note: ECON*1050 Introductory Microeconomics and ECON*1100 Introductory Macroeconomics are approved Liberal Education electives for B.Sc. students

Energy and Mass Transfer (EMT)
The following credits must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG*1210</td>
<td>Engineering Mechanics I</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*2230</td>
<td>Fluid Mechanics</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*2400</td>
<td>Engineering Systems Analysis</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*3260</td>
<td>Thermodynamics</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*3430</td>
<td>Heat and Mass Transfer</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Note: No more than 3.00 credits in ENGG courses may be taken.

Electricity and Systems (EAS)
The following credits must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG*1210</td>
<td>Engineering Mechanics I</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*2400</td>
<td>Engineering Systems Analysis</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*2450</td>
<td>Electric Circuits</td>
<td>0.50</td>
</tr>
<tr>
<td>Select at least 1.00 credits from the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGG*3410</td>
<td>Systems and Control Theory</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*3450</td>
<td>Electronic Devices</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*4460</td>
<td>Robotic Systems</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Note: No more than 3.00 credits in ENGG courses may be taken.

Signal Processing (SP)
The following credits must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG*1210</td>
<td>Engineering Mechanics I</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*2400</td>
<td>Engineering Systems Analysis</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*2450</td>
<td>Electric Circuits</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*3390</td>
<td>Signal Processing</td>
<td>0.50</td>
</tr>
<tr>
<td>ENGG*4660</td>
<td>Medical Image Processing</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Note: No more than 3.00 credits in ENGG courses may be taken.
**Individualized (IN)**

It is required that 2.50 credits are taken from approved Science electives for B.Sc. students where 1.00 credits must be at the 3000 level or above. Students declaring an Individualized Area of Emphasis must have their choice of 2.50 credits approved by an academic advisor.

**Credit Summary**

(20.00 Total Credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First year science credits</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>Required science courses semesters 3 – 8</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Restricted electives (Stream and Area of Emphasis)</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td>Liberal Education electives (# 1 in restricted elective list)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Free electives - any approved elective for B.Sc. students. (Could be less if restricted electives do not count as science)</td>
<td>3.00</td>
</tr>
</tbody>
</table>

Total Credits 20

Of the total credits required, students are required to complete 16.00 credits in science of which 2.00 credits must be at the 4000 level and an additional 4.00 credits must be at the 3000 or 4000 level.

**Minor (Honours Program)**

**Note:** Students majoring in Mathematics, Statistics, or Mathematical Science, or those in the Bachelor of Computing program, cannot minor in Mathematical Science.

A total of 5.00 credits is required to complete the Minor, including:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH*1200</td>
<td>Calculus I &lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.50</td>
</tr>
<tr>
<td>or MATH*1080</td>
<td>Elements of Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH*1210</td>
<td>Calculus II &lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.50</td>
</tr>
<tr>
<td>or MATH*1090</td>
<td>Elements of Calculus II</td>
<td></td>
</tr>
<tr>
<td>MATH*1160</td>
<td>Linear Algebra I</td>
<td>0.50</td>
</tr>
<tr>
<td>STAT*2040</td>
<td>Statistics I</td>
<td>0.50</td>
</tr>
<tr>
<td>1.50 additional credits in MATH, STAT, or CIS at the 2000 level or above &lt;sup&gt;4&lt;/sup&gt;</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>1.00 additional credits in MATH, STAT, or CIS at the 3000 level or above</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> IPS*1500 Integrated Mathematics and Physics I can count toward this 0.50 credit

<sup>2</sup> IPS*1500 Integrated Mathematics and Physics I can count toward this 0.50 credit

<sup>3</sup> CIS*1300 Programming is recommended for those wishing to take further CIS courses

<sup>4</sup> CIS*2050 cannot be counted toward these credits