# BIOMEDICAL COMPUTING – SPECIALIZATION (COMPUTING) – BACHELOR OF COMPUTING (HONOURS)

**BMCO-P-BCH** (Biomedical Computing)  
**BMCO-I-BCH** (Biomedical Computing with Professional Internship)

**Subject:** Administered by the School of Computing in cooperation with the Departments of Biology, Chemistry, and Biomedical and Molecular Sciences.  
**Plan:** Consists of 102.00 units as described below.  
**Program:** The Plan, with sufficient electives to total 120.00 units, will lead to a Bachelor of Computing (Honours) Degree.  

**Note:** Requirements for this program have been modified. Please consult the 2022-2023 [Calendar](https://www.queensu.ca/academic-calendar/archive/2022-2023/arts-science/) for the previous requirements.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Core</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>A. Complete the following:</strong></td>
<td></td>
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</tr>
<tr>
<td>CISC 121</td>
<td>Introduction to Computing Science I</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 124</td>
<td>Introduction to Computing Science II</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>B. Complete the following:</strong></td>
<td></td>
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</tr>
<tr>
<td>BIOL 102</td>
<td>Fundamentals of Biology: Molecular and Cell Biology</td>
<td>3.00</td>
</tr>
<tr>
<td>BIOL 103</td>
<td>Fundamentals of Biology: Organisms to Ecosystems</td>
<td>3.00</td>
</tr>
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<td><strong>C. Complete the following:</strong></td>
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</tr>
<tr>
<td>CHEM 112</td>
<td>General Chemistry</td>
<td>6.00</td>
</tr>
<tr>
<td><strong>D. Complete 6.00 units from the following:</strong></td>
<td></td>
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</tr>
<tr>
<td>CISC 102</td>
<td>Discrete Mathematics for Computing I &amp; MATH 112 and Introduction to Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>CISC 102</td>
<td>Discrete Mathematics for Computing I &amp; MATH 111 and Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 110</td>
<td>Linear Algebra</td>
<td></td>
</tr>
<tr>
<td><strong>E. Complete 6.00 units from the following:</strong></td>
<td></td>
<td>6.00</td>
</tr>
<tr>
<td>MATH 120</td>
<td>Differential and Integral Calculus</td>
<td></td>
</tr>
<tr>
<td>MATH 121</td>
<td>Differential and Integral Calculus</td>
<td></td>
</tr>
<tr>
<td>MATH 123</td>
<td>Differential and Integral Calculus I &amp; MATH 124 and Differential and Integral Calculus II</td>
<td></td>
</tr>
<tr>
<td><strong>F. Complete 3.00 units from the following:</strong></td>
<td></td>
<td>3.00</td>
</tr>
<tr>
<td>STAT 263</td>
<td>Introduction to Statistics</td>
<td></td>
</tr>
<tr>
<td>STAT 268</td>
<td>Statistics and Probability I</td>
<td></td>
</tr>
<tr>
<td>STAT 351</td>
<td>Probability I</td>
<td></td>
</tr>
<tr>
<td><strong>STAT_Options</strong></td>
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<tr>
<td><strong>G. Complete the following:</strong></td>
<td></td>
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</tr>
<tr>
<td>CISC 203</td>
<td>Discrete Mathematics for Computing II</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 204</td>
<td>Logic for Computing Science</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 221</td>
<td>Computer Architecture</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 223</td>
<td>Software Specifications</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 235</td>
<td>Data Structures</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 271</td>
<td>Linear Data Analysis</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>H. Complete the following:</strong></td>
<td></td>
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</tr>
<tr>
<td>BIOL 205</td>
<td>Mendelian and Molecular Genetics</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>I. Complete the following:</strong></td>
<td></td>
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</tr>
<tr>
<td>BCHM 218</td>
<td>Molecular Biology</td>
<td>3.00</td>
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<tr>
<td><strong>J. Complete the following:</strong></td>
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<tr>
<td>CISC 330</td>
<td>Computer-Integrated Surgery</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 352</td>
<td>Artificial Intelligence</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 360</td>
<td>Programming Paradigms</td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 365</td>
<td>Algorithms I</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>K. Complete 3.00 units from the following:</strong></td>
<td></td>
<td>3.00</td>
</tr>
<tr>
<td>BCHM 315</td>
<td>Proteins and Enzymes</td>
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</tr>
<tr>
<td>BIOL 334</td>
<td>Comparative Biochemistry</td>
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<tr>
<td><strong>L. Complete the following:</strong></td>
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<tr>
<td>BIOL 331</td>
<td>Analytical Genomics</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>M. Complete 9.00 units from the following:</strong></td>
<td></td>
<td>9.00</td>
</tr>
<tr>
<td>CISC 320</td>
<td>Fundamentals of Software Development</td>
<td></td>
</tr>
<tr>
<td>CISC 332</td>
<td>Database Management Systems</td>
<td></td>
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<tr>
<td>CISC 471</td>
<td>Computational Biology</td>
<td></td>
</tr>
<tr>
<td>CISC 472</td>
<td>Medical Informatics</td>
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<tr>
<td><strong>N. Complete the following:</strong></td>
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</tr>
<tr>
<td>CISC 497</td>
<td>Social, Ethical and Legal Issues in Computing</td>
<td></td>
</tr>
<tr>
<td><strong>O. Complete 3.00 units from the following:</strong></td>
<td></td>
<td>3.00</td>
</tr>
<tr>
<td>CISC 495</td>
<td>Software Evolution</td>
<td></td>
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<tr>
<td>CISC 499</td>
<td>Advanced Undergraduate Project</td>
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</tr>
<tr>
<td>CISC 500</td>
<td>Undergraduate Thesis</td>
<td></td>
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<tr>
<td><strong>2. Option</strong></td>
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<tr>
<td><strong>A. Complete 12.00 units from the following course list:</strong></td>
<td></td>
<td>2.00</td>
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<tr>
<td>BMCO_Options</td>
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<tr>
<td><strong>Electives</strong></td>
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queensu.ca/academic-calendar
3. Substitutions
A. Students in the internship version of this Plan will substitute 3.00 units from COMP at the 300-level for requirement 1.O. (CISC 499 (https://www.queensu.ca/academic-calendar/search/?P=CISC%20499)). In addition, the B.Cmp.(Hons.) Program requirements will be increased by 6.00 units from COMP at the 300-level, for a total of 126.00 units if the student is taking a 12-month internship, or by 9.00 units from COMP at the 300-level, for a total of 129.00 units if the student is taking a 16-month internship.

4. Notes
A. Students with no programming experience should review the Introductory Courses (https://www.queensu.ca/academic-calendar/arts-science/schools-departments-programs/computing/) paragraph included on the School of Computing overview page in the Calendar.

B. ELEC courses are offered by the Faculty of Engineering and Applied Science. Special permission may be required to register. All such courses will count as 3.00 units towards degree requirements in Arts and Sciences.

C. With the approval of the Undergraduate Chair, students who take CISC 500 working on a project directly related to Biomedical Computing may count 3.00 units towards BMCO_Options.

D. A maximum of 6.00 units from courses offered by other Faculties and Schools may be counted toward the program and/or Plan requirements. This includes courses in BMED, COMM, GLPH, HSCI, LAW, NURS, and courses in the Faculty of Engineering and Applied Science.

Biomedical Computing Course List
The following list contains courses offered through other Departments. In accordance with Academic Regulation 2.6 (Access to Classes), students do not have enrolment priority in all of these courses. Access to these courses may only be made available during the Open Enrolment period, and then only if space permits.

BMCO_Options
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 281</td>
<td>General Organic Chemistry I (with Virtual 3.00 Laboratory)</td>
<td>3.00</td>
</tr>
<tr>
<td>CHEM 282</td>
<td>General Organic Chemistry II</td>
<td>3.00</td>
</tr>
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</table>

CISC_Subs
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM 365</td>
<td>Computer System Architecture</td>
<td>3.00</td>
</tr>
<tr>
<td>ELEC 470</td>
<td>Applications of Numerical Methods</td>
<td>3.00</td>
</tr>
<tr>
<td>MATH 272</td>
<td>Stochastic Models in Operations Research</td>
<td>3.00</td>
</tr>
<tr>
<td>MATH 401</td>
<td>Graph Theory</td>
<td>3.00</td>
</tr>
<tr>
<td>MATH 402</td>
<td>Enumerative Combinatorics</td>
<td>3.00</td>
</tr>
<tr>
<td>MATH 434</td>
<td>Optimization Theory with Applications to Machine Learning</td>
<td>3.00</td>
</tr>
<tr>
<td>MATH 474</td>
<td>Information Theory</td>
<td>3.00</td>
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</table>

STAT_Options
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<thead>
<tr>
<th>Code</th>
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<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 243</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>CHEE 209</td>
<td>Analysis Of Process Data</td>
<td>3.00</td>
</tr>
<tr>
<td>COMM 162</td>
<td>Managerial Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>ECON 250</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>GPHY 247</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>KNPE 251</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>NURS 323</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>POLS 285</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>PSYC 202</td>
<td>Statistics in Psychology</td>
<td>3.00</td>
</tr>
<tr>
<td>SOCY 211</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>STAM 200</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
<tr>
<td>STAT 263</td>
<td>Introduction to Statistics</td>
<td>3.00</td>
</tr>
</tbody>
</table>