BIOINFORMATICS MANAGEMENT, PROFESSIONAL SCIENCE MASTER’S

Banner Code: SC-MSP-BNFM

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This Professional Science Master’s (https://www.professionalsciencemasters.org/) (PSM) degree addresses the growing demand for trained bioinformatics professionals with solid management skills able to assume leadership roles in biotechnology, pharmaceutical and health care sectors. The flexible degree structure allows students to custom design a curriculum that best suits their needs and allows a focus on the biological big data analysis, genomics, or bioinformatics software development and management. Students will receive advanced training in bioinformatics and management through coursework and an external internship. The curriculum was developed with active input from the Program Advisory Board consisting of recognized leaders in the field. Many courses are offered in a distance-learning format, allowing students to participate in class without having to travel to campus.

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Graduate Admissions Policies (http://catalog.gmu.edu/admissions/graduate-policies/) section of this catalog.

To apply for this program, please complete the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now/).

Applicants should have a bachelor’s degree in biology, computer science, or a related field with a GPA of at least 3.00 in their last 60 credits of study. Applicants should have taken courses in molecular biology, computer science, calculus, physical chemistry, and statistics. Students with deficiencies in one or more of these areas may be required to take additional courses from the undergraduate curriculum. To apply, prospective students should submit the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now/), supply an official transcript from each college and graduate institution attended, a current résumé, three letters of recommendation, and an expanded goals statement. TOEFL or IELTS scores are required of all international applicants.

The GRE is not required for admission into this program.

Policies

For policies governing all graduate programs, see AP6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

Requirements

Degree Requirements

Total credits: 31

Students should refer to the Admissions & Policies tab for specific policies related to this program.

Due to the varied course options and their associated prerequisites, students are encouraged to create a program of study with their faculty advisor by the end of their first semester of studies.

Bioinformatics Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BINF 630</td>
<td>Bioinformatics Methods</td>
<td>3</td>
</tr>
<tr>
<td>BINF 631</td>
<td>Molecular Cell Biology for Bioinformatics</td>
<td>3</td>
</tr>
<tr>
<td>BINF 702</td>
<td>Biological Data Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two from the following or other BINF-prefixed courses in consultation with the faculty advisor:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BINF 633</td>
<td>Molecular Biotechnology</td>
<td></td>
</tr>
<tr>
<td>BINF 634</td>
<td>Bioinformatics Programming</td>
<td></td>
</tr>
<tr>
<td>BINF 650</td>
<td>Introduction to Bioinformatics Database Design</td>
<td></td>
</tr>
<tr>
<td>BINF 731</td>
<td>Protein Structure Analysis</td>
<td></td>
</tr>
<tr>
<td>BINF 732</td>
<td>Genomics</td>
<td></td>
</tr>
<tr>
<td>BINF 740</td>
<td>Introduction to Biophysics</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 15

Professional Skills Courses

Please note: MBA-prefixed courses are offered on an alternative semester schedule (view the Schedule of Classes (https://patriotweb.gmu.edu/pls/prod/bwkschd.p_disp_dyn_sched/) for details). Considering this, it may be advisable to take these courses in one semester rather than over several.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BINF 705</td>
<td>Research Ethics</td>
<td>1</td>
</tr>
<tr>
<td>MBA 712</td>
<td>Project Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Select one course from the following that hasn't previously been taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 508</td>
<td>Selected Topics in Animal Biology</td>
<td></td>
</tr>
<tr>
<td>COS 500</td>
<td>Professional Preparation for STEM Disciplines</td>
<td></td>
</tr>
<tr>
<td>COS 600</td>
<td>Multidisciplinary Problem Solving and Leadership</td>
<td></td>
</tr>
<tr>
<td>EVPP 638</td>
<td>Corporate Environmental Management and Policy</td>
<td></td>
</tr>
<tr>
<td>AIT 671</td>
<td>Information System Infrastructure Lifecycle Management</td>
<td></td>
</tr>
<tr>
<td>COMM 641</td>
<td>Advanced Communication Skills for STEM</td>
<td></td>
</tr>
<tr>
<td>GBUS 613</td>
<td>Financial Reporting and Decision Making</td>
<td></td>
</tr>
</tbody>
</table>
GBUS 623  Marketing Management  
GBUS 643  Managerial Finance  
GBUS 653  Organizational Behavior  
GBUS 738  Data Mining for Business Analytics  
or MBA 738  Data Mining for Business Analytics  
GCH 691  Project Management in Public Health  
HAP 713  Project Management in Health Information Technology  
MBA 712  Project Management  
MBA 726  Negotiations  
PUAD 781  Information Management: Technology and Policy  
SWE 625  Software Project Management  
or other courses in consultation with the faculty advisor  

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Courses in consultation with the faculty advisor</td>
<td>7</td>
</tr>
</tbody>
</table>

1  When the topic is Research & Development in Biotechnology Companies.

**Scientific Electives**

Close attention should be paid to each course’s prerequisites.

Select 6 credits in courses that haven’t previously been taken, tailored to suit interests and goals in consultation with the faculty advisor.

**Big Data Analysis:**

- CSI 695  Scientific Databases
- AIT 580  Analytics: Big Data to Information
- AIT 581  Problem Formation and Solving in Big Data
- AIT 622  Determining Needs for Complex Big Data Systems

**Synthetic and Systems Biology:**

- BIOS 701  Systems Biology
- CHEM 665  Protein-Protein Interactions: Methods and Applications

**Human Health and Personal Genomics:**

- BINF 732  Genomics
- BIOL 562  Personalized Medicine
- BIOL 566  Cancer Genomics
- BIOL 665  Environmental Hazards to Human Health
- BIOS 740  Laboratory Methods in Functional Genomics and Biotechnology
- BIOS 741  Genomics

**Software Development and Analysis:**

- BINF 634  Bioinformatics Programming
- SWE 510  Object-Oriented Programming in Java
- SWE 619  Object-Oriented Software Specification and Construction
- SWE 621  Software Design and Architecture
- SWE 626  Software Project Laboratory
- SWE 637  Software Testing
- SWE 645  Component-Based Software Development
- SWE 760  Software Analysis and Design of Real-Time Systems

**Colloquium:**

- BINF 704  Colloquium in Bioinformatics (may be repeated for up to 3 credits)

**Additional Internship Experience**

- BINF 795  Bioinformatics Internship

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Credits</td>
<td>6</td>
</tr>
</tbody>
</table>

1  If chosen, it is recommended that students take the colloquium course early in their studies so that they may be exposed to various possibilities and areas of research presented by the speakers.

2  The maximum amount of internship credits that can be applied to the degree is 6 credits.

**Internship**

The internship component is intended to provide students with the opportunity to put into practice all of the skills and knowledge accumulated throughout their studies in this program. Students must arrange an internship with a private company, a governmental agency, a non-governmental organization, or some other entity with an interest in bioinformatics and management. Students must identify a specific person within that outside entity who will be the contact and manager of the internship.

Internship credit is never given for work previously done, or for work that would have been done in any case due to an existing employment relationship.

The internship work must produce one or more products such as: a comprehensive report, a departmental presentation, a research project, or an article. Internship placement and product type must be approved by the student’s faculty advisor.

Further details and procedures for completing the internship can be found with the faculty advisor.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Three credits of internship</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td>3</td>
</tr>
</tbody>
</table>

**Accelerated Master’s**

**Bachelor’s Degree (selected), Bioinformatics Management, Accelerated PSM**

**Overview**

This degree option allows highly qualified George Mason University bachelor’s students to earn a Bioinformatics Management, PSM (https://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/) degree in less time than if they had first graduated with a BS degree and then applied to the PSM program sequentially.
Admission and Processing Requirements

Students in the Biology, BS (https://catalog.gmu.edu/colleges-schools/science/biology/biology-bs/); Chemistry, BS (https://catalog.gmu.edu/colleges-schools/science/chemistry-biochemistry/chemistry-bs/); Computational and Data Sciences, BS (https://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-data-sciences-bs/); Neuroscience, BS (https://catalog.gmu.edu/colleges-schools/science/neuroscience-program/neuroscience-bs/); or Physics, BS (https://catalog.gmu.edu/colleges-schools/science/physics-astronomy/physics-bs/) with an overall GPA of at least 3.00 in their last 60 credits are welcome to apply to the Bioinformatics Management, PSM accelerated master's program. Applicants to this accelerated master's should have previously taken courses in molecular biology, computer science, calculus, physical chemistry, and statistics. Students with deficiencies in one or more of these areas may be required to take additional courses from the undergraduate curriculum.

The GRE requirement is waived for students accepted into this accelerated program.

By the beginning of the undergraduate student’s senior year, they should submit a Graduate Application for Accelerated Master’s Program form (obtained from the College of Science's Office of Academic and Student Affairs (https://cos.gmu.edu/about/contact-us/)).

By at least the beginning of their senior year, students should seek out the Bioinformatics Management, PSM (https://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/) Program Director who will aid the student in choosing the appropriate graduate courses to take and help to prepare the student for graduate studies.

In their senior year, accelerated master's students must complete the two graduate courses indicated on their Accelerated Master’s Program Application with a minimum grade of 3.00 in each course. They must maintain a minimum GPA of 3.00 in all coursework and in coursework applied to their major. In the semester specified on the application (around the completion and conferral of the undergraduate degree), students must submit the Bachelor’s/Accelerated Master’s Transition form (found on the Office of the University Registrar website (http://registrar.gmu.edu/forms/)) and will subsequently be admitted into graduate status.

Reserve Graduate Credits

Students admitted to this program may take graduate courses after completing 90 undergraduate credits, and up to 6 credits of appropriate graduate coursework may be used in partial satisfaction of the requirements for the undergraduate degree. If students earn at least a 3.00 GPA in these classes, they are granted advanced standing in the master’s program and must then complete an additional 25 credits to receive the master’s degree.

To apply these credits to the master’s degree, students must request that the credits be moved from the undergraduate degree to the graduate degree using the Bachelor’s/Accelerated Master’s Transition form found on the Office of the University Registrar website (http://registrar.gmu.edu/forms/) (as noted above).

Students may take up to 6 additional approved graduate credits as reserve graduate credit. These credits do not apply to the undergraduate degree but will reduce the subsequent master’s degree credits accordingly (e.g., with 6 credits counted towards undergraduate degree plus the maximum 6 reserve credits, the PSM could be completed with 19 post-bachelor’s credits). The ability to take courses for reserve graduate credit is available to all high achieving undergraduates with the permission of the School of Systems Biology (https://catalog.gmu.edu/colleges-schools/science/systems-biology/).

Policies

For more detailed information on accelerated master’s in general, see AP.6.7 Bachelor’s/Accelerated Master’s Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

For policies governing all graduate programs, see AP6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).