THE OHIO STATE UNIVERSITY

**Data Analytics Major**
**College of Arts and Sciences**

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January 17, 2020
(rev. February 3, 2020)

College of Arts and Sciences Curriculum Committee

Dear Committee Members:

We request that the College of Arts and Sciences Curriculum Committee approve a revision to an existing specialization in the undergraduate Data Analytics major.

We propose to change the name of the *Biomedical Informatics* specialization to *Biomedical and Public Health Analytics*, to revise the learning outcomes for the specialization to be inclusive of analytics concepts, knowledge and skills from a broader range of perspectives than exists currently in the specialization, and to revise the curriculum to enable students to meet the revised objectives. The proposed revision will reduce the number of required credit hours in the specialization to provide a closer match to other existing specializations, which should make the specialization more attractive to students. Finally, the revised curriculum will introduce the College of Public Health as a new partner in the undergraduate Data Analytics major program.

As part of our regular assessment efforts, the Management Committee of the undergraduate Data Analytics major reviews the major's core curriculum as well as the curricula for our five existing specializations. This assessment process revealed that students were facing challenges navigating some aspects of the existing curriculum. This was due to both a limited number of course options in the specialization and limited availability to offer all courses on a regular schedule. The proposed revisions to the specialization will remove these challenges and at the same time expand the range of health-related analytics concepts to which students in the specialization are exposed.

The following documents are enclosed under this cover:

1. *Proposed Modified Specialization for the Existing BS Degree – Data Analytics Major: Biomedical and Public Health Analytics Specialization*
    a. Rationale for proposed revisions
    b. Specialization educational objectives
    c. Proposed specialization curriculum
    d. Curriculum maps
2. *Curriculum sheet* (for students)
    a. Information about pre-requisite, core, specialization and general education requirements for students under the revised specialization
3. *Suggested four-year sample plan* (for students)
    a. Outline of a four-year pathway to graduation for students under the revised specialization
4. *Transition plan for students currently in the BMI specialization*
5. *Curriculum sheet and suggested four-year sample plan for **current** Biomedical Informatics Specialization*

Details about the proposed revisions can be found in the documents referenced above. A summary of the impact of the changes on the number of required credit hours for students completing the specialization are as follows:

- **Prerequisite credit hours:** The current specialization requires **13** credit hours of specialization-specific prerequisites. The revised specialization will require only **9** such credit hours. All prerequisites, with the exception of CSE 1223, satisfy General Education requirements.

- **Specialization credit hours:** The current specialization requires students to complete **21** credit hours in the specialization. Students will be able to complete the revised specialization with as few as **15** required credit hours.

Under the revised curriculum, students will be able to complete the specialization by taking as few as **131** credit hours, compared with **138** credit hours under the existing specialization, while at the same time being exposed to a wider range of ideas and concepts. We believe these changes will make the specialization more attractive to and beneficial for students.

The College of Public Health and the Department of Biomedical Informatics plan to design jointly a new course to satisfy the major's capstone requirement for students in the revised specialization. This course is labeled as "BMI 5899 / PUBH 5899: Capstone in Biomedical and Public Health Analytics" in the proposal and accompanying advising sheets. Until that course has been developed and approved, students in the specialization will continue to take "Stat 4911: Data Analytics Capstone" to satisfy the requirement.

No changes to the major's assessment plan will be required as a result of this proposal, though its implementation will be adapted to reflect the revised outcomes and the new courses. Our assessment plan calls for the use of direct and indirect measures to assess both the core educational outcomes and the outcomes that are specific to each specialization. We currently use the University's exit survey and a focus group consisting of our Academic Path Peers to obtain indirect measures; this process will remain unchanged under the revised curriculum. Direct measures are sourced from course embedded testing using goal-specific rubrics and evaluation of capstone projects, reports and presentations. The assessment plan calls for annual assessment of the core outcomes and a year-by-year assessment rotation through the specialization outcomes. While an ongoing review of the BMI specialization led to these proposed curricular revisions, we not yet formally reported assessment data on the existing specialization outcomes due to both small initial enrollments and the limited number of offerings of existing specialization courses. Following implementation of the proposed revisions, we will begin to collect direct measurements on the revised outcomes according to our existing protocol. Assessment data will be reported per the rotating schedule after students have started to graduate under the revised specialization curriculum.

Our transition plan for students who are already in the existing specialization is to allow them to complete the specialization under the revised (smaller) number of required credit hours while using the courses they have already completed toward this end. Details for this plan can be found in the attached documents.

The proposed revisions were developed jointly by the Data Analytics major's Management Committee, the Department of Biomedical Informatics in the College of Medicine, and the College of Public Health, and were presented to and discussed with the major's Steering Committee on September 26, 2019.

Please feel free to contact us with any questions or concerns about this proposed revision to the major.

Sincerely,

THE OHIO STATE UNIVERSITY

Dr. Christopher Hans
Associate Professor, Statistics
Co-director of the Data Analytics Major

Dr. Srinivasan Parthasarathy
Professor of Computer Science and Engineering
Co-director of the Data Analytics Major

**Proposed Modified Specialization for the Existing BS Degree - Data Analytics Major:**
***Biomedical and Public Health Analytics***
**Modified Submission – December 6, 2019**

## Introduction

There is interest and demand for integrating more health-related content into the curriculum for the BS degree Data Analytics major. Currently, the most compatible specialization is *Biomedical Informatics*. Representatives from the College of Public Health and the College of Medicine – Department of Biomedical Informatics met with representatives from the respective curriculum committees for the interdisciplinary BS degree Data Analytics major. Discussions focused on combining relevant public health content/courses with a select subset of courses under the current *Biomedical Informatics* specialization to develop the modified specialization in *Biomedical and Public Health Analytics*.

The curriculum for the proposed modified and hybridized specialization in *Biomedical and Public Health Analytics* was established in alignment with educational objectives established for the specialization. These educational objectives represent competencies, or what students are expected to know and be able to do upon completion of the BS degree Data Analytics specialization in *Biomedical and Public Health Analytics*. The curriculum consists of a combination of courses that include foundational content (9-10 credits) delivered via three courses. Additional basic and applied content is attained via an additional selected elective (2-3 credits) plus a capstone experience (4 credits).

This is a unique combination of content area. Indeed, students completing the major with this specialization will be able to gather, review, organize, calculate and interpret more comprehensive complementary and compatible data applicable to both clinical health care and population-based public health practice. They will be qualified for applicable data analytics positions at agencies and organizations engaged in health care delivery, insurance, public health, and human resources.

The modified specialization will require a preferred 15-17 credits compared with the current 21 credit BMI specialization. The existing core educational objectives for the Data Analytics major plus the educational objectives (competencies) for the proposed modified specialization follow.

## Core Educational Objectives for the BS Degree Major in Data Analytics

(https://data-analytics.osu.edu/major/core-curriculum)

A student graduating with a Bachelor of Science degree with a major in Data Analytics will demonstrate:

1. an understanding of and ability to apply computer science principles relating to data representation, retrieval, programming, and analysis.
2. an understanding of and ability to apply mathematical and statistical models and concepts to detect patterns in data, and to draw inferences and conclusions supported by data.
3. critical thinking skills associated with problem identification, problem solving and decision making, assessing value propositions supported by data, and generating a logical synthesis of information from data.
4. the ability to apply knowledge gained from one area to problems and data in another.
5. the ability to communicate findings and their implications, and to apply them effectively in organizational settings.

**Specialization Educational Objectives (Competencies) Proposed for *Biomedical and Public Health Analytics***

In addition to the Core Educational Objectives for the BS degree – Data Analytics major, students graduating with a specialization in *Biomedical and Public Health Analytics* will be able to:

1. demonstrate an understanding of the core sub-disciplines of biomedical informatics and public health that play a role in the design, implementation, and management of clinical, research, and translational information systems.
2. describe the contributing theoretical frameworks that are conventionally used to inform the design and use of biological data, medical information systems, and integrative data discovery and analysis tools.
3. apply critical evaluation skills that allow for the analysis of system design, interpretation and utilization of biomedical and public health information systems and data.

**Proposed Curriculum for the *Biomedical and Public Health Analytics* Specialization (15-17 Credits)**

**Required Courses (9 to 10 Credits):**

- **MolGen 4500** General Genetics (3 cr) or **4606** Molecular Genetics (4 cr)
- **BMI 5710** Introduction to Biomedical Informatics (3 cr)
- **PUBHLTH 5015** Public Health Data Analytics I (3 cr)

**Elective Courses (Select One; 2 to 3 Credits):**

- **BMI 5720** Introduction Imaging Informatics (3 cr)
- **BMI 5730** Introduction Bioinformatics (3 cr)
- **BMI 5740** Introduction Research Informatics (3 cr)
- **BMI 5750** Methods in Biomedical Informatics (3 cr)
- **BMI 5760** Public Health Informatics (3 cr)
- **BMI 5770** Health Analytics: Data to Discovery to Dissemination (3 cr)
- **PUBHEPI 5420** Infectious Disease Modeling in Humans and Animals (3 cr)
- **PUBHBIO 5280** Introduction to Genomic Data Analysis (2 cr)
- **PUBHEPI 5421** Mathematics of Infectious Disease Dynamics(3 cr)
- **GEOG 5226** Spatial Simulation and Modeling in GIS (3 cr)

**Capstone Experience (4 Credits):**

- **BMI 5899/PUBH 5899** Capstone in Biomedical and Public Health Analytics (4 cr)*

* BMI 5899/PUBH 5899 is expected to be designed in the near future. Until this course has been designed and approved, students in the specialization will continue to take STAT 4911 Data Analytics Capstone to satisfy the major's capstone requirement.

**(Please Continue to Next Page)**

**Table 1. Map of Proposed Curriculum (15-17 credits) for the *Biomedical and Public Health Analytics* Specialization vs. the Major Competencies:**

| BS Degree *Data Analytics* Major Competencies | Foundation Courses (9-10 credits) | | | Elective Courses (select one) (2-3 credits) | | | | | | | | Capstone (4 credits) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MolGen 4500 or 4606 | BMI 5710 | PUBHLTH 5015 | BMI 5720 | BMI 5730 | BMI 5740 | BMI 5760 | PUBHEPI 5420 | PUBHBIO 5280 | PUBHEPI 5421 | GEOG 5226 | BMI 5899/ PUBH 5899 |
| 1. an understanding of and ability to apply computer science principles relating to data representation, retrieval, programming, and analysis. | | X | X | X | X | X | X | | | | | X |
| 2. an understanding of and ability to apply mathematical and statistical models and concepts to detect patterns in data, and to draw inferences and conclusions supported by data. | | X | X | X | X | X | X | X | X | X | | X |
| 3. critical thinking skills associated with problem identification, problem solving and decision making, assessing value propositions supported by data, and generating a logical synthesis of information from data. | | X | X | X | X | X | X | X | X | X | | X |
| 4. the ability to apply knowledge gained from one area to problems and data in another. | | X | X | X | X | X | X | X | X | X | X | X |
| 5. the ability to communicate findings and their implications, and to apply them effectively in organizational settings. | | X | X | X | X | X | X | X | X | X | X | X |
| | | | | | | | | | | | | |

**Table 2. Map of Proposed Curriculum (15-17 credits) for the *Biomedical and Public Health Analytics* Specialization vs. the Specialization Competencies:**

| ***Biomedical and Public Health Analytics*** **Specialization Competencies** | **Foundation Courses (9-10 credits)** | | | **Elective Courses (select one) (2-3 credits)** | | | | | | | | **Capstone (4 credits)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **MolGen 4500 or 4606** | **BMI 5710** | **PUBHLTH 5015** | **BMI 5720** | **BMI 5730** | **BMI 5740** | **BMI 5760** | **PUBHEPI 5420** | **PUBHBIO 5280** | **PUBHEPI 5421** | **GEOG 5226** | **BMI 5899/ PUBH 5899** |
| 1. Demonstrate an understanding of the core sub-disciplines of biomedical informatics and public health that play a role in the design, implementation, and management of clinical, research, and translational information systems. | | **X** | **X** | | | | | | | | | |
| 2. Describe the contributing theoretical frameworks that are conventionally used to inform the design and use of biological data, medical information systems, and integrative data discovery and analysis tools. | **X** | **X** | **X** | | | | | | | | | |
| 3. Apply critical evaluation skills that allow for the analysis of system design, interpretation and utilization of biomedical and public health information systems and data. | | | | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| | | | | | | | | | | | | |

# BACHELOR OF SCIENCE (BS) DATA ANALYTICS:
## BIOMEDICAL AND PUBLIC HEALTH ANALYTICS SPECIALIZATION

### Major Prerequisites (22 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major. Online options may be available for courses marked ●. Please refer to the ASC General Education course list for GE online courses.

| Department | Course | Hours | Term Offered |
|---|---|---|---|
| Math | **Math 1151** ● (1161 or 1181H) – Calculus I | 5 | AU/SP/SU |
| | **Math 1152** ● (1172, 2162 or 2182H) – Calculus II | 5 | AU/SP/SU |
| Computer Science & Engineering | ***CSE 1223** – Computer Programming in Java | 3 | AU/SP/SU |
| Chemistry | CHEM 1110 ●/1210/1250/1610 – Chemistry I | 5 | AU/SP/SU |
| Biology | BIO 1113 – Energy Transfer and Development | 4 | AU/SP/SU |

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

### Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

| Department | Course | Hours | Terms Offered |
|---|---|---|---|
| Math | Math 2568 ● – Linear Algebra | 3 | AU/SP/SU |
| Industrial & Systems Engineering | ISE 3230 – Systems Modeling and Optimization | 3 | AU |
| Computer Science & Engineering | **CSE 2221** – Software I: Software Components | 4 | AU/SP/SU |
| | CSE 2231 – Software II: Development & Design | 4 | AU/SP/SU |
| | CSE 2321 – Foundations I: Discrete Structures | 3 | AU/SP/SU |
| | CSE 2421 or 3430 – Systems I: Computer Systems | 4 | AU/SP/SU |
| | CSE 3241 – Databases I: Computer Architecture | 3 | AU/SP/SU |
| | CSE 3244 or 5242 – Adv. DB & Cloud Computing | 3 | AU/SP |
| | CSE 5243 – Data Mining | 3 | AU/SP |
| | CSE 5544 or ISE 5760 – Data Visualization | 3 | AU/SP |
| Statistics | STAT 3201 – Probability for Data Analytics | 3 | AU/SP |
| | STAT 3202 – Statistical Inference for Data Analytics | 4 | AU/SP |
| | STAT 3301 – Statistical Modeling for Discovery I | 3 | AU |
| | STAT 3302 – Statistical Modeling for Discovery II | 3 | SP |
| | STAT 4620 – Statistical Learning | 2 | AU |
| | STAT 3303 – Statistical Decision Making | 3 | SP |

### Biomedical and Public Health Analytics Specialization (15-17 hours)

| | | |
|---|---|---|
| MolGen 4500 or 4606 – Molecular Genetics | 3-4 | AU/SP/SU |
| BMI 5710 ● – Introduction to Biomedical Informatics | 3 | AU |
| PUBHLTH 5015 – Public Health Data Analytics | 3 | AU |
| Biomedical and Public Health elective – Choose one course from back of sheet | 2-3 | AU/SP |
| BMI 5899/PUBHLTH 5899/STAT 4911 – Capstone in Data Analytics **(SP Senior year)** | 4 | SP |

### GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of the General Education curriculum requirements.

# BACHELOR OF SCIENCE (BS) DATA ANALYTICS:
## BIOMEDICAL AND PUBLIC HEALTH ANALYTICS SPECIALIZATION

| ELECTIVES: BIOMEDICAL INFORMATICS AND PUBLIC HEALTH ANALYTICS | | | |
|---|---|---|---|
| **COURSE** | **TITLE** | **HOURS** | **PREREQUISITES** |
| Choose **one** of the following: | | | |
| BMI 5720 | Intro to Imaging Informatics | 3 | None |
| BMI 5730 | Intro to Bioinformatics | 3 | None |
| BMI 5740 | Intro to Research Informatics | 3 | None |
| BMI 5750 ● | Methods in Biomedical Informatics | 3 | Basic knowledge of computer science principles, statistical methods, and medical terminology |
| BMI 5760 ● | Public Health Informatics | 3 | None |
| BMI 5770 | Health Analytics: Data to Discovery to Dissemination | 3 | None |
| PUBHEPI 5420 | Modeling Infectious Disease in Humans and Animals | 3 | Junior standing or above |
| PUBHBIO 5280 | Intro to Genomic Data Analysis | 2 | Junior standing or above, Math 1151 or 1156, Stat 2450 or higher, Biology 1113 or MolGen 5660 |
| PUBHEPI 5421 | Mathematics of Infectious Disease Dynamics | 3 | Math 1152 or 1172 |
| GEOG 5226 | Spatial Simulation and Modeling | 3 | None |

# BACHELOR OF SCIENCE (BS) DATA ANALYTICS:
# BIOMEDICAL AND PUBLIC HEALTH ANALYTICS SPECIALIZATION

## Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

| Year | Autumn | | Spring | |
|---|---|---|---|---|
| | **Course** | **Hrs.** | **Course** | **Hrs.** |
| 1 | ASC 1100.xx | 1 | Math 1152 or 2162 or 1172 or 2182H** | 5 |
| | Math 1151 or 1161 or 1181H | 5 | CSE 2221 | 4 |
| | CSE 1223 or equiv | 3 | GE Foreign Language 1 | 4 |
| | CHEM 1110 or 1210 (GE Phys Sci) | 5 | BIO 1113 (GE Bio Sci) | 4 |
| | GE Writing Level I | 3 | | |
| | **Total:** | **17** | **Total:** | **17** |
| 2 | CSE 2231 | 4 | Math 2568 | 3 |
| | CSE 2321 | 3 | CSE 2421 or 3430 | 4 |
| | STAT 3201 | 3 | STAT 3202 | 4 |
| | GE Foreign Language 2 | 4 | GE Writing Level 2 | 3 |
| | MOLGEN 4500 or 4606 | 3-4 | GE Foreign Language 3 | 4 |
| | **Total:** | **17-18** | **Total:** | **18** |
| 3 | ISE 3230 | 3 | CSE 5544 **or** ISE 5760 | 3 |
| | CSE 3241 | 3 | STAT 3302 | 3 |
| | STAT 3301 | 3 | GE Historical Study | 3 |
| | BMI 5710*** | 3 | GE Open Option* | 3 |
| | GE Literature | 3 | GE Visual and Performing Arts | 3 |
| | **Total:** | **15** | **Total:** | **15** |
| 4 | CSE 5243 | 3 | CSE 3244 | 3 |
| | STAT 4620 | 2 | STAT 3303 | 3 |
| | PubHlth 5015*** | 3 | BMI/PubHlth elective*** | 2-3 |
| | GE Cult. & Ideas or 2nd Historical Study | 3 | STAT 4911 Capstone | 4 |
| | GE Social Science | 3 | GE Social Science | 3 |
| | GE Natural Science | 3 | | |
| | **Total:** | **17** | **Total:** | **15-16** |

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is recommended for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** Most BMI and Public Health courses are offered only one semester per year. Careful planning is needed.

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

**Total hours to complete the degree program = 131**

Revised: 02/2020

# Biomedical and Public Health Analytics Specialization
Transition Plan

Students who have already declared BMI as their specialization sub-plan ("transitioning students" below) will be allowed to complete the major under the revised (smaller) number of required credit hours while using any courses they have already completed in the existing specialization toward this end. Students who declare BPHA as their specialization sub-plan after the revisions are approved will take courses under the revised curriculum.

Transitioning students may count toward the MolGen requirement any MolGen course that was previously approved as part of the student's plan of study. Otherwise, students should take MolGen 4500 or 4606 under the new curriculum.

Transitioning students are required to take BMI 5710 and to fulfill the capstone requirement, as these are required under the both the existing and proposed curricula.

The proposed curriculum requires students to take PBHLTH 5015 plus one elective. Because PBHLTH 5015 is not required under the existing curriculum, transitioning students should instead take two elective courses from the list below. Students may opt to take PBHLTH 5015 as one of the elective courses. This will allow transitioning students to count all 5000-level BMI courses they have already taken toward the specialization requirements.

## **Biomedical and Public Health Analytics Specialization** (15-17 hours)
Transition Curriculum

| | | |
|---|---|---|
| Any previously approved MolGen course, or MolGen 4500 or 4606 – Molecular Genetics | 3-4 | AU/SP/SU |
| BMI 5710 ● – Introduction to Biomedical Informatics | 3 | AU |
| Biomedical and Public Health electives – Choose two courses from the elective list below*. | 5-6 | AU/SP |
| BMI 5899/PUBHLTH 5899/STAT 4911 – Capstone in Data Analytics **(SP Senior year)** | 4 | SP |

| **TRANSITION PLAN ELECTIVES: BIOMEDICAL INFORMATICS AND PUBLIC HEALTH ANALYTICS** | | | |
|---|---|---|---|
| **COURSE** | **TITLE** | **HOURS** | **PREREQUISITES** |
| Choose **two** of the following: | | | |
| BMI 5720 | Intro to Imaging Informatics | 3 | None |
| BMI 5730 | Intro to Bioinformatics | 3 | None |
| BMI 5740 | Intro to Research Informatics | 3 | None |
| BMI 5750 ● | Methods in Biomedical Informatics | 3 | Basic knowledge of computer science principles, statistical methods, and medical terminology |
| BMI 5760 ● | Public Health Informatics | 3 | None |
| BMI 5770 | Health Analytics: Data to Discovery to Dissemination | 3 | None |
| PBHLTH 5015* | Public Health Data Analytics | 3 | PUBHBIO 2210 or 6210 or STAT 3202, 3470 or STAT 5301 or permission of instructor. |
| PUBHEPI 5420 | Modeling Infectious Disease in Humans and Animals | 3 | Junior standing or above |
| PUBHBIO 5280 | Intro to Genomic Data Analysis | 2 | Junior standing or above, Math 1151 or 1156, Stat 2450 or higher, Biology 1113 or MolGen 5660 |
| PUBHEPI 5421 | Mathematics of Infectious Disease Dynamics | 3 | Math 1152 or 1172 |
| GEOG 5226 | Spatial Simulation and Modeling | 3 | None |

*Transitioning students may elect to take PBHLTH 5015, but it is not required.

Current BMI Specialization

# BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BIOMEDICAL INFORMATICS SPECIALIZATION

## Major Prerequisites (26 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major.

| Department | Course | Hours | Term Offered |
|---|---|---|---|
| Math | **Math 1151** (1161 or 1181H) – Calculus I | 5 | AU/SP/SU |
| | **Math 1152** (1172, 2162 or 2182H) – Calculus II | 5 | AU/SP/SU |
| Computer Science & Engineering | ***CSE 1223** – Computer Programming in Java | 3 | AU/SP/SU |
| Chemistry | CHEM 1110/1210/1250/1610 – Chemistry I | 5 | AU/SP/SU |
| Biology | BIO 1113 – Energy Transfer and Development | 4 | AU/SP/SU |
| | BIO 1114 – Form, Function, Diversity, and Ecology | 4 | AU/SP/SU |

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

## Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

| Department | Course | Hours | Terms Offered |
|---|---|---|---|
| Math | Math 2568 – Linear Algebra | 3 | AU/SP/SU |
| Industrial & Systems Engineering | ISE 3230 – Systems Modeling and Optimization | 3 | AU |
| Computer Science & Engineering | **CSE 2221** – Software I: Software Components | 4 | AU/SP/SU |
| | CSE 2231 – Software II: Development & Design | 4 | AU/SP/SU |
| | CSE 2321 – Foundations I: Discrete Structures | 3 | AU/SP/SU |
| | CSE 2421 or 3430 – Systems I: Computer Systems | 4 | AU/SP/SU |
| | CSE 3241 – Databases I: Computer Architecture | 3 | AU/SP/SU |
| | CSE 3244 or 5242 – Adv. DB & Cloud Computing | 3 | AU/SP |
| | CSE 5243 – Data Mining | 3 | AU/SP |
| | CSE 5544 or ISE 5760 – Data Visualization | 3 | AU/SP |
| Statistics | STAT 3201 – Probability for Data Analytics | 3 | AU/SP |
| | STAT 3202 – Statistical Inference for Data Analytics | 4 | AU/SP |
| | STAT 3301 – Statistical Modeling for Discovery I | 3 | AU |
| | STAT 3302 – Statistical Modeling for Discovery II | 3 | SP |
| | STAT 4620 – Statistical Learning | 2 | AU |
| | STAT 3303 – Statistical Decision Making | 3 | SP |

## Biomedical Informatics Specialization (21 hours)

| | |
|---|---|
| MOLGEN 5660 – Molecular and Cellular Biology (MOLGEN 5650 & 4500 approved as alternates) | 5 |
| BMI 5710 – Intro to Biomedical Informatics | 3 |
| BMI 5720 – Intro to Imaging Informatics (any BMI 5000-level approved as alternate) | 3 |
| BMI 5730 – Intro to Bioinformatics | 3 |
| BMI 5740 – Intro to Research Informatics | 3 |
| STAT 4911 – Capstone in Data Analytics **(SP Senior year)** | 4 |

## GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of your General Education curriculum requirements.

Revised 03/2019

Current BMI Specialization

# BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BIOMEDICAL INFORMATICS SPECIALIZATION

## Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

| Year | Autumn | | Spring | |
|---|---|---|---|---|
| | **Course** | **Hrs.** | **Course** | **Hrs.** |
| 1 | ASC 1100.xx | 1 | Math 1152 or 2162 or 1172 or 2182H** | 5 |
| | Math 1151 or 1161 or 1181H | 5 | CSE 2221 | 4 |
| | CSE 1223 or equiv | 3 | GE Foreign Language 1 | 4 |
| | Chemistry 1110 or 1210 (GE Phys Sci) | 5 | Biology 1113 (GE Bio Sci) | 4 |
| | GE Writing Level I | 3 | | |
| | **Total:** | **17** | **Total:** | **17** |
| 2 | CSE 2231 | 4 | Math 2568 | 3 |
| | CSE 2321 | 3 | CSE 2421 or 3430 | 4 |
| | Stat 3201 | 3 | Stat 3202 | 4 |
| | GE Foreign Language 2 | 4 | GE Writing Level 2 | 3 |
| | Biology 1114 (GE Bio Sci) | 4 | GE Foreign Language 3 | 4 |
| | **Total:** | **18** | **Total:** | **18** |
| 3 | ISE 3230 | 3 | CSE 5544 **or** ISE 5760 | 3 |
| | CSE 3241 | 3 | Stat 3302 | 3 |
| | Stat 3301 | 3 | BMI 5730*** | 3 |
| | BMI 5710*** | 3 | GE Open Option* | 3 |
| | BMI 5720*** | 3 | GE Visual and Performing Arts | 3 |
| | GE Historical Study | 3 | GE Literature | 3 |
| | **Total:** | **18** | **Total:** | **18** |
| 4 | CSE 5243 | 3 | CSE 3244 | 3 |
| | Stat 4620 | 2 | Stat 3303 | 3 |
| | MOLGEN 5660*** | 5 | BMI 5740*** | 3 |
| | GE Cult. & Ideas or 2nd Historical Study | 3 | STAT 4911 Capstone | 4 |
| | GE Social Science | 3 | GE Social Science | 3 |
| | **Total:** | **16** | **Total:** | **16** |

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** Most BMI specialization courses are offered only one semester per year. Careful planning is needed.

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

**Total hours to complete the degree program = 138**

Version: 03/18/2019