A Course Syllabi

This appendix contains recent syllabi for science, mathematics, and computer science courses. Note some syllabi were slightly altered in AY 2020-2021 due to restrictions from the global pandemic.

Science Courses

Mathematics Courses

Computer Science Courses

1. Course number and name
   BIO 101, General Biology I

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year
   Mastering Biology with Pearson, which includes: Urry LA, Cain ML, Wasserman SA, and Minorsky PV. 2020. Campbell Biology in Focus, 3rd edition. New York: Pearson

   a. Other supplemental materials
      None

5. Specific course information

   a. Catalog description of the content of the course
      This course considers the basic concepts of life science with emphasis on the methods of science and the role of science in society, the chemistry of life, and molecular and cellular evolution. Selected topics include cellular biochemistry, the central dogma of biology, regulation of gene expression, cell structure and function, respiration and photosynthesis, and cell cycles. This course is primarily for students in health science programs or in the School of Engineering. First semester of a full-year course; must be taken in sequence.

   b. prerequisites or co-requisites
      Corequisites: BIO101L

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Course Objectives:

      The students will be introduced to the philosophy of science and the basic concepts of life sciences, in particular. The student will be encouraged to develop library and communication skills, familiarize him/herself with experimental design and the interpretation of biological data and build a foundation for advanced study in biology. In addition, the student will be encouraged to thoughtfully consider the ethical implications of scientific research.

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   None listed in syllabus

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (06/27/21)

1. Course number and name
   BIO 101L, General Biology I Lab

2. Credits and contact hours
   1

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year

   a. Other supplemental materials

5. Specific course information

   a. Catalog description of the content of the course
      Lab to accompany BIO 101. Selected projects develop skills in experimental design, data analysis and scientific writing. (2 lab hrs.)

   b. prerequisites or co-requisites
      Corequisites: BIO101

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Learning Objectives (the student will be able to):

      - **TBD**

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lecture Topics

   - **TBD**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised:

1. Course number and name
   BIO 102, General Biology II

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year
   Mastering Biology with Pearson, which includes: Audesirk T, Audesirk G, and Byers B. 2016. Biology: Life on Earth with Physiology, 11th edition. New York: Pearson

   a. Other supplemental materials
      None

5. Specific course information

   a. Catalog description of the content of the course
      This course covers the basic concepts of life science with an emphasis on animal anatomy and physiology, animal reproduction and development, the nervous system, evolutionary mechanisms and ecological principles. Selected topics include microevolution, speciation, macroevolution, animal behavior and application of comparative anatomy and physiology to illuminate evolutionary relationships and their ecological context. This course is primarily for students in health science programs or in the School of Engineering. Second semester of a full-year course; must be taken in sequence.

   b. prerequisites or co-requisites
      Prerequisites: BIO101, BIO101L (Minimum Grade C-)
      Corequisites: BIO102L

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Course Objectives:

      The students will be introduced to the philosophy of science and the basic concepts of life sciences, in particular. The student will be encouraged to develop library and communication skills, familiarize him/herself with experimental design and the interpretation of biological data and build a foundation for advanced study in biology. In addition, the student will be encouraged to thoughtfully consider the ethical implications of scientific research.

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   None listed in syllabus

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (06/27/21)

1. Course number and name
   BIO 102L, General Biology II Lab

2. Credits and contact hours
   1

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year
   Knisely, Karin. 2017. A Student Handbook for Writing in Biology, 5th Ed. Sunderland: Sinauer Associates, Inc.
   Smith, D.G. and Schenk, M.P. 2011. A Dissection Guide & Atlas to the Fetal Pig, third edition. Morton Publishing Company, Englewood, CO

   a. Other supplemental materials
      Dissection kit, Biology Goggles, SimBio Virtual Labs: Finches and Evolution, Laboratory manual (provided in Blackboard)

5. Specific course information

   a. Catalog description of the content of the course
      Lab to accompany BIO 102. Selected projects develop skills in experimental design, data analysis and scientific writing. (2 lab hrs.)

   b. prerequisites or co-requisites
      Prerequisites: BIO101, BIO101L (Minimum Grade C-)
      Corequisites: BIO102

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      None listed in syllabus (See BIO102 syllabus)

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Laboratory Units

   - **Syllabus, Course Policies, Lab Safety**
   - **Invertebrates**
   - **Vertebrate Anatomy**
   - **Nervous System**
   - **ELISA**
   - **Ecology**
   - **Evolution**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (06/27/2021)

1. Course number and name
   BIO150, General Biology for Majors

2. Credits and contact hours
   4

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year

   - ***A Student Handbook for Writing in Biology, 5th Edition*, Knisely, Karin, 2017.**
   - ***Mastering Biology Online Study System, 12th Edition* (ISBN 9780135855836), Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., Orr, R. B., Campbell, N.A, 2020.**

   a. Other supplemental materials
      None.

5. Specific course information

   a. Catalog description of the content of the course
      Students develop sound learning strategies and introductory knowledge within five core concepts in biology: science as a way of knowing, chemistry of life, structure and function relationships; major pathways and transformations of energy and matter, as well as living systems as interactive and interconnected. This is the first course of a three-course sequence for biology and related majors.

   b. prerequisites or co-requisites
      Corequisites: BIO150L

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Outcomes are given as a list of topics (see below).

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lecture Topics

   - **Science as a Way of Knowing: To help students to understand major epistemological considerations, e.g., How is science different from other kinds of inquiry, e.g., like faith or other philosophical disciplines? What is the Criterion of Demarcation? What is a hypothesis? What distinguishes treatments and controls? What does the asymmetry of proof and disproof refer to and why is this issue important to understanding what scientific theories are. What are the three hallmarks of a scientific investigation?**
   - **Atoms, Bonds and Molecules: Why do atoms interact and form bonds? What kinds of bonds are common in biological systems and what characteristics do they have?**

- **Macromolecules: their Chemistry and Biology: What are the four major kinds of organic molecules, their structural features, and functional roles in biological systems? What kinds of bonds are critical to the functioning of each kind of macromolecule? What are the structural features of nucleic acids and proteins that enable reproduction, information storage, mutation, and catalysis?**
- **Energy, Enzymes and Catalysis: What is catalysis and how is it regulated in biological systems? What are the structural features of biological catalysts that enable them to work with lock-and-key specificity? What are the typical energetics of a catalyzed reaction? What ultimately determines the timing and structure of the various catalysts?**
- **Prokaryotes and Eukaryotes: What are the structural and functional differences between prokaryotes and eukaryotes?**
- **Cell Communication: How do membranes work? How is transport across membranes regulated? What are the components of the endomembrane system and how do they interact? How did the double membranes of the nucleus, mitochondria, and chloroplasts originate - what are the contending hypotheses and evidence?**
- **Respiration and Photosynthesis: How is energy captured and converted to various chemical forms in photosynthesis and respiration? How do photosynthesis and respiration work as biochemical systems, including major inputs and outputs? What is chemiosmosis and how does it function, in both photosynthesis and respiration, and how are membranes and their proteins involved in this work?**
- **Anatomy and Physiology: How are vertebrate systems organized? What are the major organs in a vertebrate system? How do these major organs function for homeostasis? What are the cellular components that control the function of cells, tissues and organs in an organ system?**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised:

1. Course number and name
   BIO150L, General Biology for Majors Lab

2. Credits and contact hours
   0

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year
   ***A Student Handbook for Writing in Biology, 5th Edition*, Knisely, Karin, 2017.**

   a. Other supplemental materials
      ***BIO 150L General Biology Lab Manual* and Biology (or Chemistry) Googles (all available at the University Bookstore)**

5. Specific course information

   a. Catalog description of the content of the course
      Lab to accompany BIO 150. Students take an investigative/inquiry-based approach and become competent within the process of science including experimental design and analysis, as well as scientific communication and collaboration.

   b. prerequisites or co-requisites
      Corequisites: BIO150

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Learning Objectives (the student will be able to):
      - **Learn basic laboratory and microscope skills**
      - **Assume leadership and responsibility for designing, executing, analyzing and reporting scientifically sound experiments**
      - **Learning to write and present in scientific format**

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lab Topics

   - **Scientific Method**
   - **Scientific Writing/Plagiarism**
   - **Biological Molecules**
   - **Enzymes**
   - **Microscopy**
   - **Osmosis**
   - **Cellular Respiration**
   - **Anatomy**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised:

1. Course number and name
   BIO151, Molecular and Cell Biology and Genetics

2. Credits and contact hours
   4

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year

   - ***A Student Handbook for Writing in Biology, 5th Edition*, Knisely, Karin, 2017.**
   - ***Mastering Biology Online Study System, 12th Edition* (ISBN 9780135855836), Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., Orr, R. B., Campbell, N.A, 2020.**

   a. Other supplemental materials
      None.

5. Specific course information

   a. Catalog description of the content of the course
      Students investigate key concepts in molecular and cell biology and genetics. Topics include evolution, the central dogma, regulation of gene expression, cell structure and physiology, cell communication, immunology, cancer and cell division.

   b. prerequisites or co-requisites
      Prerequisites: BIO150, BIO150L (Minimum Grade C-)
      Corequisites: BIO151L

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Learning Objectives (the student will be able to): Outcomes are given as a list of topics (see below).

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lecture Topics

   - **Gene Expression. How do the molecular structures of DNA, RNA, and protein enable expression of the same information in the three different kinds of molecules? What is the genetic code and how was it elucidated? What are the roles of ribosomes, tRNA, rRNA, and mRNA in protein synthesis? What major kinds of regulation of gene expression are exhibited in prokaryotes? How is this system more complicated in the multicellular eukaryotic descendants of prokaryotes?**
   - **Cell Communication. How do cells receive and interpret information from their surrounding environment? How do cells communicate with one another? What are the major signaling pathways in eukaryotic cells and how do they influence cell behavior? What are the apoptotic pathways and what signals trigger them? What is the cell cycle? How do cyclin and cyclin-dependent kinases influence cell cycles? How does loss of cell cycle control lead to cancer?**

- **Genetics. What are the fundamental processes of meiosis? How are the traits of parents transmitted to their offspring? How is genetic variation produced and the evolutionary importance of this variation? What two laws of inheritance did Gregor Mendel discover using a scientific approach? What is the importance of Morgans discovery and how does it apply to patterns of inheritance? How do alterations of chromosome number or structure result in a genetic disorder? What are non-Mendelian patterns of inheritance?**
- **Evolution. What is the central dogma of biology and how does it relate to the biological capabilities of the hereditary molecule, to the very existence and nature of evolution? What are viruses and how do they replicate? What are the key concepts of Darwins Theory of evolution? What is the biological species concept? How does natural selection influence adaptive evolution? What roles do genetic drift and gene flow have in natural selection? How has life evolved?**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised:

1. Course number and name
   BIO151L, Molecular and Cell Biology and Genetics Lab

2. Credits and contact hours
   0

3. Instructor's or course coordinator's name
   Coordinator: Prof. Nancy Burns

4. Text book, title, author, and year
   ***A Student Handbook for Writing in Biology, 5th Edition*, Knisely, Karin, 2017.**

   a. Other supplemental materials
      ***BIO 151L General Biology Lab Manual* and Biology (or Chemistry) Googles (all available at the University Bookstore) and Basic Calculators**

5. Specific course information

   a. Catalog description of the content of the course
      Selected projects enable students to develop skills in experimental design through an investigative/inquiry-based approach, data analysis and scientific writing.

   b. prerequisites or co-requisites
      Prerequisites: BIO150, BIO150L (Minimum Grade C-)
      Corequisites: BIO151

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Not specified. See Topic list and Course Description.

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lecture Topics

   - **DNA Fingerprinting**
   - **Gene Expression**
   - **Scientific Writing**
   - **Cell Signaling**
   - **Cell Communication**
   - **Evolution**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised:

1. Course number and name
   CHE 110, General Chemistry I

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Dr. James F. Kirby, Ph. D.

4. Text book, title, author, and year
   General Chemistry by D. Ebbing & S. Gammon, 11th ed., Cengage Learning, 2017.

   a. Other supplemental materials
      Cengage Unlimited, OWLv2, Calculator supporting logarithmic functions

5. Specific course information

   a. Catalog description of the content of the course
      Students study the atomic theory of matter, nomenclature, chemical formulas and reaction equations, stoichiometry, the gas laws and the kinetic molecular theory, thermochemistry, atomic structure, periodicity of the elements, chemical bonding and molecular structure. (Note: this course is designed for science majors.)

   b. prerequisites or co-requisites
      A math placement score of 3 or higher (or suitable math course) is required to enroll in CHE110. Corequisites: CHE110L

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Outcomes are given as a list of fundamental principles and concepts (see below).

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Fundamental Principles and Concepts

   - **Physical and chemical properties of matter**
   - **S.I. units and their application in dimensional analysis**
   - **Density**
   - **Proper use of significant figures**
   - **Structure of the atom, atomic number, atomic mass and isotopes**
   - **Significance of the periodic table and its use to predict the formation of molecules and compounds**
   - **Chemical formulas of compounds and how they are named**
   - **Mass relationships in chemical reactions and the Law of Conservation of Matter**
   - **Balance chemical equations and use them to calculate the amount of product formed from a given amount of reactants (stoichiometry)**
   - **Solution behavior of electrolytes and non-electrolytes**

- **Chemical reactions in aqueous solutions including acid-base reactions, oxidation and reduction reactions and precipitation reactions**
- **Express the concentration of a solution using molarity and dilute a solution to obtain a desired concentration**
- **Gas behavior based on the Kinetic Molecular Model**
- **Thermochemistry and the Law of Conservation of Energy as applied to chemical systems**
- **Energy changes in chemical reactions**
- **Quantum theory and the electronic structure of the atom**
- **Electron configuration and the Aufbau Principle**
- **Periodic classification of the elements and periodic variation in their physical properties**
- **Basic concepts of chemical bonding in both ionic compounds and covalent molecules**
- **Lewis structures and molecular geometries and polarities of molecules based on application of the VSEPR model**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   CHE 110L, General Chemistry I Lab

2. Credits and contact hours
   1

3. Instructor's or course coordinator's name
   Lab Coordinator: Dr. Jennifer Cruz

4. Text book, title, author, and year
   Laboratory manual for the course (available from the campus bookstore)

   a. Other supplemental materials
      Approved safety goggles, approved clothing (see Laboratory Safety Rules), approved lab notebook capable of carbon-copying, pen, calculator

5. Specific course information

   a. Catalog description of the content of the course
      Lab must be taken with CHE 110. (3 lab hrs.)

   b. prerequisites or co-requisites
      Corequisites: CHE110

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      None Listed (See CHE110)

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lab Experiments

   - **Measurement and Introduction to Lab Equipment**
   - **Separation Methods**
   - **Determination of the Formula of a Metal Oxide**
   - **The Determination of Salt Solutions by Density**
   - **Precipitation Reactions and the Synthesis of Chalk**
   - **Determining the Molar Mass of an Unknown Acid by Titration**
   - **Antacid Effectiveness by Back Titration**
   - **Gas Law Experiment: Determination of the Molar Mass of a Volatile Liquid**
   - **Using Calorimetry to Determine Specific Heat and Heat of Solution**
   - **Enthalpy of Decomposition of Hydrogen Peroxide**
   - **Spectrophotometric Determination of Blue Dye #1 in Consumer Samples**
   - **Molecular Structures and Shapes**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   CHE 111, General Chemistry II

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Frank Tagliaferro

4. Text book, title, author, and year
   General Chemistry by D. Ebbing & S. Gammon, 11th ed., Cengage Learning, 2017

   a. Other supplemental materials
      Cengage Unlimited, OWLv2, Calculator supporting logarithmic functions

5. Specific course information

   a. Catalog description of the content of the course
      Students study intermolecular forces, properties of solutions, kinetics, chemical equilibrium, pH, acid-base solution chemistry, thermodynamics and electrochemistry. Problem-solving is emphasized.

   b. prerequisites or co-requisites
      Prerequisites: CHE110, CHE110L (Minimum Grade C-)
      Corequisites: CHE111L

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Outcomes are given as a list of fundamental principles and concepts (see below).

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Fundamental Principles and Concepts

   - **Understand the role of intermolecular forces in the physical properties of liquids and solids**
   - **Demonstrate a basic knowledge of crystal structure and the impact of intermolecular forces on physical properties**
   - **Understand phase changes and develop the ability to interpret phase diagrams**
   - **Calculate the concentration of solutions using molarity, molality, and**
   - **Understand the effect of temperature and pressure on solubility**
   - **Determine the melting point, freezing point, vapor pressure and osmotic pressure of solutions using colligative properties for solutions composed of non-electrolytes and electrolytes**
   - **Determine the rate law and reaction rate of a chemical system**
   - **Understand activation energy and how temperature affects the rate of a reaction**
   - **Understand reaction mechanisms and the role of catalysts in the rate of a reaction**

- **Understand and apply the principles of equilibrium to chemical systems**
- **Calculate concentrations of products or reactants using the equilibrium expression and equilibrium constants**
- **Apply Le Chateliers Principle to chemical systems**
- **Determine the pH of acids, bases, buffers and salt solutions**
- **Understand and apply the Laws of Thermodynamics**
- **Predict whether a chemical reaction will occur spontaneously**
- **Balance oxidation-reduction reactions**
- **Determine the electrical potential of an oxidation-reduction reaction**
- **Understand and use the Nernst Equation to calculate free energy, equilibrium constants and electrical potential of systems that are not at standard conditions**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   CHE 111L, General Chemistry II Lab

2. Credits and contact hours
   1

3. Instructor's or course coordinator's name
   Lab Coordinator: Dr. Robert Grosso

4. Text book, title, author, and year
   Laboratory manual for the course (available from the campus bookstore)

   a. Other supplemental materials
      Approved safety goggles, approved clothing (see Laboratory Safety Rules), approved lab notebook capable of carbon-copying, pen, calculator

5. Specific course information

   a. Catalog description of the content of the course
      Lab must be taken with CHE 111. (3 lab hrs.)

   b. prerequisites or co-requisites
      Prerequisites: CHE110, CHE110L (Minimum Grade C-)
      Corequisites: CHE111

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      None Listed (See CHE111)

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lab Experiments

   - **Safety and Introduction**
   - **Evaporation and Intermolecular Forces**
   - **Conductivity of Solutions: The Effect of Concentration**
   - **Effect of Temperature on Solubility**
   - **Molar Mass by Freezing Point Depression**
   - **Chemical Kinetics of Hydrogen Peroxide Decomposition**
   - **Dissolution Kinetics of Solids**
   - **Determination of the Acid Ionization Constant**
   - **Buffers**
   - **Determination of the Solubility Product Constant of Calcium Hydroxide**
   - **Entropy, Gibbs Free Energy, and Reaction Quotient**
   - **Vitamin C Analysis by Oxidation-Reduction Titration**
   - **Cell Potentials and Electrochemistry**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   PHY 121, University Physics I

2. Credits and contact hours
   4

3. Instructor's or course coordinator's name
   Prof. Robert Fischetti

4. Text book, title, author, and year
   Modified Mastering Physics with Pearson eText (Standalone Access Card) for University Physics with Modern Physics

   a. Other supplemental materials
      Pen/pencil, notebook, calculator, laptop

5. Specific course information

   a. Catalog description of the content of the course
      This is a calculus-based physics course. Students examine classical Newtonian physics from kinematics, the study of motion, to dynamics, the study of why motion occurs. Topics include Newton's laws, conservation of energy and momentum, torque, equilibrium of static bodies and fluids, and thermal properties of matter. Through experimentation, computer modeling and group problem-solving, students apply these principles to predict the outcome of a number of reality-based and open-ended problems. (6 studio-lab hrs.)

   b. prerequisites or co-requisites
      Prerequisites: MA141 or MA151 (Minimum Grade C-)

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      See course description (no specific goals/outcomes)

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Course Topics

   - **Units, quantities and vectors**
   - **Motion along a straight line**
   - **Motion in two or three dimensions**
   - **Newtons Laws of Motion**
   - **Applying Newtons Laws of Motion**
   - **Work and kinetic energy**
   - **Potential energy and energy conservation**
   - **Momentum, impulse and collisions**
   - **Rotation of Rigid bodies**
   - **Dynamics of rotational motion**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   PHY 122, University Physics II

2. Credits and contact hours
   4

3. Instructor's or course coordinator's name
   Prof. Douglas S. Goodman

4. Text book, title, author, and year
   Modified Mastering Physics with Pearson eText (Standalone Access Card) for University Physics with Modern Physics

   a. Other supplemental materials
      Pen/pencil, notebook, calculator, laptop

5. Specific course information

   a. Catalog description of the content of the course
      This is a calculus-based physics course. Students examine physical phenomena including vibrations and waves, sound, light, optics, electricity and magnetism including the study of D.C. and A.C. circuits and some elements of modern physics. Through experimentation, computer modeling and group problem-solving, students apply these principles to predict the outcome of a number of reality-based and open-ended problems. (6 studio-lab hrs.)

   b. prerequisites or co-requisites
      Prerequisites: PHY121 (Minimum Grade C-)

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      See course description (no specific goals/outcomes)

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lecture Topics

   - **Vectors**
   - e/m **Ratio**
   - **DC Motor**
   - **PhET: E-field**
   - **Faraday Cage**
   - **PhET: Voltage**
   - **Circuits**
   - **Helmholtz Coil**
   - **Induction**
   - **Traveling Wave**

- **Polarization**
- **Standing Waves**
- **Photons**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   CSC 110, Programming and Problem Solving

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Prof. Jonathan Blake

4. Text book, title, author, and year
   Introduction to Programming and Problem-Solving Using Scala, Second Edition by Mark Lewis and Lisa Lacher (2016)

   a. Other supplemental materials
      None

5. Specific course information

   a. Catalog description of the content of the course
      This course is an introduction to computer programming. While we will be studying the Scala programming language, we will be focusing on good programming practice and introductory prob- lem solving techniques that will provide you with the tools to write efficient, correct code in any programming language. This course is not just a programming course! Note that this course is a synchronus WEB course run as a flipped classroom. Students prepare for each class/module by completing outside work (videos, readings, quizzes, etc) and spend class time synchronously working either individually or in groups on small projects. When learning to program, there is no substitute to writing code, and we will spend as much time as possible doing that this semester.

   b. prerequisites or co-requisites
      Corequisite: CSC110L

   c. indicate whether a required, elective, or selected elective
      Required

6. Specific goals for the course

   (a) specific outcomes of instruction
      Learning Objectives (the student will be able to):

      - **Discuss the challenges inherent in communicating with (programming) a (non-reasoning) computer**
      - **Break a complex problem down into smaller more manageable components**
      - **Provide step-by-step instructions to solve small computational problems**
      - **Using at least one programming language, write examples of and solve problems in pro- grams with the following basic programming constructs and tools**
        - **Mathematical expressions**
        - **Conditional expressions**
        - **Simple iterative statements**
        - **Simple functions**
        - **Simple data structures, such as arrays, lists, and strings**
      - **Discuss the importance of commenting and good code structure and style**

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      C1, C2, C6

7. Brief list of topics to be covered
   Lecture Topics

   - **Introduction**
   - **Scala Basics**
   - **Conditionals**
   - **Functions**
   - **Intro to Loops**
   - **Recursion**
   - **Collections**
   - **State machines**
   - **Loops Revisited**
   - **Function Parameters**
   - **Text Files**
   - **Case Classes**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   CSC 110L, Programming and Problem Solving Lab

2. Credits and contact hours
   1 (1.25)

3. Instructor's or course coordinator's name
   Prof. Emre Tokgoz

4. Text book, title, author, and year
   See CSC110 Syllabus

   a. Other supplemental materials
      None

5. Specific course information

   a. Catalog description of the content of the course
      Students gain experience in the practice of programming and problem solving by completing a series of hands-on activities, which increase in complexity, covering a range of topics from the CSC 110 course. This course is taken in conjunction with CSC 110.

   b. prerequisites or co-requisites
      Corequisite: CSC110

   c. indicate whether a required, elective, or selected elective
      Required

6. Specific goals for the course

   (a) specific outcomes of instruction
      See CSC110 Syllabus

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   None listed

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/28/2021)

1. Course number and name
   CSC 210, Computer Architecture and Organization

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Prof. Jonathan Blake

4. Text book, title, author, and year
   Essentials of Computer Organization and Architecture by Null and Lobur (2018)

   a. Other supplemental materials
      None

5. Specific course information

   a. Catalog description of the content of the course
      Students are introduced to the organization and architecture of computers. Topics related to computer or- ganization include digital logic, data representation, computer arithmetic, data path and control unit im- plementation, memory system organization, and I/O communications. Architecture topics include machine language programming, instruction set design, and factors affecting processor performance.

   b. prerequisites or co-requisites
      Prerequisites: CSC111 and CSC111L (Minimum Grade C-)

   c. indicate whether a required, elective, or selected elective
      Required

6. Specific goals for the course

   (a) specific outcomes of instruction
      Learning Objectives (the student will be able to):
      - **Understand number conversion and representation**
      - **Implement logic functions with gates**
      - **Build simple chips/components using logic gates**
      - **Implement complex processor components using simple chips**
      - **Understand the software/hardware interface**
      - **Implement solutions to simple programming problems in assembly language**

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None C1, C2

7. Brief list of topics to be covered
   Course Topics

   - **Introduction to architecture and organization**
   - **Binary numbers**
     - **Number representation**
     - **Number conversion**
     - **Signed numbers**
     - **Floating point representation**
   - **Binary arithmetic**

- **Boolean algebra**
- **Logic gates**
- **Combinational and sequential circuits**
- **CPU organization**
- **Data path**
- **memory organization**

Prepared by: Christian Duncan
Creation date: 06/26/2021
Revised: Jonathan Blake (6/27/2021)

1. Course number and name
   CSC215, Algorithm Design and Analysis

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Christian Duncan

4. Text book, title, author, and year
   The OpenDSA project.

   - **The version used is associated with a Canvas course.**
   - **Here is a link to a non-live but interactive version,** `http://lti.cs.vt.edu/LTI_ruby/Books/CSC215/html/`
   - **The original non-interactive version:** ***Data Structures and Algorithm Analysis (3.2 - Java Edition)*****, by Clifford Shaffer**
   - **Available as a PDF:** `http://people.cs.vt.edu/~shaffer/Book/JAVA3elatest.pdf`

   a. Other supplemental materials
      None

5. Specific course information

   a. Catalog description of the content of the course
      This course presents a study of the design and analysis of algorithms. Topics include asymptotic analysis, complexity theory, sorting and searching, underlying data structures, recursion, greedy algorithms, divide and conquer, dynamic programming, and NP-completeness. Additional topics may include graph algorithms, probabilistic algorithms, distributed computing and parallel algorithms.

   b. prerequisites or co-requisites
      Prerequisites: CSC111, MA205 (Minimum Grade C-)

   c. indicate whether a required, elective, or selected elective
      Required

6. Specific goals for the course

   (a) specific outcomes of instruction
      Course Learning Objectives (the student will be able to):

      i. **Use mathematical and computational concepts, such as inductive reasoning and recurrence relations, to analyze an algorithm's asymptotic run-time performance;**
      ii. **Use creative thinking skills in solving computational problems;**
      iii. **Apply brute-force, exhaustive search, dynamic programming, and greedy techniques in developing algorithmic solutions;**
      iv. **Apply decrease-and-conquer (prune-and-search) and divide-and-conquer techniques in developing algorithmic solutions;**
      v. **Describe and apply various advanced data structures such as balanced binary trees, heaps, hashtables, and graphs in the design and analysis of efficient algorithms;**
      vi. **Explain the basic premise behind the class of NP-complete problems; and**
      vii. **Use experimental analysis to test the practical validity of a data structure or algorithm.**

(b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
None C1 (CLO 1, 2, 3, 4, 5), C2 (CLO 7), C3 (CLO 6), C6 (CLO 2, 3, 4, 5)

7. Brief list of topics to be covered
Lecture Topics

- **Motivation for proof writing and asymptotic analysis**
- **Discrete Math review**
- **Data Structures review**
- **Asymptotic Analysis**
- **Recursion**
- **Binary (Search) Trees**
- **Heaps and Priority Queues**
- **Sorting Algorithms (Quadratic, Divide-and-Conquer, Heap, Radix)**
- **Hashing and Hashtables**
- **Recurrence Relations and Master Theorem**
- **Graphs and Graph Algorithms**
- **Basic NP-Completeness**

Prepared by: Christian Duncan
Creation date: 06/28/2021
Revised:

1. Course number and name
   CSC315, Theory of Computation

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Christian Duncan

4. Text book, title, author, and year
   ***Theory of Computation, 3rd Edition*, Sipser, 2012**

   a. Other supplemental materials
      None

5. Specific course information

   a. Catalog description of the content of the course
      This course provides an introduction to the classical theory of computer science. In particular, it covers automata, formal languages, computability, and complexity.

      Our aim in this course is to develop a fundamental understanding of the nature of computing. Throughout all the topics, we will answer one underlying question stated on page 1 of the course textbook:

      "What are the fundamental capabilities and limitations of computers?"

      We will look at sub-questions like: "What can be computed?"; "How do you prove something cannot be computed? (Is this even possible?)"; "What makes some problems so much harder than others to solve?"

   b. prerequisites or co-requisites
      Prerequisites: CSC215 or MA301 (Minimum Grade C-)

   c. indicate whether a required, elective, or selected elective
      Required

6. Specific goals for the course

   (a) specific outcomes of instruction
      Course Learning Outcomes (the student will be able to):

      i. Create finite state and push-down automata with specific properties (to recognize specific languages).
      ii. Create regular and context-free grammars with specific properties (to generate specific languages).
      iii. Use the pumping lemma to show particular problems cannot be solved by finite state automata (particular languages are not regular).
      iv. Use the pumping lemma to show particular problems cannot be solved by push-down automata (particular languages are not context-free).
      v. Create Turing Machines to solve particular problems (to recognize specific languages).
      vi. Use diagonalization or reducibility methods to prove a problem is undecidable.
      vii. Explain the importance of NP-completeness and the "P=NP" problem.
      viii. Use reducibility to prove a problem is NP-complete.
      ix. Explain the relationship between deterministic and non-deterministic computation time and space.

(b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
None C1 (CLO 1, 2, 5), C3 (CLO 3, 4, 6, 7, 8, 9), C6 (CLO 1, 2, 5)

7. Brief list of topics to be covered
Lecture Topics

- **Mathematics Review**
- **Regular Languages**
- **Context-Free Languages**
- **Church-Turing Thesis (Turing Machines)**
- **Decidability**
- **Reducibility**
- **Time Complexity**
- **NP-Completeness**

Prepared by: Christian Duncan
Creation date: 06/28/2021
Revised:

1. Course number and name
   CSC375, Machine Learning

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Prof. Emre Tokgoz

4. Text book, title, author, and year
   Deep Learning with PyTorch by Eli Stevens, Luca Antiga, and Thomas Viehmann, Manning Publications, 2020. ISBN 9781617295263

   a. Other supplemental materials
      Supplemental material provided on Blackboard

5. Specific course information

   a. Catalog description of the content of the course
      General Catalog Description: This course explores advanced computer science topics not available in other courses, as well as new topics as they emerge in this rapidly evolving discipline. Topics may be interdisciplinary.

      Specific Course Description: Students are initially introduced to the fundamentals of Python programming. Machine Learning concepts are covered by using Jupyter Notebook and Python with emphasis given to the use of PyTorch library with applications. Students are expected to work in groups to explain theoretical Machine Learning concepts with real-life applications and strategize and solve problems. Participants are also introduced to basic bioinformatics concepts by using Biopython. Healthcare applications are emphasized throughout the course. The completion of a real-life semester project in groups is an essential component of grading and participation.

   b. prerequisites or co-requisites
      Prerequisites: CSC215 and SER225 (Minimum Grade C-)

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      Course Learning Outcomes (the student will be able to):

      i. Apply Python programming language in healthcare.
      ii. Function effectively in teams to explain theoretical machine learning concepts.
      iii. Use Machine Learning for meaningful data analysis.
      iv. Fulfill ethical and professional responsibilities by working in groups on projects.
      v. Use PyTorch for Machine Learning image analysis.
      vi. Design software solutions by using Python.
      vii. Complete a real-life project by working in groups and applying machine learning concepts.

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      C1, C2, C3, C4, C5, C6

7. Brief list of topics to be covered
   Lecture Topics

- **Software Fundamentals**
- **Machine Learning Fundamentals using Jupyter Notebook**
- **Coverage of Machine Learning techniques and fundamental theoretical knowledge needed to cover Deep Learning with PyTorch**
- **Team Presentations of Book Chapters**
- **Introduction to Biopython and Fundamentals of Bioinformatics**

Prepared by: Christian Duncan
Creation date: 06/28/2021
Revised: Jonathan Blake (06/28/2021)

1. Course number and name
   CSC375, Cloud Computing

2. Credits and contact hours
   3

3. Instructor's or course coordinator's name
   Solomon Abioloa (Prof. Jonathan Blake)

4. Text book, title, author, and year
   N/A (Online resources will be used)

   a. Other supplemental materials
      Supplemental material provided on Blackboard

5. Specific course information

   a. Catalog description of the content of the course
      General Catalog Description: This course explores advanced computer science topics not available in other courses, as well as new topics as they emerge in this rapidly evolving discipline. Topics may be interdisciplinary.

      Specific Course Description: This introductory 3 credit course provides a hands-on approach to cloud computing. Through this course students will be exposed to a wide variety of cloud computing providers, concepts, and projects. This course will specifically cover in detail Googles Cloud Platform and Amazons Web Services. At the completion of this course students will be familiar with key cloud concepts. Will develop their own cloud project and be prepared to sit for one of the cloud certification exams on either cloud platform.

   b. prerequisites or co-requisites
      Prerequisites: CSC215 and SER225 (Minimum Grade C-)

   c. indicate whether a required, elective, or selected elective
      Selected elective

6. Specific goals for the course

   (a) specific outcomes of instruction
      None listed in syllabus

   (b) explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      None

7. Brief list of topics to be covered
   Lecture Topics

   - **Overview of Cloud Computing**
   - **Cloud Service Models IaaS, PaaS, SaaS**
   - **Cloud Computing Components Virtual Machines, Servers,**
   - **Cloud Computing Services**
   - **Infrastructure Availability Zones, Regions, Edge Locations**
   - **Hands On Exploring the various main services in GCP/AWS**
   - **Pricing and Billing in GCP/AWS**
   - **Security in the Cloud**

- **Databases and Networking in the Cloud**
- **Big Data and Machine Learning in the Cloud**

Prepared by: Christian Duncan
Creation date: 06/28/2021
Revised: Jonathan Blake (06/28/2021)