Note on the Proposal

This proposal is part of a larger document combining proposals from Hawai‘i Community College, Honolulu Community College, and Kaua‘i Community College. Thus, some of the wording in this document may seem odd when read as a stand-alone document.

The program is based on what has already been implemented at Kapiolani and Leeward CC, although they have been altered to meet the goals of the specific campuses.

The steps for adoption are as follows:

1. local curriculum adoption process (for us, CCAAC, Faculty Senate, etc.)
2. review by the Academic Affairs Administrators & Vice Chancellors Academic Affairs Council (the UHCC system group)
3. review by the Council of Chief Academic Officers (CCAO)
4. Board of Regents

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Appendix D:
The AS in NS at Windward Community College

The Associate of Science in Natural Science will be a transfer degree designed for students pursuing STEM-related educational and career goals.

This proposal is part of a larger proposal involving Hawai‘i Community College, Honolulu Community College, and Kaua‘i Community College. The proposal is similar to AS in NS degrees currently available from Kapi‘olani Community College and Leeward Community College.
The proposed semester of implementation is Fall 2013.

1. Curriculum

As discussed in the main document, the AS in NS has two concentrations: Biological Science and Physical Science. The key differences are that the Biological Science concentration requires credits in Biology and the Physical Science concentration requires an additional level of calculus.

<table>
<thead>
<tr>
<th>Common Requirements</th>
<th>for Biological Science Concentration (minimum 28 credits)</th>
<th>for Physical Science Concentration (minimum 24 credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG 100 (Foundation FW)</td>
<td>BIOL 171 (3)</td>
<td>CHEM 161 (3)</td>
</tr>
<tr>
<td>MATH 103 or higher (Foundation FS)</td>
<td>BIOL 171L (1)</td>
<td>CHEM 161L (1)</td>
</tr>
<tr>
<td>Two courses from Foundation FG A, B, and C</td>
<td>BIOL 172 (3)</td>
<td>CHEM 162 (3)</td>
</tr>
<tr>
<td>One diversification course from DA, DH, or DL</td>
<td>BIOL 172L (1)</td>
<td>CHEM 162L (1)</td>
</tr>
<tr>
<td>One diversification course from DS</td>
<td>CHEM 161 (3)</td>
<td>MATH 205 (4)</td>
</tr>
<tr>
<td>One diversification course from DB or DP</td>
<td>CHEM 161L (1)</td>
<td>MATH 206 (4)</td>
</tr>
<tr>
<td>Minimum 9 credits transfer-level natural science courses (DP, DB, DY)</td>
<td>CHEM 162 (3)</td>
<td>PHYS 151 (3) or PHYS 170 (4)</td>
</tr>
<tr>
<td>Students pursuing the Physical Sciences concentration must take at least one biological science course as an elective.</td>
<td>CHEM 162L (1)</td>
<td>PHYS 151L (1) or PHYS 170L (1)</td>
</tr>
<tr>
<td>General electives: transfer-level courses in any field to achieve a total of 60 credits</td>
<td>MATH 205 (4)</td>
<td>PHYS 152 (3) or PHYS 272 (3)</td>
</tr>
<tr>
<td>two Writing Intensive courses</td>
<td>PHYS 151 (3) or PHYS 170 (4)</td>
<td>PHYS 152L (1) or PHYS 272L (1)</td>
</tr>
<tr>
<td>one HAP designated course</td>
<td>PHYS 151L (1) or PHYS 170L (1)</td>
<td></td>
</tr>
</tbody>
</table>

2. Relationship of the AS in NS to the College’s Mission

Windward CC Mission is:
“Windward Community College offers innovative programs in the arts and sciences and opportunities to gain knowledge and understanding of Hawai‘i and its unique heritage. With a special commitment to support the access and educational needs of Native Hawaiians, we provide O‘ahu’s Ko‘olau region and beyond with liberal arts, career and
lifelong learning in a supportive and challenging environment — inspiring students to excellence.” (see http://windward.hawaii.edu/About_WCC/index.php)

The proposed AS in NS will allow the college to fulfil its mission by encouraging its students to pursue degrees in the sciences, thus providing access to science-related careers to the Koʻolau region of Oʻahu.

The science curriculum at Windward CC includes classes that consider Hawaiian-related themes, such as the ahupua’a and fishponds. By encouraging students to take the AS in NS, it is hoped that we will likewise encourage students to better understand the role that science plays in Hawaii.

3. Relationship of the AS in NS to College’s Outcomes

A. Windward CC’s General Education Learning Outcomes

Information on Windward Community College’s General Education Outcomes can be found at http://windward.hawaii.edu/General_Education/. There are four General Education Outcomes.

i. Global and Cultural Awareness: Develop the ability to perceive how people interact with their cultural and natural environments, through their own worldview and through the worldviews of others, in order to analyze how individuals and groups function in local and global contexts.

The AS in NS will provide students with an understand of the physical and biological processes that are the foundation of human existence. Some relevant topics would include the relationship between geology and human society, the nature and impact of human diseases, and the nature of scientific thought.

ii. Critical Thinking and Creativity: Make judgments, solve problems, and reach decisions using analytical, critical, and creative thinking skills.

The AS in NS will provide students with the ability to think critically in terms of the scientific research methods, learning how to carry out experiments, analyze physical and biological phenomena, and understand the nature of scientific process.

Creativity will also be an important aspect of the degree insofar as students will learn how to create research experiments and respond creatively to scientific problems.

iii. Communication: Use written, visual, and oral communication to discover, develop, and communicate meaning, and to respond respectfully to the ideas of others in multiple environments.
The AS in NS will have a significant communication component. Students will create scientific reports and presentations, analyze topics in lectures and labs, and approach education in terms of the scientific method, which encourages open and respectful debate.

iv. Information Literacy: Identify information needed in a variety of situations, and access, evaluate, and use relevant information effectively and responsibly.

Students in the AS in NS will be taught to analyze information throughout the degree. Students will be expected to access relevant information as part of the research process.

B. Windward CC’s Program Learning Outcomes for the AS in NS

The Program Learning Outcomes for the proposed AS in NS have been agreed to by the four campuses who are part of this proposal. Upon graduation, students will be able to:

1. analyze data effectively using the most currently available technology
2. communicate scientific ideas and principles clearly and effectively
3. analyze and apply fundamental mathematical, physical, and chemical concepts and techniques to scientific issues
4. apply fundamental concepts and techniques in their chosen field of study, such as biology, chemistry, geology, engineering, etc.

General alignment of the Program Learning Outcomes to the General Education Learning Outcomes

<table>
<thead>
<tr>
<th></th>
<th>PLO #1: analyze data effectively using the most currently available technology</th>
<th>PLO #2: communicate scientific ideas and principles clearly and effectively</th>
<th>PLO #3: analyze and apply fundamental mathematical, physical, and chemical concepts and techniques to scientific issues</th>
<th>PLO #4: apply fundamental concepts and techniques in their chosen field of study, such as biology, chemistry, geology, engineering, etc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global and Cultural Awareness</td>
<td>significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Thinking and Creativity</td>
<td>significant</td>
<td>significant</td>
<td>significant</td>
<td>significant</td>
</tr>
</tbody>
</table>
The two pathways of Life Science and Physical Science share much of their curriculum and outcomes. The General Education Outcomes are met in part through the required completion of the majority of their baccalaureate General Education requirements. The Institutional Outcomes permeate all courses taught at the Hawaii CC campus. The Program Outcomes are directly supported by the Course Learning Outcomes of the courses required in the AS-NS program. All are regularly assessed and reviewed.

4. Relationship of the AS in NS to the College’s Strategic Goals

Windward Community College adopted a 7 year Strategic plan in 2008, based on the strategic goals of the University of Hawai’i as a whole.

[link to strategic plan]

**UHCC Goal: 1.1 Increase Native Hawaiian enrollment by 3% per year, particularly in regions that are underserved.**

**Windward CC Goal: 1.6 Increase by 6-9% the number of Native Hawaiians (from 45 to 78) who receive degrees or certificates in each Annual Fiscal Year.**

The AS-NS program allows the college to identify STEM students and to provide them with the assistance and support they need for academic success. STEM programs are an excellent place to implement non-traditional learning environments such as peer tutoring, community based learning, and problem based learning.

**UHCC Goal: 2.5 Increase the diversity and number of programs offered to or in underserved regions by increasing the number and types of programs offered by at least one per two years that can be completed through distance learning technologies.**

**Windward CC Goal: 2.7 Increase the number of transfers to UH System and non-system baccalaureate institutions who achieve an average GPA of 3.14 by 5% per year.**
Windward CC Goal: 2.8 Increase the diversity and number of programs offered to or in underserved regions by increasing the number and types of programs offered by at least one per two-year period.

The new program will help meet the college’s goal of expanding the programs available to our students. In the last few years, the college has greatly expanded the science-related certificates available to students. The AS in NS will create an important pathway for the students at our college who are interested in pursuing degrees and careers in STEM-related fields.

UHCC Goal: 4.3 Increase by 3% per year the number of degrees and certificates awarded in Science, Technology, Engineering, and Math (STEM) fields.

Windward CC Goal: 4.5 Promote the knowledge, skills, and opportunities that support current and emerging STEM fields and careers by increasing credit and noncredit STEM course enrollments by 3% per year.

Windward CC Goal: 4.8. Increase the number of degrees and certificates awarded in Science, Technology, Engineering, and Math (STEM) fields. (includes both credit and noncredit) by 3% per year.

Increasing the enrollment in STEM-related classes and the graduation rates of students in STEM-related fields are obvious goals of the AS in NS degree. The degree is expected to increase enrollment by directing student education to STEM-related classes, thus increasing the overall demand. Likewise, students pursuing STEM-related fields at this point either receive an AA or transfer to a 4-year college without receiving any degree. The AS in NS will provide an appropriate associates-level degree for students pursuing STEM-related fields. Given the low number of STEM-related degrees and certificates currently awarded, the AS in NS should allow Windward Community College to easily meet this goal.

5. Course Descriptions

Course descriptions for the college are available at [http://windward.hawaii.edu/courses/](http://windward.hawaii.edu/courses/)

The following are the central science courses for the AS in NS.

BIOL 171 - General Biology I (3 credits) - for Biological Science Concentration

Introductory biology for all life science majors. Cell structure and chemistry, growth, reproduction, genetics, evolution, viruses, bacteria, and simple eukaryotes.(3 hours lecture)
Recommended Preparation: High school chemistry or college chemistry and registration in BIOL 171L.

Student Learning Outcomes

- Explain the process and philosophical basis of scientific inquiry.
- Distinguish between living things and inanimate objects.
- Describe the classification of living things, the kinds of criteria used to classify them, and the formal protocol in naming them.
- Describe the chemical architecture of living things and the functions of the major groups of biological molecules.
- Describe the parts, their structure and functions, of cells, diversity of cell types, cell metabolism, cell communication, and cell division processes (mitosis and meiosis).
- Solve problems in Mendelian genetics.
- Describe the processes whereby genes are expressed as the characteristics of the whole organism.
- Describe evolution as the unifying principle of biological science; and present the evidence supporting evolution and natural selection.
- Discuss current hypotheses/theories regarding the evolutionary process and the origins of life, eukaryotic cells, sexuality, and multicellularity.
- Describe the characteristics, systematics, and biology of viruses, prokaryotes, protists, and fungi.

BIOL 171L: General Biology Lab I - (1 credit) - for Biological Science Concentration

Laboratory to accompany BIOL 171. (3 hours laboratory)

Pre-Requisite(s): Credit for or registration in BIOL 171.
Recommended Preparation: High school chemistry or college chemistry.

Student Learning Outcomes

- Use the scientific method of inquiry to investigate biological phenomena.
- Apply the concepts learned in BIOL 171 to an experimental and hands-on observational setting.
- Collect, reduce, and interpret biological data.
- Prepare written objective reports describing and interpreting experimental and observational results.
- Demonstrate the use of some of the standard tools of the biological scientist, such as microscopes, scales, spectrophotometers, computers, and other analytical tools.
- Apply the standard analytical procedures of biology, such as chromatography, biochemical analyses, preparation of materials for microscopic examination, culture techniques, and statistical procedures (descriptive statistics and hypothesis testing).
BIOL 172: General Biology II (3 credits) - for Biological Science Concentration

Continuation of BIOL 171. Anatomy, physiology, and systematics of plants and animals, behavior, ecosystems, populations, and communities. (3 hours lecture)

Pre-Requisite(s): Credit for BIOL 171 and 171L.  
Co-Requisite(s): BIOL 172L.

Recommended Preparation: High school biology and college level reading and writing skills.

Student Learning Outcomes

- Distinguish between the major groups of higher plants by recognizing the anatomical, morphological, developmental features, and life cycles defining these groups.
- Distinguish between the major groups of animals by recognizing the anatomical, morphological, and developmental features defining these groups.
- Describe the biology of higher plants, including the following concepts: basic plant characteristics, plant adaptations to terrestrial versus aquatic life styles, and vascular plant reproduction, growth, anatomy, nutrition, transport mechanisms, and hormonal integration.
- Describe the biology of animals, including the following concepts: adaptations to terrestrial versus aquatic life styles, embryology, behavior, and the anatomy and physiology of animal organ systems (i.e., digestion, respiration, circulation, osmoregulation, thermoregulation, immunity, reproduction, nervous, and endocrine system).
- Describe the basic principles of ecology, including population ecology, community ecology, and ecosystem function.
- Describe the characteristics of the major biomes and ecosystems of the Earth.
- Describe the interrelationships between land, sea, the atmosphere and the living things that occupy these environments.

BIOL 172L: General Biology Lab II - (1 credit) - for Biological Science Concentration

Laboratory to accompany BIOL 172. (3 hours laboratory)

Co-Requisite(s): BIOL 172.  
Recommended Preparation: High school biology and college level reading and writing skills.

Student Learning Outcomes

- Use the scientific method of inquiry to investigate biological phenomena.
- Apply the concepts learned in BIOL 172 to an experimental and hands-on observational setting.
- Collect, reduce, and interpret biological data.
- Prepare written objective reports describing and interpreting experimental and observational results.
- Apply standard analytical procedures for the comparative study of plants and animals, such as the handling of living and preserved materials for study, dissection procedures, preparation of materials for microscopic examination, and use of dichotomous keys.
- Identify the diagnostic anatomical features of organisms representing major groups of plants and animals.
- Identify the major systematic groups to which specimens of plants and animals belong.

**CHEM 161: General Chemistry I - (3 credits) for both Concentrations**

http://windward.hawaii.edu/courses/CHEM161/

Basic principles of inorganic chemistry with an emphasis on problem solving. First course of a two-course sequence designed to meet the one-year General Chemistry requirement for pre-med, science and engineering majors. Topics include chemical calculations, electronic structure, chemical bonding, states of matter and solutions.(3 hours lecture)

Pre-Requisite(s): A grade of “C” or better in Math 103 or higher, or placement into Math 135 or consent of instructor.

Co-Requisite(s): Registration in CHEM 161L.

Recommended Preparation: Student should have taken high school chemistry, CHEM 100, or CHEM 151.

Student Learning Outcomes

- Use the mole concept in solving stoichiometry problems involving solids, liquids, gases and solutions.
- Balance chemical equations, classify reactions, identify and analyze the role of the chemicals involved in chemical reactions.
- Predict the behavior of gases while undergoing changes in volume, pressure, temperature and quantity.
- Manipulate thermochemical equations and calculate the amount of energy involved in chemical reactions.
- Predict physical and chemical properties of elements based on electronic structure and location in the Periodic Table.
- Predict physical and chemical properties of compounds based on chemical bonding, geometry and intermolecular interactions.

**CHEM 161L: General Chemistry Laboratory I (1 credit) - for both Concentrations**

http://windward.hawaii.edu/courses/CHEM161L/
Laboratory experiments illustrating fundamental principles of chemistry. (3 hours laboratory)

Pre-Requisite(s): Credit for or registration in CHEM 161.

Student Learning Outcomes

- Apply laboratory safety procedures and respond to hazards.
- Use molecular and crystal models, perform common laboratory techniques competently and computer-based experiments to verify chemistry laws on stoichiometry, thermochemistry, behavior of gases and liquids.
- Apply and articulate the scientific method by preparing lab reports using the standard scientific format. Express in writing core chemistry principles, results of experiments and do critical thinking by synthesizing conclusions based on observations and data.
- Make and record precise measurements, calculate results using significant figures, standard deviations and identify sources of error in laboratory experiments.
- Use computer competently, word-processing, spreadsheet and graphing.
- Prepare chemical solutions, perform dilutions, calculate solution concentrations and generate a calibration curve.

CHEM 162: General Chemistry II (3 credits) - for both Concentrations

http://windward.hawaii.edu/courses/CHEM162/

Second course of a two-course sequence designed to meet the one-year General Chemistry requirement for pre-med, science and engineering majors. Topics include thermochemistry, kinetics, acid-base equilibrium, solubility equilibrium and electrochemistry. Emphasis on problem solving. (3 hours lecture)

Pre-Requisite(s): A grade of “C” or better in CHEM 161, credit for or registration in MATH 135, or consent of instructor.
Co-Requisite(s): CHEM 162L.

Student Learning Outcomes

- Predict properties of pure substances using phase diagrams.
- Predict properties (boiling point, melting point, osmotic pressure, vapor pressure) of solutions based on concentration.
- Determine reaction rate law and calculate rate constants and half-life based on experimental data.
- Calculate the equilibrium concentration of chemicals in solution involved in precipitation, and acid-base and reactions.
- Predict spontaneous reactions based on enthalpy and entropy considerations.
- Determine the electrochemical potential of redox reactions.
CHEM 162L: General Chemistry Laboratory II (1 credit) - for both Concentrations
http://windward.hawaii.edu/courses/CHEM162/

Laboratory experiments illustrating fundamental principles of chemistry.(3 hours laboratory)

Pre-Requisite(s): Credit for or registration in CHEM 162.

Student Learning Outcomes

- Develop an appreciation for the methods of scientific inquiry through computer-based laboratory experiments showing real-time data.
- Apply knowledge to determine molar mass of unknown substance using freezing point depression data of solution.
- Calculate chemical reaction rate and constant using graphing analysis.
- Predict the effects of concentration and temperature changes on equilibrium mixtures using Le Chatelier's principle.
- Determine whether equilibrium is established and calculate equilibrium concentrations/constants and cell potentials.
- Apply and articulate the scientific method by preparing lab reports using the standard scientific format. Express in writing core chemistry principles, results of experiments and do critical thinking by synthesizing conclusions based on observations and data.

MATH 205: Calculus I (4 credits) - for both Concentrations
http://windward.hawaii.edu/courses/MATH205/

Basic mathematical concepts, topics in differentiation, and introductory integration of algebraic and trigonometric functions. Applications of differentiation and integration will be demonstrated.(4 hours lecture)

Pre-Requisite(s): Grade of “C” or better in MATH 140 or equivalent, satisfactory math placement test score, or consent of instructor.

Student Learning Outcomes

- Understand and use the formal and intuitive definitions of limits and apply them in limit calculations and in determining continuity.
- Demonstrate proficiency in determining derivatives and apply different interpretations of the derivative.
- Utilize precise mathematical language and symbols to effectively communicate mathematics in written and/or oral form.
- Use calculus techniques to analyze and solve applied problems.
- Use derivatives to analyze and sketch graphs and/or to solve related problems.
- Demonstrate proficiency in determining antiderivatives and integrals.
- Utilize integration in applied problems.

MATH 206: Calculus II (4 credits) - for Physical Science Concentration

http://windward.hawaii.edu/courses/MATH206/

Differentiation and integration concepts of trigonometric, exponential, logarithmic and hyperbolic functions. Integration implements, infinite series, and applications of derivatives and integrals are also featured. (4 hours lecture)

Pre-Requisite(s): Grade of “C” or better in MATH 205 or equivalent or consent of instructor.

Student Learning Outcomes

- Apply limits, derivatives, and integrals to inverse functions, logarithmic, exponential, hyperbolic, and inverse trigonometric functions.
- Utilize various techniques of integration.
- Determine whether a sequence or series converges.
- Use concepts from the course to solve problems.
- Solve differential equations.
- Utilize precise mathematical language and symbols to effectively communicate mathematics in written and/or oral form.

PHYS 151: College Physics I (3 credits) - for both Concentrations

http://windward.hawaii.edu/courses/PHYS151/

A noncalculus one semester course for preprofessional or nonengineering majors. Study of the basic concepts of physics, including the fundamental principles and theories in mechanics, energy, and waves. (3 hour lecture)

Pre-Requisite(s): Credit for or registration in MATH 140 or higher, or consent of instructor.
Co-Requisite(s): PHYS 151L.

Student Learning Outcomes

- Demonstrate a general understanding of the underlying philosophy of the physics, including the scientific method.
- Apply the basic concepts of physics, including mechanics, energy, simple oscillatory systems, gas laws and fluid dynamics.
- Apply the concept of conservation laws in problem solving.
- Apply basic algebraic and graphical analysis techniques to physics problems.
- Compare and contrast macroscopic and microscopic systems in physics.
- Define quantitatively and qualitatively the common terms used in physics.
- Assess the limitations of the scientific method and apply error analysis.
- Determine when to apply physics principles to everyday situations.

**PHYS 151L: College Physics Laboratory I** (1 credit) - for both Concentrations

[http://windward.hawaii.edu/courses/PHYSL151/](http://windward.hawaii.edu/courses/PHYSL151/)

Experiments in statics, mechanics, energy, waves, and friction.(3 hours laboratory)

Pre-Requisite(s): Credit for or registration in PHYS 151.

**Student Learning Outcomes**

- Apply the scientific method to physical science systems involving mechanics, energy, simple oscillatory systems, gas laws and fluid dynamics.
- Collect, report and analyze data obtained in a laboratory setting in a manner exhibiting organization, proper documentation and critical thinking.
- Manipulate data and apply quantitative techniques, such as graphing and statistical analysis.
- Demonstrate a basic understanding of the standard instruments used in physics.
- Identify environmental factors, which affect the outcome of an experiment or observation and apply basic error analyses techniques.

**PHYS 152: College Physics II** (3 credits) - for both Concentrations

[http://windward.hawaii.edu/courses/PHYSL152/](http://windward.hawaii.edu/courses/PHYSL152/)

A noncalculus, one-semester course for pre-professional or nonengineering majors. Study of the basic concepts of physics, including the fundamental principles and theories in electricity, magnetism, optics, and modern physics.(3 hours lecture)

Pre-Requisite(s): Credit for PHYS 151 or equivalent, or consent of instructor.
Co-Requisite(s): PHYS 152L.

**Student Learning Outcomes**

- Demonstrate a general understanding of the underlying philosophy of the physics, including the scientific method.
- Apply the basic concepts of physics, including thermodynamics, static and dynamic laws of electricity and magnetism, circuit analysis, electromagnetic radiation, optical systems, and the fundamentals of atomic and nuclear physics.
- Apply the concept of conservation laws in problem solving.
- Apply basic algebraic and graphical analysis techniques to physics problems.
- Compare and contrast macroscopic and microscopic systems in physics.
- Define quantitatively and qualitatively the common terms used in physics.
- Assess the limitations of the scientific method and apply error analysis.
- Recognize the physical science principles as applied to everyday situations.

PHYS 152L: College Physics Laboratory II (1 credit) - for both Concentrations

http://windward.hawaii.edu/courses/PHYS152L/

Experiments in electricity, magnetism, optics, and modern physics.(3 hours laboratory)

Pre-Requisite(s): Credit for or registration in PHYS 152.

Student Learning Outcomes

- Apply the scientific method to physical science systems involving thermodynamics, static and dynamic laws of electricity and magnetism, electrical and electronic circuit analysis, electromagnetic radiation, optical systems, and the fundamentals of atomic and nuclear physics.
- Collect, report and analyze data obtained in a laboratory setting in a manner exhibiting organization, proper documentation and critical thinking.
- Manipulate data and apply quantitative techniques, such as graphing and statistical analysis.
- Demonstrate a basic understanding of the standard instruments used in physics.
- Identify environmental factors, which affect the outcome of an experiment or observation and apply basic error analyses techniques.

PHYS 170: General Physics I (4 credits) - for both Concentrations

This is the first of a rigorous, calculus-based course in physics for the professional or engineering majors. The study of the concepts of physics including the fundamental principles and theories of mechanics, energy, waves and thermodynamics.(4 hours lecture)

Pre-Requisite(s): Credit for MATH 205 or higher or equivalent or consent of instructor.
Co-Requisite(s): PHYS 170L and credit for or registration in MATH 206 or equivalent, or consent of instructor.

Student Learning Outcomes

- Demonstrate a solid conceptual understanding of kinematics, dynamics, wave phenomena, and thermodynamics.
- Solve applicable problems using differential calculus and vector analysis.
- Apply the laws of physics to computational problems in kinematics, dynamics, wave phenomena, and thermodynamics.
PHYS 170L: General Physics I Laboratory (1 credit) - for both Concentrations

This laboratory course is a rigorous, calculus-based study for professional or engineering majors. Laboratory exercises are designed to reinforce the fundamental concepts of kinematics, mechanics, energy, waves and thermodynamics.(3 hours laboratory)

Co-Requisite(s): Credit for or registration in PHYS 170.

Student Learning Outcomes

- Demonstrate an experimental understanding of some basic physical concepts and theories.
- Demonstrate familiarity with various instruments and their use in making reliable and precise measurements.
- Calculate a result with the appropriate number of significant figures.
- Analyze data using calculation and graphical methods.
- Organize an accurate and complete laboratory notebook.

PHYS 272: General Physics II (3 credits) - for both Concentrations

http://windward.hawaii.edu/courses/PHYS272/

This is the second in a rigorous, calculus-based physics course for the professional or engineering major. The study of the concepts of physics including the fundamental principles and theories of electricity, magnetism, light, and optical theory.(3 hours lecture)

Pre-Requisite(s): Credit for MATH 206 or higher or equivalent and a grade of “C” or better in PHYS 170 or consent of instructor.
Co-Requisite(s): PHYS 272L.

Student Learning Outcomes

- Demonstrate a solid conceptual understanding of electricity, magnetism, light, and optical theory.
- Solve applicable problems using calculus and vector analysis.
- Apply the laws of physics to computational problems in electricity, magnetism, and wave phenomena.

PHYS 272L: General Physics II Laboratory (1 credit) - for both Concentrations

http://windward.hawaii.edu/courses/PHYS272L/

This laboratory course is a rigorous, calculus-based study for professional or engineering majors. Laboratory exercises are designed to reinforce the fundamental concepts of electricity, magnetism, light and optical theory.(3 hours laboratory)
Pre-Requisite(s): Credit for or registration in PHYS 272.

Student Learning Outcomes

- Demonstrate experimental understanding of some basic physical concepts and theories.
- Demonstrate familiarity with various instruments and learn to make reliable measurements.
- Calculate a result with the appropriate number of significant figures.
- Analyze data using calculation and graphical methods.
- Organize an accurate and complete laboratory notebook.

6. Projected Program Enrollment

The AS in NS will exist alongside the college’s AA degree. There are two primary sources of students: those who would otherwise obtain an AA degree but would prefer an AS degree and those who transfer before obtaining an associates degree but would be interested in obtaining an AS degree.

The college has estimated program enrollment based on the enrollment for key science-related classes offered at the college that would be expected to be taken only by students interested in STEM-related careers and education.

<table>
<thead>
<tr>
<th></th>
<th>Spring 2011</th>
<th>Fall 2011</th>
<th>Spring 2012</th>
<th>Fall 2012</th>
<th>Spring 2013</th>
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<td>22</td>
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<td>CHEM 162</td>
<td>20</td>
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</tr>
<tr>
<td>MATH 205</td>
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<td>18</td>
<td>18</td>
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<tr>
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<td>8</td>
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<td>PHYS 152</td>
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</tr>
<tr>
<td>PHYS 272</td>
<td>not offered</td>
<td>not offered</td>
<td>not offered</td>
<td>11</td>
<td>not offered</td>
</tr>
</tbody>
</table>

The enrollment in these classes has been largely consistent for the last three years. PHYS 272 was offered for the first time in Fall 2012.

The college estimates that enrollment in the AS in NS will 8 for the 2013-2014 academic year, 16 for the 2014-2015 academic year, and 24 for the 2015-2016 academic year.
The estimates are reasonable given the enrollment levels, which suggest that there are currently 10 or 20 students who would be suitable for the degree. Thus, enrollment in the first year of the degree would be of current students who are, in effect, already doing what is required for the degree. In the second year of the degree, the enrollment increase will be due to additional publicity directed towards current and new students.

The enrollment increase in the third year will be based more on new students entering the college in 2014 who are guided towards the degree.

One special target group for this degree are students entering from high school who are already interested in STEM careers. Often, these students may be tempted to go directly to a four-year college. However, with an organized STEM Associate in Science will allow students to complete the first two years of their degree at the community college.

7. Service to Non-Majors
The primary impact of the AS in NS to non-majors will be twofold. First, the increased demand for more specialized math and science courses will make it more viable for them to be offered at Windward. Second, the increased number of students specializing in STEM-related fields will create a pool of potential tutors and supplemental instructors for introductory science classes.

8. Cost Narrative and Template
There are no significant staff and resource requirements connected with this proposal. The college already offers the classes for this degree. Additional lecturer and supply costs are anticipated from an increased demand for courses.
## Academic Cost and Revenue Template - New Program (adjust template for appropriate number of years) (Updated 06/12/12)

**ENTER VALUES IN YELLOW CELLS ONLY**

### CAMPUS/Program:
Windward Community College

Provisional Years (2 yrs for Certificate, 3 yrs for Associate Degree, 6 yrs for Bachelor’s Degree, 3 yrs for Masters Degree, 5 yrs for Doctoral Degree)

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
</table>

### ENTER ACADEMIC YEAR (i.e., 2011-2012):

|-----------|-----------|-----------|-----------|-----------|-----------|

### Students & SSH:

<table>
<thead>
<tr>
<th></th>
<th>A. Headcount enrollment (Fall)</th>
<th>B. Annual SSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>8</td>
<td>240</td>
</tr>
<tr>
<td>2014-15</td>
<td>16</td>
<td>480</td>
</tr>
<tr>
<td>2015-16</td>
<td>24</td>
<td>720</td>
</tr>
</tbody>
</table>

### Direct and Incremental Program Costs Without Fringe:

<table>
<thead>
<tr>
<th></th>
<th>C. Instructional Cost without Fringe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>$40,000</td>
</tr>
</tbody>
</table>

### Revenue:

<table>
<thead>
<tr>
<th></th>
<th>G. Tuition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>$25,440</td>
</tr>
</tbody>
</table>

### Program Cost per SSH With Fringe:

<table>
<thead>
<tr>
<th></th>
<th>K. Instructional Cost with Fringe/SSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>$225</td>
</tr>
</tbody>
</table>

### Instructional Cost with Fringe per SSH:

<table>
<thead>
<tr>
<th></th>
<th>K. Instructional Cost/SSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>$225</td>
</tr>
</tbody>
</table>

### Program used for comparison:

<table>
<thead>
<tr>
<th></th>
<th>Program used for comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>Kapiolani Community College</td>
</tr>
</tbody>
</table>

(Reviewed by campus VC for Administrative Affairs)
### A. Headcount Enrollment
- **Headcount enrollment of majors each Fall semester**
  - Campus data may be used when majors are a subset of enrollment reported in IRO reports.

### B. Annual SSH
  - Add the SSH for the Fall and Spring reports to obtain the annual SSH. This is all SSH taught by the program, including to non-majors. Adjust if majors are subset of SSH reported.

### C. Instructional Cost without Fringe
- **Formula for column D:** \( \text{IF(OR(D32<>""),D32+D34,"")} \)

### D. Other Personnel Cost
- **Salary cost (part or full time) for personnel supporting the program (APT, clerical lab support, advisor, etc.)**
  - This includes personnel providing necessary support for the program who may not be directly employed by the program and may include partial FTEs. Add negotiated collective bargaining increases and 4% per year for inflation thereafter.

### E. Unique Program Cost
- **Costs specific to the program for equipment, supplies, insurance, etc.**
  - For provisional years, this would be actual cost. For established years, this would be projected costs using amortization for equipment and add 4% per year for inflation thereafter.

### F. Tuition
- **Annual SSH X resident tuition rate/credit**
  - *Formula for column D: \( \text{IF(D10<>""),(SUM(D33,D35)/D10,"")} \)

### G. Support Cost/SSH
- **The campus' non instructional expenditure/ssh + systemwide support – organized research (UHM only)**
  - *Formula for column D: \( \text{IF(OR(D37<>""),D37+D38-D39,"")} \)

### H. Total Program Cost/SSH
- **K + L**
  - *Formula for column D: \( \text{IF(OR(D31<>""),D31+D36,"")} \)

### I. Total Campus Expenditure/SSH
- **Taken from UH Expenditures Report**
  - For example, for 2009-2010: UHM = $923, UHH = $682, UHWO = $501, HawCC = $408, HonCC = $505, KapCC = $316, KauCC = $396, Maui CC = $396, WinCC = $457

### J. Comparable Program/Division Instructional Cost/SSH
- **Taken from UH Expenditures Report**
  - (http://www.hawaii.edu/budget/expend.html) or campus data, as available. Please note in the space provided, the program used for the comparison.

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For example, from the 2010-11 UH Expenditure Report (http://www.hawaii.edu/cgi-bin/iro/maps?esuhfy1011.pdf), the support expenditure/ssh per campus is:

- **UHM**
  - $507.00 + $56 - $128 for organized research = $435

- **UHH**
  - $437.00 + $45 = $482

- **UHWO**
  - $230.00 + $28 = $258

- **Haw CC**
  - $155.00 + $34 = $189

- **Hon CC**
  - $234.00 + $44 = $278

- **Kap CC**
  - $123.00 + $29 = $152

- **Kau CC**
  - $328.00 + $59 = $387

- **Lee CC**
  - $123.00 + $27 = $150

- **Maui CC**
  - $160.00 + $35 = $195

- **Win CC**
  - $264.00 + $40 = $304

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**K1. Salaries without Fringe**
- **Full Time Faculty and Lecturers who are >.5 FTE based on FTE directly related to the program. Add negotiated collective bargaining increases and 4% per year for inflation thereafter.**
  - *Formula for column D: \( \text{IF(AND(D18<>""),D32*1.35,"")} \)

**K2. K1 X 1.35**
- *Formula for column D: \( \text{IF(D32<>""),D32*1.35,"")} \)

**K3. Salaries without Fringe**
- **Lecturers who are <.5 FTE based on FTE directly related to the program. Add negotiated collective bargaining increases and 4% per year for inflation thereafter.**
  - *Formula for column D: \( \text{IF(D34<>""),D34*1.05,"")} \)

**K4. K3 X 1.05**
- *Formula for column D: \( \text{IF(D34<>""),D34*1.05,"")} \)

**K5. Total Program Cost/SSH**
- **The campus non instructional expenditure/ssh + systemwide support – organized research (UHM only)**
  - As provided by UH Expenditure Report (http://www.hawaii.edu/budget/expend.html)
  - *Formula for column D: \( \text{IF(OR(D31<>""),D31+D36,"")} \)

**K6. Net Cost**
- **F - I**
  - This is the net incremental cost of the program to the campus. A negative number here represents net revenue (i.e., revenue in excess of cost). If there is a net cost, please explain how this cost will be funded.
  - *Formula for column D: \( \text{IF(AND(D18<>""),D24<>""),D18-D24,"")} \)

**K7. Total Cost**
- **G + H**
  - *Formula for column D: \( \text{IF(OR(D21<>""),D21+D23,"")} \)

**K8. Total Revenue**
- **Annual SSH X resident tuition rate/credit**
  - *Formula for column D: \( \text{IF(D10<>""),(SUM(D33,D35)/D10,"")} \)

**K9. Total Direct and Incremental Cost**
- **C + D + E**
  - *Formula for column D: \( \text{IF(OR(D32<>""),D32+D34,"")} \)

**K10. Unique Program Cost**
- **Costs specific to the program for equipment, supplies, insurance, etc.**
  - For provisional years, this would be actual cost. For established years, this would be projected costs using amortization for equipment and add 4% per year for inflation thereafter.

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**M. Total Program Cost/SSH**
- **K + L**
  - *Formula for column D: \( \text{IF(OR(D31<>""),D31+D36,"")} \)

**N. Total Campus Expenditure/SSH**
- **Taken from UH Expenditures Report**
  - For example, for 2009-2010: UHM = $923-131 (organized research) = $792, UHH = $682, UHWO = $501, HawCC = $408, HonCC = $505, KapCC = $316, KauCC = $396, Maui CC = $396, WinCC = $457

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**Rev. 06.12.12**