1. Program or Unit Description

ICS Program Mission Statement
The Information and Computer Science program is committed to providing an intellectually challenging curriculum that prepares graduates to understand the fundamental concepts in computer science and the practices, values and demands of related professions.

Program Description
The Information and Computer Science program plays two different roles, it is both a transfer program (AS-NS in Information and Communication Technology), as well as a Career and Technical Education (CTE) program.

The curriculum leading to an Associate in Science degree in Information and Computer Science is designed to prepare individuals for employment as technical assistants to professional and administrative personnel using computers. Students may choose one area of specialty: Network Support Specialist, Information Security Specialist, Software Developer Specialist or Cloud Support Specialist. Over this past year, program faculty have been working on an additional track in Data Science. Skills in oral and written communication, social science, global issues, and mathematics complete the preparation for employment. The program can be completed entirely via distance education using various modalities of delivery.

The core program requirements are designed to facilitate transfer to the baccalaureate programs in Information and Computer Sciences at UH Manoa, the Bachelor of Science degree in Computer Science degree at UH Hilo, the Bachelor of Applied Sciences degree in Applied Business and Information Technology at UH Maui College, and the Bachelor of Applied Sciences in Information Security and Assurance at UH West Oahu. Leeward CC graduates are able to continue academic study towards a four-year degree while professionally employed in the industry.

The ICS Program has been articulated by Program Coordinating Council continuously for the past two decades. The most recent agreement is dated September 2017 among all the community colleges of the UH System and UH Maui College. Our core courses remain aligned with UH Manoa, UH West Oahu and UH Hilo, as well as nationally with curriculum guidelines approved by the Association for Computing Machinery (ACM).

The ICS program is recognized by the National Security Agency as a Center of Academic Excellence – 2 Year (CAE-2Y) in Cybersecurity. The application process vetted our program against national guidelines for cybersecurity programs.
2. Analysis of the Program/Unit

The demand indicators show a slight decrease in state and county computer science jobs. However, demand for computer science and IT professionals is rising at a fast pace. A recent study by the UHCCs indicate large numbers of trained professionals will be needed in the immediate and long-term futures. Every business that uses computers needs a team of IT professionals to safeguard the integrity of its hardware, software and data. Computer science professionals are required in every field including agriculture, education, health care, manufacturing, transportation, tourism and more.

The US military is seeking a trained workforce in cybersecurity, data science, and other information technology fields. In a recent conference call, the US Army projected an immediate need for more than 500 professionals trained in data science and cybersecurity within the next year. Both computers and computer professionals have become ubiquitous commodities. The need for professionals in computer fields is so evident and so important that money and time from varied sources has been allocated to support these fields across the nation and within the UH System. The UHCCs C3T4 grant for cybersecurity which ended in 2017 allotted over half a million dollars to support computer security education across the UH campuses. We continue to self-support and upgrade the equipment purchased under that grant for our computer science program at Leeward CC. Over the past year, we purchased three new servers to support our program and allow for distance education delivery. The ICS consortium and other STEM initiatives are in place to coordinate the efforts from the various campuses to serve students given the increasing demand for the courses that we offer. STEM resources from the past two years are listed here: http://www.hawaii.edu/offices/aa/stem/stem-resources/.

Over seven years ago, then UH Chief Information Technology officer David Lassner gathered every computer science, computer engineering and IT program throughout the UH System for regular meetings. Representatives from the US military also participated in the meetings. Our cybersecurity group has solidified and it is now under the leadership of the UH Chief Security officer, Jodi Ito. The NSA and industry representatives continue to be present during our meetings. Aware of the need for computer security specialists, sources external to the UH System help us better tailor our educational programs to grow their future employees. In regards to job availability for our students, the CIP code selection reports a lower number of jobs than are actually available for our graduates. The limitation of using one CIP code to report numbers of jobs results in narrow results. Our program prepares students for employment in multiple fields including forensics, cybersecurity, information assurance, data science, programming, database management and helpdesk troubleshooting. These fields are not captured in the current CIP code used for program review reporting. OPPA is aware that this continues to be an issue, and not just in our campus but in other campuses as well. According to a report distributed during our ICT consortium meeting organized by the STEM education office at UH Manoa, the ‘T’ in STEM is the one with the most growth from all the STEM disciplines. The number of jobs available in the state is greater than is reported in our annual report data. The UH System STEM education office has a page with links to resources of jobs: http://www.hawaii.edu/offices/aa/stem/stem-resources/
The number of students transferring to the Bachelor degree programs at UH Manoa and the BAS in Information Security at UH West Oahu have steadily increased. Leeward CC is the largest feeder into the NSA/DHS certified National Center of Academic Excellence in Cyber Defense Education at UH West Oahu. Leeward CC maintains a transfer pathway into the BAS in Advanced Business and Information Technology at UH Maui College. The articulation agreements allow seamless transfer for students who have earned a degree from Leeward CC. This provides many advantages for our students, including articulated transcript evaluation and students are automatically accepted as juniors in the bachelor degree programs at our four-year institutions.

Our ICS program health indicators for demand and efficiency are healthy. The program health indicators for effectiveness are progressing. Demand for our ICS courses remains steady showing full-time enrollment equivalency changing from 202 to 193 in the last year. SSH in all program classes remained steady from 6,069 to 5,775 in the last year. The total number of classes taught remained steady going from 113 to 109. Program efficiency indicators remained healthy and steady over the past year. There was a slight increase in in fill rate from 87.8% to 88.1% over the past year. The number of majors to FTE BOR-appointed faculty also increased from 43 to 44. Program effectiveness indicators are progressing. There was a slight increase in the successful completion, persistence Fall to Spring, and persistence Fall to Fall rates over the past year. The number of unduplicated degrees and certificates awarded remained steady. An analysis with other UHCCs which offer IT degrees indicates that Leeward awards more than double the number of ICS/IT degrees than any other institution. Transfers to four-year degree programs grew from 29 to 37 over the past year.

We met both of the Perkins core indicators which are reported, 1P1 Postsecondary Placement and 2P1 Earned Recognized Credential. We are pleased that the number of Native Hawaiian majors grew from 36 to 43 and Pell grant recipients grew from 35 to 53 over the past year. Our efforts to increase participation of non-traditional students and underrepresented groups in our program are working.

Mike Bauer participated virtually in the NCWIT (National Center for Women in Information Technology) Summit where techniques to support, recruit and retain underrepresented groups in computer science and other STEM fields are discussed. Mike Bauer also attended a virtual ACM SIGCSE (Association for Computing Machinery’s Special Interest Group in Computer Science Education) Technical Symposium on Computer Science Education with the same goal.

During the COVID pandemic we closed “The Hub,” our on-campus student help desk. We hope to resume operations once the pandemic’s effects diminish. When operational, the hub provides valuable experience for computer science students in hardware troubleshooting and maintenance. The hub has helped many students that had problems with their computers. It helps students feel supported while promoting our program. By using the hub services, students realize that the skills obtained in the computer science program are useful. It may influence their decision to join our program becoming a tool we use to recruit and retain students. Aside from the experience that our students acquired by helping other students, we saved our Leeward CC students a great amount of
money. In our last accreditation team visit, the hub was recognized in one of the seven commendations Leeward CC received.

The art of effective teaching in a community college demands that we tailor our course offerings and pedagogies to our student population. Student demand for online courses continues to grow. The C3T4 grant enabled us to purchase NetLab. NetLab is a virtual environment that enables our students to acquire hands-on experience in network setup and troubleshooting from home. Without NetLab, at least nine of our courses could not successfully be offered completely online, so students would be required to be present on campus. Face-to-face instruction would necessitate the purchase of additional physical equipment to allow every student to participate within the allotted class time. NetLab is very important for the ICS program. It allows student usage on a 24/7 basis. Due to NetLab and other initiatives, our number of online classes grew from 38 in 2020 to 87 in 2021. The number of students served in online classes grew from 664 to 1,541 in 2021.

3. Program Student Learning Outcomes or Unit/Service Outcomes

ICS Program Outcomes

- Demonstrate computing literacy.
- Describe the functions and interrelationships of the building blocks of an operating system.
- Develop object-oriented computer programs in at least two programming languages.
- Apply mathematics to solve computing problems.
- Effectively communicate in written and oral form, a system solution its documentation, and its implementation.
- Use project management tools to manage information systems development projects.
- Work effectively as part of a group/team.
- Design a relational database with proper documentation
- Demonstrate proficiency in computer maintenance and networking.
- Software Developer Specialist: Develop a foundation in computer programming, data structures and discrete mathematics.
- Network Support Specialist: Apply computer-networking principles to build and troubleshoot networks.
- Information Security Specialist: Apply the tools and techniques of information security to secure physical and digital information.
- Cloud Support Specialist: Utilize methodologies and tools that assist with discovering and securing data in the cloud.
Associate in Science Degree, Information & Computer Science

Core Requirements 27 credits
ICS 101 Digital Tools for the Information World (3)
ICS 110M or ICS 110P Introduction to Programming (3)
ICS 111 Introduction to Computer Science I (3)
ICS 125 Personal Computer Maintenance and Repair or ICS 131 Introduction to Virtualization (3)
ICS 129 Introduction to Databases (3)
ICS 171 Introduction to Computer Security (3)
ICS 184 Introduction to Networking (3)
ICS 231 Introduction to Linux (3)
ICS 270 Systems Analysis (3)

General Education Requirements 21 credits
One DS Course (3)
ENG 100 Composition I (3)
ENG 225 or ENG 209 Technical Writing (3) or Business Writing (3)
SP 151 or SP 251 Personal and Public Speech (3) or Principles of Effective Public Speaking (3)
ICS 170 Ethics for the Digital World (3)
One FG Course (3)
ICS 141 or MATH 103 or MATH 135 Discrete Mathematics for Computer Science (3) or College Algebra (3) or Precalculus: Elementary Functions (3)

Electives 3 credits any college course 100 or higher (3)

Specialization 9 credits Select One Specialization Below

Specialization: Network Support Specialist
ICS 215 Introduction to Scripting (3)
ICS 273 Network Design and Administration (3)
ICS 274 Advanced Network Design and Administration (3)

Specialization: Information Security Specialist
ICS 215 Introduction to Scripting (3)
ICS 281 Ethical Hacking (3)
ICS 282 Computer Forensics (3)

Specialization: Software Developer Specialist
ICS 211 Introduction to Computer Science II (3)
ICS 212 or ICS 215 Program Structure (3) or Introduction to Scripting (3)
ICS 241 Discrete Mathematics for Computer Science II (3)

Specialization: Cloud Support Specialist
ICS 215 Introduction to Scripting (3)
ICS 281 Ethical Hacking (3)
ICS 284 Cloud Security (3)

ICS AS Degree Summary:
- ICS Core Courses 27 credits
- Specialization Courses 9 credits
- General Education Courses 21 credits
- Electives 3 credits
- Total 60 credits

Certificate of Achievement in ICS
The Certificate of Achievement in Information and Computer Science is designed to provide the student with entry-level skills or job upgrading for positions under direct supervision in computer support, cabling and basic networking, office application support, and database management.

First Semester
ICS 101 Digital Tools for the Information World (3)
ICS 110M or ICS 110P Introduction to Programming (3)
ICS 129 Introduction to Databases (3)
ENG 100 Composition I (3)
MATH 103 or MATH 135 or higher or ICS 141 College Algebra (3) Precalc: Elementary Functions (3) Discrete Math for Computer Sci I (3)

Second Semester
ICS 111 Introduction to Computer Science I (3)
ICS 125 Personal Computer Maintenance and Repair (3)
ICS 170 Ethics for the Digital World (3)
ICS 184 Introduction to Networking (3)
SP 151 or SP 251 Personal and Public Speech (3) Principles of Effective Public Speaking (3)
Total Credits 30

Upon completion of the Certificate of Achievement in ICS, the student will be able to:
- Demonstrate computing literacy.
- Solve problems, develop algorithms and write object-oriented computer programs in a programming language.
- Design and a relational database with proper documentation.
- Demonstrate proficiency in computer maintenance and networking.
Certificate of Achievement in Information Security
The Certificate of Achievement in Information Security is designed to provide the student with the preparation needed to take the exams for several industry certifications.

First Semester
ICS 111 Introduction to Computer Science I (3)
ICS 170 Ethics for the Digital World (3)
ICS 171 Introduction to Computer Security (3)
ICS 184 Introduction to Networking (3)
ICS 231 Introduction to Linux (3)

Second Semester
ICS 101 Digital Tools for the Information World (3)
ICS 129 Introduction to Databases (3)
ICS 215 Introduction to Scripting (3)
ICS 281 Ethical Hacking (3)
ICS 282 Computer Forensics (3)

Total Credits 30

Upon completion of the Certificate of Achievement in Information Security, the student will be able to:

- Solve problems, develop algorithms and write object-oriented computer programs using a programming language.
- Design a relational database with proper documentation.
- Demonstrate proficiency in computer maintenance and networking.
- Exhibit proper use of an operating system.
- Apply the tools and techniques of information security to secure physical and digital information.

Courses Leading to Industry Certifications
Industry certifications must be taken in specialized testing centers. The ICS discipline is exploring the possibility of making Leeward Community College a CompTIA testing center. See http://home.pearsonvue.com/For-test-centers.aspx

- A+ (ICS 125)
  CompTIA A+ is a vendor neutral computer support certification that is trusted around the world. It validates essential knowledge and skills needed to support computer users within an organization including hardware, networking, mobile devices, operating systems, troubleshooting, virtualization, security and operational procedures. This certification is earned by passing two exams. See https://www.comptia.org/certifications/a#overview

- Network+ (ICS 184)
CompTIA Network+ is a vendor neutral networking certification that is trusted around the world. It validates the essential knowledge and skills needed to confidently design, configure, manage and troubleshoot any wired and wireless devices. CompTIA Network+ certified individuals are in-demand worldwide. See https://certification.comptia.org/certifications/network

- Security + (ICS 171)

CompTIA Security+ is the certification globally trusted to validate foundational, vendor-neutral IT security knowledge and skills. As a benchmark for best practices in IT security, this certification covers the essential principles for network security and risk management – making it an important stepping stone of an IT security career. See https://certification.comptia.org/certifications/security

- Linux+ (ICS 231)

CompTIA Linux+ certifies foundational skills and knowledge of Linux operating system. Linux is the central operating system for much of the world’s IT infrastructure. Linux+ is an essential credential for individuals working in IT, especially those on the path of a Web and software development career. See https://certification.comptia.org/certifications/linux

- CEH (ICS 281)

This course will significantly benefit security officers, auditors, security professionals, site administrators, and anyone who is concerned about the integrity of the network infrastructure. See http://www.globalknowledge.com/training/course.asp?pageid=9&courseid=20241&catid=191&country=United+States

- EnCE (ICS 282)

The EnCase® Certified Examiner (EnCE®) program certifies both public and private sector professionals in the use of Guidance Software's EnCase® computer forensic software. EnCE® certification acknowledges that professionals have mastered computer investigation methodology as well as the use of EnCase® software during complex computer examinations. Recognized by both the law enforcement and corporate communities as a symbol of in-depth computer forensics knowledge, EnCE certification illustrates that an investigator is a skilled computer examiner. See https://www.guidancesoftware.com/training/Pages/ence-certification-program.aspx

A) Evidence of Industry Validation

Industry certifications are a great boost to IT personnel salaries. Some employers require a college degree, but many employers look for industry certifications as a form of validation that future employees have the necessary experience to perform their assigned tasks at work. Many students
must decide whether to spend their time studying to obtain industry certifications or to get college credit. Our approach blends these two options into college courses that prepare them to take industry certifications. Over the past year, we provided exam vouchers to 26 students to take one industry certification exam. This number is expected to grow next year.

**B) Expected Level of Achievement**
For success at least 70% of the students should perform at least 70% of a given task correctly. Success in industry certification exams is measured differently. Some exams require scores of at least 90% in order for a student to pass. Students are notified about these facts in the classroom.

**C) Courses Assessed**
The following courses were assessed during the past year. All courses have been assessed at least once in the last five-year assessment cycle. This allows for all the previously mapped PLOs to be assessed along with the related course SLOs.

- ICS 101 Digital Tools for the Information World
- ICS 110P Introduction to Programming
- ICS 111 Introduction to Computer Science I
- ICS 141 Discrete Mathematics for Computer Science I
- ICS 170 Ethics for the Digital World
- ICS 212 Program Structure
- ICS 215 Introduction to Scripting
- ICS 241 Discrete Mathematics for Computer Science II
- ICS 293D Cooperative Education

**D) Assessment Strategy/Instrument**
NetLab is an important tool in many of our classes. NetLab is a virtual environment that provides students with the hands-on experience required in the industry. NetLab allows students access from home making it easier for students to fit these hands-on training sessions into their busy schedule. NetLab is an instrumental part of many of our courses assignments as well as an assessment tool.

Courses that use NetLab

- ICS 125 Personal Computer Maintenance and Repair
- ICS 171 Introduction to Computer Security
- ICS 184 Introduction to Networking
- ICS 231 Introduction to Linux
- ICS 273 Network Design and Administration
- ICS 274 Advanced Network Routing and Optimization
- ICS 281 Ethical Hacking
- ICS 282 Computer Forensics
- ICS 284 Cloud Security
E) Results of Program Assessment
As of the end of the Spring 2021 semester, all ICS program courses have been assessed at least once in the last five-year cycle. It is important to mention that all our lecturers helped the ICS program with SLO assessment. The ICS program has a shortage of full-time tenure-track faculty positions. There are some courses that are taught only by lecturers. Our lecturers have graciously helped us with course SLO assessment.

The courses which were staffed solely by lecturers at least once in the past year:

- ICS 170 Ethics for the Digital World
- ICS 212 Program Structure
- ICS 215 Introduction to Scripting
- ICS 231 Operating Systems

Assessment of the SLOs mapped into the PLOs achieved the required 70% mastery by at least 70% of the students in each course. We rely on the use of technology tools for course and program assessment. For example, NetLab, Laulima Tools and recommended external tools such as Padlet and FlipGrid are effective tools we use to perform assessment of our program.

4. Action Plan

Keeping Leeward CC’s mission statement in mind; We are striving to help more students obtain their goals, to graduate and obtain an AS in Information & Computer Science or AS in Natural Science, enter the workforce and/or transfer to a four-year degree program. During the COVID pandemic, all of our classes were offered online. Students indicate that they prefer online asynchronous course delivery by a large margin. It enables them to better juggle multiple family and job responsibilities with their academic studies. We will continue to offer our AS in ICS degree entirely online. All new courses developed will be required to have an online offering available for students. ICS faculty will use the distance education guidelines and professional development opportunities to develop high-quality online courses. ICS faculty will have their online courses assessed by peers with online experience, including those from other disciplines. ICS faculty members Michael Bauer and Petersen Gross have completed online training from Quality Matters to build better online courses. Michael Bauer is also a certified peer reviewer for Quality Matters. As the pandemic is anticipated to wane, we plan on offering some split courses which allow for students to choose either online or hybrid instruction.

In response to UH System initiatives and industry trends, the ICS program will introduce new courses in data science, machine learning and data visualization. The new courses will teach important skills for IT professionals. We are also expanding our early college offerings. We will form a Business and Industry Leadership Team to obtain feedback for continual improvement and adaptability to industry trends.
5. Resource Implications

During the past year, the ICS program had six full time tenure-track faculty. One of the six retired at the end of the current year. We will need to replace that faculty member next year. One of our faculty members who is receiving release time did not request overload. A second faculty member receiving release time was granted an exception to receive overload while on release time. Collectively, these two faculty members had 37 credit hours of release time during the fall and spring semesters. They received additional release time in summer. Three of the other four faculty members worked with overload. The ICS program has up to eleven lecturers teaching during any given semester. Some of them can only teach a limited range or courses or for a limited number of credits due to full-time jobs limiting their availability. Even with these limitations, four lecturers have completely full loads of five classes per semester. Three of them teach a sixth class every semester. The only full-time lecturer with the skills to teach almost any course in the ICS curriculum is Edward Meyer. Ed teaches a wide repertoire of courses which greatly supports the ICS program. Ed developed one new course for the ICS program and has assisted with curriculum development for five other courses. He is currently the only instructor for two of our courses. We need to continue to work toward funding a full-time position for Edward Meyer. In addition, we are continually recruiting additional lecturers. We hired five new lecturers during the past year. New requests from high schools for ten sections of early college courses will require additional lecturers next year. In addition, we are looking toward expanding ICS course offerings at Waianae Moku.

NetLab is very important for the ICS program. It provides students with the opportunity to access virtual equipment and to perform hands-on activities from home. The virtual equipment provided by NetLab, if it were real would cost up to $100,000 and be confined to the classroom. NetLab provides the same service for a fraction of the cost and makes it available to our students 24/7 from anywhere access to the Internet is available.

We need to continue to sustain the NetLab through service agreements and software licenses. Support for the NetLab requires $3,000.00 per year for software licenses. We also need to budget for periodic server replacements for NetLab. We recently purchased three new servers to support NetLab.

We hope to reopen and maintain the Hub next year. We need the current space and to hire student workers to manage it. Ideally some of the ICS lecturer’s offices will be relocated to the Hub to provide some relief to the currently overpopulated computer science faculty area. The cost for student workers to staff the Hub 40 hours per week at $11.65 per hour is $7,456 per 16-week semester.

ICS student tutors need to be hired to support our programming classes. The cost for student tutors working 10 hours per week at $11.65 is $1,864 per 16-week semester.
Together the sustainability of NetLab and the Hub is projected to cost $21,640 per year, however it will offer invaluable benefits to our students, the program and the college.

☐ I am NOT requesting additional resources for my program/unit.