Integrated Industrial Technology

ANNUAL REPORT OF PROGRAM DATA 2021

UNIVERSITY OF HAWAIʻI LEeward Community College
1. Program or Unit Description

The Integrated Industrial Technology program offers an Associate in Science Degree (AS-IIT) as well as a Certificate of Achievement and Certificate of Completion. The AS-IIT degree is a 61-credit degree program intended to provide students with a foundation in electronic, electrical, mechanical, and automated control systems to meet the workforce needs of an emerging industrial technology industry in Hawaii.

This program provides students with a theoretical and practical understanding of mechatronic systems and fosters the development of practical technical skills such as troubleshooting, component level repair, and stresses system level integration. Graduates can program, operate, maintain, calibrate, and repair the equipment that make up complex industrial control systems.

The degree prepares students for occupations that involve the integration of electronic, electrical, mechanical, and communications systems. Typical occupations include automated programmable electromechanical systems technicians, robotics, and manufacturing systems technicians, as well as process control systems integration technicians.

The IIT degree and certificate programs are open to anyone, however recruitment for program participants are primarily focused in three areas: high school graduates, military veterans, and industry professionals. Additionally, the program provides an alternative graduation pathway for students that are not able to complete the more rigorous Associate in Science - Natural Science (ASNS) program.

The program coordinator and program counselor use a recruiting strategy that helps to identify potential students that have both an aptitude and desire to pursue a career field in mechatronic technology. In partnership with Kamehameha schools, the program is sponsoring summer camps and outreach counseling at public high schools in West Oahu to identify potential students as early as sophomore year of High School.

The program provides a clear structured pathway for both full and part time students, program courses are typically scheduled afternoons and evenings, this provides an opportunity for adult learners (industry professionals) to return to attain a degree in their profession. The program takes advantage of the existing Prior Learning Assessment (PLA) program and provides an avenue for adult learners to earn a degree faster than traditional students.

2. Analysis of the Program/Unit

The Integrated Industrial Technology Program received probationary approval from the UH Board of Regents in Spring 2017. The first cohort of students started in Spring 2018, with a cohort beginning in fall of 2018, fall 2019, fall 2020, and fall 2021. The unduplicated head count for the program stands at 89 students.

The programs Overall-Health indicator is cautionary. This is in large part due to the program being new, with outreach efforts to high schools and transitioning military being hampered by pandemic related restrictions, as indicated in the programs Demand indicator of cautionary.
The program Efficiency indicator is unhealthy. The program does not have a full-time teaching faculty assigned, relying on lecturers significantly increases program costs. A few select courses were covered by full time engineering faculty during this reporting period, this practice will continue in the future as instructors familiarize themselves with the curriculum. The program Effectiveness indicator is Health. Most students that enter the program are earning both CC and CA certificates as well as the AS degree. Despite the overall health indicator of cautionary, the program’s outlook is positive in terms of graduates and incoming freshmen and post-graduation employment.

To remain viable, relevant, and productive, the IIT program must provide programs and services that are responsive to student choice and the economic demands of industry and businesses. The Integrated Industrial Technology Associate in Science Degree program was developed in response to a rapid increase in demand for electromechanical and mechanical engineering technicians in a variety of industries. Specifically, Hitachi Rail Honolulu. Hitachi Rail projects hiring approximately 150 electromechanical technicians in the next 4 years. To date Hitachi has recruited and hired fourteen program graduates. Combined with an increased need for technicians in the food and beverage manufacturing, and public utility industries, the demand for IIT program graduates to fill high skill high wage career positions in Hawaii is high. Demand for high skill, high wage jobs will aid recruiting efforts and increase demand. The program does not have a full-time teaching faculty assigned; thus, the courses are taught by the program coordinator, lecturers, and engineering faculty. When the program is awarded permanent status by the UH board of Regents, the campus will have more latitude to hire a full-time teaching faculty assigned to the IIT program.

The IIT program student demographics indicate a diverse student population in terms of age group, veteran status, ethnicity, and full vs part time student. There is a considerable gender gap with females being significantly underrepresented (12%).

3. Program Student Learning Outcomes or Unit/Service Outcomes

The Associate in Science in Integrated Industrial Technology is a technology driven, purpose-built multidisciplinary degree program designed to meet the needs of Hawaii companies. The program learning outcomes reflect a broad spectrum of technical specialties incorporated into the coursework.

- **Apply the principles of mathematics, electronics, mechanical systems, and controls systems to program, maintain, calibrate, and repair advanced integrated systems in manufacturing and transportation.**

Two courses in the fourth semester of the degree program are directly associated with this PLO. *IIT-271 Distributed Control Systems, and IIT-281 SCADA systems* incorporate the knowledge and skills gained in all previous coursework, students design, program, and calibrate an industrial mechatronic system, troubleshoot, and repair mechanical and software faults and integrate stand alone systems using a SCADA protocol.
• **Use appropriate safety, health, and personal protection procedures applicable to an industrial working environment.**
This PLO is primarily addressed in the first semester course, *IIT-101 Safety, Health and Environment*. The course establishes an academic foundation in safety, health, and personal protection. Reinforced by instructor led practical applications in concurrent 1st semester courses *IIT-121 Electro hydraulics and Pneumatics* and *IIT-131 Mechanical Drive Systems*. Students are called upon to practice proper personal protection in all subsequent coursework for the degree.

• **Demonstrate an understanding of the structure and function of mechatronic systems and follow a logical sequence for isolating problems within an industrial process.** Systems Integration and troubleshooting are the bedrock of all third and fourth semester courses. Students are required to navigate complex troubleshooting scenarios and provide a logical hypothesis using root cause analysis techniques learned in *IIT-171 Principles of Process Quality*. Additionally, students troubleshoot a complex mechatronic system using the SMC IPC-200 which emulates a liquid production and bottling plant and includes the technologies used in the continuous process industry, such as pneumatics, electric motors, sensors, continuous processes, programmable controllers, and industrial communications.

• **Analyze process control system operations and select the appropriate sensing equipment for that operation.** *IIT-231 Process Instrumentation* provides students with both knowledge and practical application of sensors and sensing equipment using Simtronics process simulation software and Arduino Input/Output sensor programming. The knowledge and skills gained in this course are reinforced in *IIT-271 SCADA systems*.

• **Analyze the operating difficulties of an automated system and perform the corrective actions needed.** Students are introduced to troubleshooting in first semester courses IIT-121 and IIT-131, though they are provided with a formal process for troubleshooting in *IIT-171 Principles of Process Quality*. This course provides a theoretical foundation in analysis of variance and root cause analysis. IIT-171 uses mathematical models to quantify variance and RCA. IIT-231 expands on ANOVA by introducing variability in both the process product and the instruments used to measure variability. Students utilize X bar R charts to analyze process variability and stability.

• **Utilize proper procedures for inspection, preventive maintenance, and corrective maintenance of integrated industrial systems.** Third semester courses *IIT-251- Motors and Motion Control* and *IIT-201 DC & AC Circuits* provide foundations in preventative and corrective maintenance as well as inspection of integrated industrial systems. *IIT-281 SCADA Systems* provides students with practical experience in corrective maintenance of control and data acquisition hardware and software that is used to analyze system performance.

• **Demonstrate an understanding of the theory, construction, installation, and operation of hydraulic and pneumatic systems in an automated controls environment.** First semester course IIT-121 Electro-hydraulics and Pneumatics is a comprehensive study of fluid power systems that includes practical exercises and instructor led projects using a fluid power demonstration
trainer. Concepts are reinforced in *IIT-231, Process Instrumentation* by incorporating electrohydraulic control using input and output sensors.

**Demonstrate an understanding of mechanical drive systems, their function, and the operation in an automated controls environment.** First Semester course *IIT-131 Mechanical Drive Systems* provides students with both theoretical and practical application of a variety of mechanical Drive Systems. Concepts introduced in this course are reinforced in forth semester courses that involve systems integration.

**Apply principles of process quality assurance to an automated control environment.** Second semester course *IIT-151 Principles of Process Quality* provides a comprehensive study of root cause analysis, the primary troubleshooting methodology employed to determine defective equipment and systems.

**Use CAD/CAM to create drawings of parts and assemblies to create prototypes using additive manufacturing.** Second semester course *IIT-151 Rapid Prototyping* provides students with the knowledge and skills to design two- and three-dimensional objects using computer aided design (CAD) software. Students design parts and assemblies of common industrial equipment and translate that data to computer aided manufacturing (CAM) equipment for production. Students are introduced to both additive and subtractive manufacturing processes to manufacture parts and assemblies.

The Integrated Industrial Technology AS Degree program was awarded probationary status by the UH Board of Regents in April 2017. The program coordinator and Math and Science Division Chair are continuously evaluating the coursework through a variety of methods, including a Business and Industry Leadership Team (BILT). The data collected since the start of course offerings will be evaluated and used to apply for permanent program status in summer 2021.

### 4. Action Plan

The Integrated Industrial Technology (IIT) AS degree and certificate programs provide students on O‘ahu with a foundation in electronic, electrical, mechanical, and automated control systems to prepare them for high skill-high wage career jobs that meet the workforce needs of an emerging industrial technology industry in Hawaii. In keeping with the college mission, we foster students to become responsible global citizens locally, nationally, and internationally.

The IIT program must stay current with rapidly changing technology and stay connected with local industry to ensure we are meeting the requirements of local employers. The IIT program is a partner school with the Package Machinery Manufacturers Institute (PMMI). The Program learning outcomes align with the PMMI mechatronics certifications. Students are encouraged to take the certification exams to obtain a national certification. Additionally, the program learning outcomes align with the Society of Manufacturing Engineers (SME). By aligning the IIT curriculum with national credentials that are stackable, portable, and aligned with industry needs graduates are prepared for a wide range of careers in industrial technology.

Last year the program piloted an industry advisory group, the Business, and Industry Leadership Team (BILT). The BILT aims to shift the emphasis of industry input from the traditional evaluate and critique methodology to a collaborative instructional design model that allows us to respond to industry input and align the curriculum with current technology.
In 2020 the program was awarded a grant from Kamehameha Schools to develop a long-term outreach and recruiting program to engage high school students in career exploration, technical camps, and early college experiences for underserved populations. Due to the pandemic outreach effort were difficult, we received a no cost extension to the grant and were able to fulfill the grant requirements to conduct outreach to high schools as well as offer several summer camps for high school students. 

As the state comes out of the restrictions imposed by the state to curtail the spread of Covid 19, we will be stepping up our outreach and recruiting efforts. The goal is to seek out high school students that have an aptitude for engineering technology with emphasis on underserved populations. Additionally, we will be encouraging women to consider a career in mechatronics, the fall 2021 cohort has three women enrolled.

5. Resource Implications

The IIT degree program falls under the administrative control of the Math and Science Division. The program was initially developed for workforce development and courses are concurrently offered as credit bearing courses and non-credit bearing workforce development courses. The faculty that initially designed and taught the IIT workforce development courses is presently the discipline coordinator for the IIT degree. The IIT discipline coordinator is an 11-month faculty that is responsible for both the credit bearing and workforce development programs, there is no overload cost to the college for coverage of the IIT discipline coordinator duties. All classroom and laboratory equipment is presently being furnished by the Office of Workforce development. The Math and Science Division provides a small budget ($500) for consumables and other expenses. As the program grows the Math and Science Division should consider increasing the IIT annual budget for the purchase of consumables, annual subscription to online content, software update fees, and equipment maintenance. Long term budgeting for the replacement of laboratory assets will be determined following the transition of the IIT program from probationary to permanent status.

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

6. Optional: Edits to Occupation List for Instructional Programs

The SOC codes aligned with the IIT program are still valid.

☐ I am requesting changes to the SOC codes/occupations listed for my program/unit.