ALLAN HANCOCK COLLEGE

PROGRAM REVIEW

2017-2018

Program Name: Electronics Technology

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PROGRAM REVIEW

ELECTRONICS TECHNOLOGY

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PROGRAM REVIEW

Status Summary - Plan of Action-Post Validation

During the academic year 2007-2008, Electronics Technology completed program review. The self- study and validation teams developed a final plan of action-post validation based on information in the self study and the recommendations of the validation team. For each plan, indicate the action taken, the result of that action, and the current status of the plan, if it is incomplete.

(If any plan was made and action not taken, please state the rationale for not pursuing that particular item.)

PLAN OF ACTION	ACTION TAKEN, RESULT AND STATUS
To improve desired student outcomes and improve student performance:	
Continue to update and modify our programs and courses to reflect technology advancements and changing employment trends.	All EL course outlines were reviewed and updated as necessary in Fall 2016-Spring 2017.
Maintain currency in laboratory equipment and student workstations.	New oscilloscopes and a classroom set of laptops were acquired in 2017-18.
Maintain currency in student laboratory experimentation materials.	Not attainable for all but EL 118/119 due to lack of FT EL faculty.
Continue development of student laboratory manuals.	Not attainable for all but EL 118/119 to lack of FT EL faculty.
Continue to expand course delivery methods to provide flexibility of scheduling to meet student and industry needs.	Not attainable due to lack of FT EL faculty.
Continue staff development workshops in order to develop, implement, and assess student learning outcomes.	Annual faculty workshops on SLOs have been offered.
Continue to attend professional conferences and workshops.	PT EL faculty have participated in regional "Best Practices for CTE Faculty" workshops and those targeting the Information & Communications Technology/Digital Media industry sector.
Maintain active membership in the NSF consortiums.	Not attainable due to lack of FT EL faculty.
Provide teacher training for PT technology instructors.	PT EL faculty have participated in regional "Best Practices for CTE Faculty" workshops and those targeting the Information & Communications Technology/Digital Media industry sector.
Continue to assess entry-level students in math abilities to adjust course material and presentations.	Assessment of entry-level math abilities continues to be anecdotal in the absence of development of specific SLOs for entry-level EL courses.
Continue partnerships with Engineering Program and MESA.	EL migrated from the Math Sciences Dept. to the Industrial Technology Dept. Partnerships continue, but not as pro-actively without benefit of FT EL faculty.
Continue process of evaluation of online courses using student surveys.	EL courses have not been offered online since retirements of FT faculty.
Continue policy of keeping labs open on Fridays for student collaboration, research, experimentation, and faculty-student interactions.	The policy has not been maintained.
Maintain articulations with high school and 4-year institutions.	Articulations with CSU Fresno, Cal Poly SLO and Cal Poly Pomona have been maintained.
Continue mentoring students in our major.	PT faculty and CTE Counselor, David Hernandez, continue to mentor students.

Develop strategies to improve student success in distant learning and entry level program courses.	EL courses have not been offered online.
Develop an intro course to our Cisco Academy to help entry-level students succeed in the Networking Essentials series of courses.	EL 333, Intro to Network Security, has been developed.
Recommend Cisco CCENT certification to the Networking Essentials 2 course students.	Accomplished and remains ongoing.
Study and compare course outcomes with employer requirements for implementing the reduction of number of units required for completing our technology programs.	Convenings of EL Industry Advisory Committee meetings were not able to be maintained in the absence of FT faculty. A survey of local employers was conducted in fall 2017, resulting in a reformation of an Advisory Committee and convenings in July 2018.
Offer new technology growth area courses and workshops in telecommunications, renewable energy, computer maintenance, networking, and mechatronics, not to increase degree units, but to enhance enrollments in our programs.	On hold pending more analysis and feedback from Advisory Committee.
Create a Computer Maintenance degree program.	On hold pending more analysis and feedback from Advisory Committee. Further curriculum development cannot advance without FT faculty.

PLAN OF ACTION	ACTION TAKEN, RESULT AND STATUS

To accommodate changes in student characteristics:

Maintain student transfer capabilities, entry-level job/career training, and current employee skill upgrades/training.	Achieved and ongoing.
Continue to offer additional day course options to accommodate more younger-aged students.	Not attainable due to lack of FT faculty and lack of qualified PT faculty available to teach during the day.
Increase percentage of under-represented groups. Maintain Vocational ESL electronics program.	Vocational ESL electronics has not been maintained due to lack of FT faculty. To increase percentage of under-represented groups, educational outreach workshops entitled "Intro to Industrial Technology" have been offered in spring 2017 and spring 2018. Workshops feature hands-on activity sessions in all IT programs, including EL.

To improve the educational environment:

Implement new Cisco System curriculum beginning fall 2008.	Active since 2008 and currency of curricula maintained.
Continue modification/creation of student laboratory exercises and develop lab manuals to reduce student textbook costs.	Ongoing.
Develop workshops that support skill upgrades for technologies that are not part of our regular program content.	Development of stand-alone credit courses have been discouraged.
Study ways to reduce the number of units required for students to complete our program.	Efforts continue with curriculum review in process, but implementation cannot advance without FT faculty.

ALLAN HANCOCK COLLEGE

Allan Hancock College Program Review

2018-2019 Comprehensive Self-Study

I. Program Mission *(must align with college mission statement)*

- ☑ For all programs, describe the need that is met by the program or the purpose of the program, and explain how it aligns with the college mission and strategic plan.
- ☑ For CTEA programs only, show that "the program does not represent an unnecessary duplication of other vocational or occupational training programs in the area."

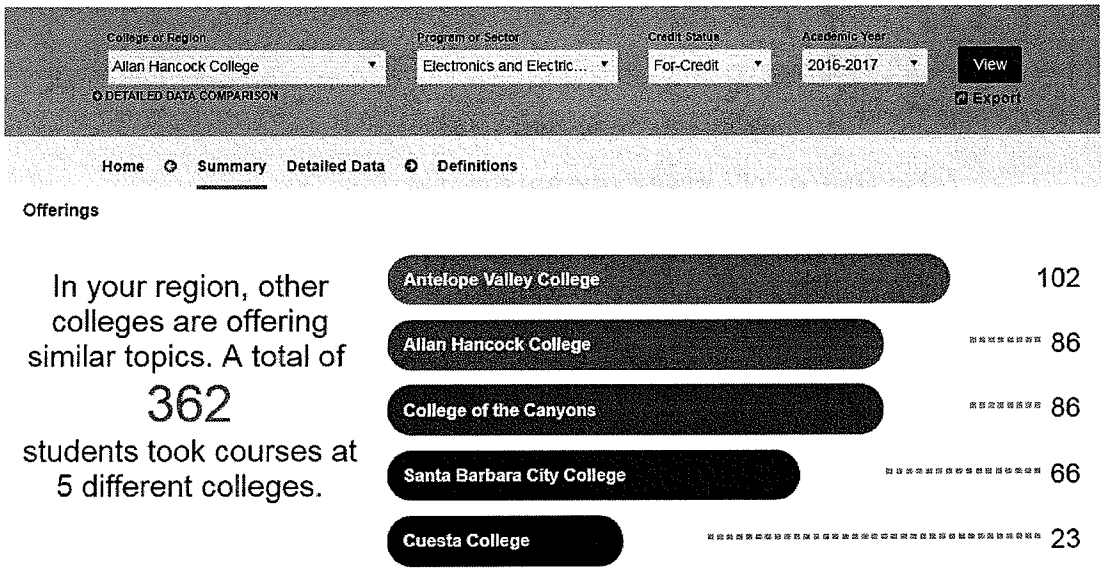
The mission of the Electronics Technology program is to provide comprehensive and technical education to a diverse community of learners to prepare students for employment as electronics professionals. The Electronics Technology program takes pride in providing quality, hands-on experiences to produce and develop top quality engineering and electronics technicians to meet current and projected labor market needs in high-skill, high-wage occupations. Our goal is student success in today's innovative and fast-growing technical industries, including aerospace, agriculture, and manufacturing. Training and instructional support activities meet rigorous academic standards, align with the mission of Allan Hancock College (AHC), and advance the goals of all five strategic directions identified in the 2014-2020 Strategic Plan.

The Electronics Technology program currently offers the following degrees and certificates:

- ELECTRONIC ENGINEERING TECHNOLOGY (A.S.)
- ELECTRONICS TECHNOLOGY (A.S.)
- ELECTRONICS TECHNOLOGY: MECHATRONICS (A.S. & Certificate of Achievement)
- ELECTRONICS TECHNOLOGY: ELECTRONIC TRAINING (Certificate of Achievement)
- ELECTRONICS TECHNOLOGY with EMPHASIS IN NETWORK MAINTENANCE AND DIGITAL TECHNOLOGIES (A.S. & Certificate of Achievement)

As an identified career and technical education (CTE) program, AHC is one of five community college districts in the South Central Coast Region that offers program(s) of study in Electronics and Electric Technology (TOP Code 0934). Figure 1, below, taken from LaunchBoard, shows that in 2016-17, the program served nearly one-fourth (23.76%) of all students in the region taking courses in this discipline. This provides validation that AHC's Electronics Technology program does not represent unnecessary duplication of other similar programs in the area.

Figure 1



II. Progress Made Toward Past Program/Departmental Goals

Summarize the progress the discipline has made toward achieving its goals during the past six years. Discuss briefly the quality, effectiveness, strengths and struggles of the program and the impact on student success as reflected in past comprehensive program reviews and Annual Updates.

The last comprehensive Electronics Technology program review was completed in 2007-2008, at a time when the program was a part of the Mathematical Sciences Department and supported by two full-time instructors. Most of the program's goals had been achieved prior to 2010, when both instructors retired (and have since never been replaced). Both FT instructors had supported as many career days and outreach events at area high schools as possible. One of the instructors, Bob Alldredge, was a charter member of the planning committee for the inaugural AHC Career Exploration Day event in 2004, and the program has continued to participate in this outreach activity annually since then. All the high schools in the area visited the labs and listened to presentations by the full-time faculty. The Electronics faculty developed mechatronics degree and certificate programs and offered mechatronic workshops with participation by 69 underrepresented high school students. These activities were supported by leveraging NASA Curriculum Improvement Partnership Award, NSF SpaceTEC, and Department of Labor Workforce Innovation in Regional Economic Development (WIRED) grants. Educational outreach had also extended to include 45 underrepresented junior high school students at week-long summer space camps during the same time period, 2004-2010. Full-time instructors also partnered with industry, NASA, and Vandenberg Air Force Base to offer high school teachers and college faculty professional development opportunities through Space Launch Conferences that culminated, when possible, in a thrilling launch viewing. Electronics Technology (EL)/Computer Electronics Technology (CEL) programs were healthy and

enjoyed a high of nearly 50 FTES in 2008-2009.

When the two full-time Electronics faculty members retired in 2010, program enrollments dropped precipitously in the immediately following four years, as shown in Figure 2, below. With only part-time faculty, courses were relegated to only being offered in the evenings in primary terms. As data from the Office of Institutional Effectiveness show, the program has declined with the lack of a full-time instructor to oversee the curriculum. Part-time instructors are not able to teach all of the offered course work in the Electronics program.

Enrollment went from a high in 2008-09, with 345 students in 35 sections and generating 47.9 FTES, to an all-time low in 2012-13 of 121 students enrolled in 8 sections and generating 16.61 FTES. It is a credit to the determination, commitment, and grit of part-time faculty members whose efforts have allowed the Electronics program to reap incremental enrollment and FTES growth in intervening years. In 2016-17, 145 students enrolled in 12 sections and generated 24.35 FTES.

Figure 2

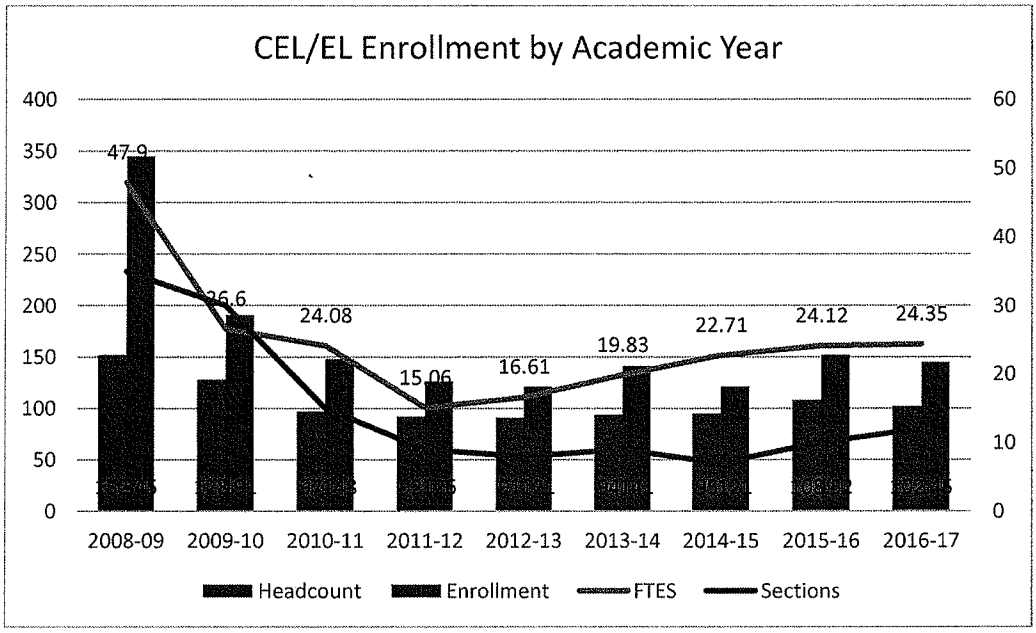
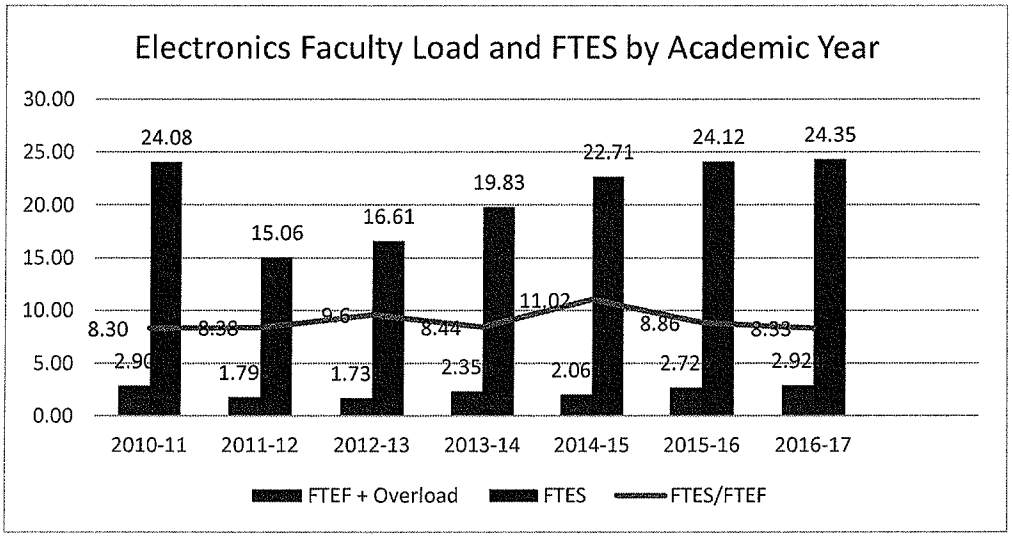


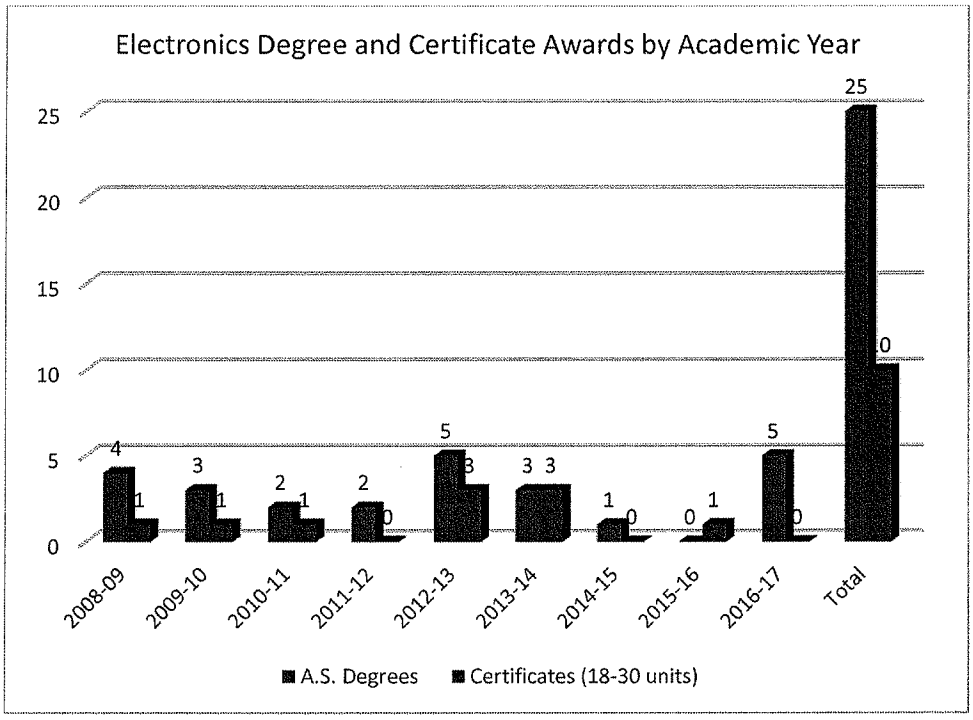
Figure 3 presents a graph of faculty load and FTES by academic year. The quotient of FTES/FTEF is a measure of efficiency or productivity, and data show that although FTES has steadily grown over the past six years, FTES/FTEF has averaged 9.11 with very little fluctuation except in 2014-15, when only seven sections of exclusively evening Electronics courses were offered and a FTES/FTEF quotient of 11.02 was achieved.

Figure 3



The Electronics Technology program currently offers four A.S. degrees and three Certificates of Achievement. Over the past nine years, 25 degrees and 10 certificates have been awarded (Figure 4).

Figure 4



Articulation agreements have been established and maintained with Cal Poly Pomona (EL 118/119; EL 122/123; EL 125; EL 126; and EL 146); Cal Poly San Luis Obispo (EL 118/119); CSU Fresno (EL 118/119; EL 122/123); and CSU Sacramento (EL 125;

EL 126). These core electronics courses uphold the rigor and topic coverage required for transfer into any engineering technology program at four-year institutions.

The lack of a full-time discipline lead for Electronics, combined with difficulty recruiting qualified part-time faculty willing to teach with remuneration that is not competitive with the private sector, has negatively affected the ability to: 1) maintain and expand outreach efforts to attract new students into the major; 2) pursue and increase articulation agreements; 3) capitalize on dual enrollment opportunities; 4) ensure students' ability to access a full portfolio of day and evening Electronics courses; and 5) ensure that students majoring in the discipline can complete and achieve degrees and certificates in a timely manner.

III. Analysis of Resource Use and Program Implementation

Describe the program's current allocation and use of human, physical, technology, and fiscal resources. Are resources sufficient and appropriate to meet program needs? Can program resources be reallocated to better meet student needs? If so, how?

Human Resources

The program is in desperate need of a full-time faculty member. Only full-time faculty can accomplish what it takes Electronics Technology to achieve its program goals, succeed, and advance the Industrial Technology Department. The two retired instructors served as contact points and ambassadors for the program and the community. They collaborated with local electronics and aerospace companies, participated in many career day and outreach events, and developed strong working relationships with high school instructors, even delivering presentations addressing a variety of technology topics in their classes. They accomplished the entire task for the program and kept the program up-to-date. Enrollment was up; workforce needs of the industry were met; and the community's economic development was strengthened.

At least one full-time faculty is essential to rebuild and maintain a robust industry advisory committee to conduct a needs assessment to ensure that industries and local employers' workforce needs are met; maintain currency with industry practices and technology; strengthen ties with other regional Electronics Technology K-16 faculty; and maintain compliance with CTEA federal regulations and Board Policy and Administrative Procedure 4102, Advisory Committees for Instructional Programs. Ideally, a good program should provide instructional capacity for two full-time instructors and four to six adjunct instructors.

In order to streamline course offerings, improve scheduling, increase the number of completers, and bring the curriculum in line with industry standards, we need to revise the Electronics Technology program completely. All course/program revision will be based on the recommendation of the Advisory Committee.

For example, upon research and recent consultation with other regional faculty with robust Electronics Technology programs, a recommendation for the addition of a soldering course may be warranted. Honing and demonstrating soldering skills is essential for an electronics technician. Another program improvement strategy to increase enrollment, upon recommendation of the Advisory Committee, may result in the resurrection of EL 100, Survey of Electronics, created and approved for AHC general education credit in 2004.

Other than the Industrial Technology (IT) Department's Administrative Assistant II, who provides clerical operational support for seven programs served under the IT "portfolio," there are no other classified staff supporting Electronics Technology. With an electronics lab and networking lab hard pressed for part-time faculty to organize and maintain instructional materials and resources, staff is needed to provide program support and ensure environments that are safe, attractive, and conducive to learning. In the past, along with the two full-time instructors, Electronics Technology was supported by an Instructional Assistant.

Facilities

Electronics Technology has two outdated labs. Classrooms are small and crowded with old equipment and parts. Students and faculty are inconvenienced and ill-served by current facilities that require them to pick up and move between two and sometimes three disparate campus classrooms in a single evening to accommodate and participate in lecture and lab course components of certain core courses in the discipline. Refurbishing available O-300 classroom and office space and re-assigning other O-300 facilities back to IT when Fine Arts programs relocate to the new Fine Arts Complex present opportunities to address current and future needs.

Fiscal Resources

Electronics Technology meets eligibility criteria to apply for program improvement support, within allowable guidelines, through federal Carl Perkins Career and Technical Education Act (CTEA) and, more recently, state Strong Workforce Program categorical funds. Without the benefit of full-time faculty to lead, champion, and implement curriculum development and other program improvement projects, such viable grant opportunities will remain underutilized.

IV. Program SLOs/Assessment

What are your program student learning outcomes? Have each of these been assessed since the last comprehensive program review? Describe changes you have made to courses or the program based on these data.

Data summarized in "Context Statistics and Evidence," appended in this self-study,

show that student learning outcomes (SLOs) have been written for 14 courses in Electronics Technology. To date, six of the courses have been mapped to at least one of 10 program student learning outcomes (PSLOs), appended in "SLO Performance Report by Department with SLO." Those identical six courses have been mapped to Institutional Learning Outcomes.

Although nine of the courses had planned assessments scored in 2016-17, five remain with no planned assessments. At least one Action Plan has been written for 12 of the courses; two courses have action plans that remain outstanding while none of the courses have Action Plan Responses.

Progress on assessment of course and program student learning outcomes have been obviously hampered by the lack of full-time faculty to monitor, lead, and ensure timely course review, assessment, and revision as appropriate and necessary. Many courses have not been able to be offered, thereby presenting no opportunities to assess for SLOs.

V. Distance Learning (If applicable):

Describe the distance education courses offered in your program and any particular successes or challenges with these courses. Include the enrollment as well as percentage of courses offered by modality and the rationale for this ratio.

☐ Compare the success and retention of your online offerings to the same courses offered face-to-face. Analyze any gaps and plans to address these.

As well, describe how program instructors ensure regular substantive instructor- initiated contact in online classes.

Electronics Technology is a face-to-face and hands-on laboratory program. These courses are not structured to be nor are they offered on line. Most of the part-time faculty, however, employ Canvas, the district's content management system, to provide syllabi and instructional materials and communicate with their students.

VI. Success, Retention, and Equity

Describe how the program works to promote student success. Include teaching innovations, use of academic and student support services (library, counseling, LAP, community partnerships, etc.). Refer to list of Student Services.

☑ Then, utilizing data from the office of Institutional Effectiveness, report on student success through course completion and retention data. Analyze, by discipline, success by gender, age, ethnicity, and online (may analyze other variables such as disability, English as a second language, day vs. night courses, etc. as appropriate).

☑ Suggest possible reasons for these trends and planned actions to address any disproportionate impact.

Promoting Student Success

It is essential for all instructional programs to understand the students they serve and plan accordingly. Figure 5, below, is a screen shot from the statewide data system, LaunchBoard, which is supported by the California Community Colleges Chancellor's Office.

Figure 5

In 2016-17, 90% of students enrolled in Electronics Technology courses were part-time, and 24% had previously earned a post-secondary certificate or degree. In the same year, the program served disproportionately more male students (87%) and less female students (13%) in comparison to Allan Hancock College overall (48% male, 51% female). Gender equity is an issue that is pervasive among many CTE and especially Industrial Technology programs, and the EL program needed to enroll 33 additional female students to close this gender equity gap. The program also served disproportionately more White students (44%) and less Hispanic students (40%) than Allan Hancock College overall (34%

White and 54% Hispanic); according to LaunchBoard, enrollment of five additional Hispanic students are needed to close the race/ethnicity equity gap in access. Furthermore, equity gaps in access reported in LaunchBoard in age of students, with disproportionately more EL students served who are older than 25 than those aged 19 or less and those who are age 20-24. To close these identified age equity gaps, 14 additional students age 19 or less and five additional students age 20-24 need to be served. Other LaunchBoard data providing comparative student populations in 2016-17 are tabulated below.

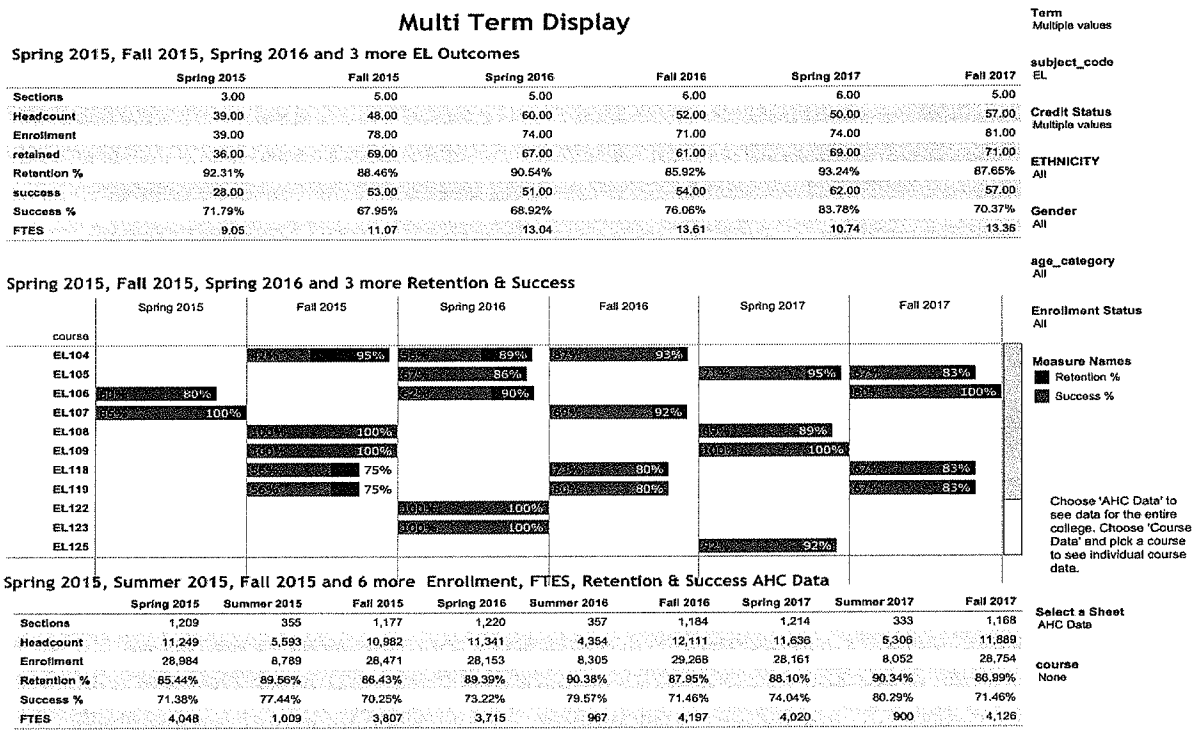
Distinct Population	Electronics Technology	AHC Overall
Foster Youth	0%	2%
Veteran	14%	3%
Students with Disabilities	14%	5%
First-Generation Students	21%	20%
Economically Disadvantaged	78%	74%
Ever Received Financial Aid	62%	57%
Ever Participated in EOPS	13%	12%
Ever Took a Math or English Basic Skills Course	64%	52%
English Language Learners	0%	2%
First-Time Students	14%	26%
Students Who Exited Higher Education	33%	24%
Skills-Builder Students	19%	14%

To help address pervasive gender and race/ethnicity equity gaps in access, the Industrial Technology Department strategically planned and executed free "Intro to Industrial Technology" educational outreach workshops, supported by federal Carl Perkins CTEA grant allocations, in spring 2017 and spring 2018. The Department partnered recruited broadly throughout the campus and with local high school CTE contacts, and although the workshops were open to all, women, first-time college, and economically disadvantaged populations of students were among targeted populations. The workshops featured presentations and hands-on activities tailored to each discipline of Industrial Technology, including electronics technology, and all workshop sessions were very well received. Both workshops were led by a female part-time Machine and Manufacturing Technology instructor, Cynthia Holm, and inspirational keynote presenters were also female professionals representing careers in Industrial Technology. Funding for these types of workshops, and other educational outreach activities targeting middle and high school and community college students (for example, the widely-popular Mechatronics Institutes from years past) should be pursued on an ongoing basis so that outcomes may be tracked to collect data and assess long-term efficacy beyond anecdotal evidence.

Encouraged and facilitated by program faculty, supervising Dean, Industrial Technology Department Chair, Electronics Technology students continue to utilize and

remain accessible to a number of Student Services programs on campus. Among supportive services provided are a CTE Counselor, David Hernandez, whose schedules office hours at least one evening per week in the Industrial Technology Complex; CTE textbooks held on reserve in the Learning Resource Center; CTE textbook and laptop lending services for through Extended Opportunities, Programs, and Services (EOPS) and College Achievement Now, if eligible; tutoring support via the Math Center; and assistive learning devices and technical support through the Learning Assistance Program. Regrettably, with the loss of full-time faculty, all courses in the program have been exclusively offered in the evening, when many of these campus services are either closed or minimally staffed.

Figure 6



Multi Term Display

Spring 2015, Fall 2015, Spring 2016 and 3 more EL Outcomes

	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
Sections	3.00	5.00	5.00	6.00	6.00	5.00
Headcount	39.00	48.00	60.00	52.00	50.00	57.00
Enrollment	39.00	78.00	74.00	71.00	74.00	81.00
retained	36.00	69.00	67.00	61.00	69.00	71.00
Retention %	92.31%	88.46%	90.54%	85.92%	93.24%	87.65%
success	28.00	53.00	51.00	54.00	62.00	57.00
Success %	71.79%	67.95%	68.92%	76.06%	83.78%	70.37%
FTES	9.05	11.07	13.04	13.61	10.74	13.36

Spring 2015, Fall 2015, Spring 2016 and 3 more Retention & Success

Spring 2015, Summer 2015, Fall 2015 and 6 more Enrollment, FTES, Retention & Success AHC Data

	Spring 2015	Summer 2015	Fall 2015	Spring 2016	Summer 2016	Fall 2016	Spring 2017	Summer 2017	Fall 2017
Sections	1,209	355	1,177	1,220	357	1,184	1,214	333	1,168
Headcount	11,249	5,593	10,982	11,341	4,354	12,111	11,636	5,306	11,889
Enrollment	28,984	8,789	28,471	28,153	8,305	29,268	28,161	8,052	28,754
Retention %	85.44%	89.56%	86.43%	89.39%	90.38%	87.95%	88.10%	90.34%	86.99%
Success %	71.38%	77.44%	70.25%	73.22%	79.57%	71.46%	74.04%	80.29%	71.46%
FTES	4,048	1,009	3,807	3,715	967	4,197	4,020	900	4,126

Term
Multiple values

subject_code
EL

Credit Status
Multiple values

ETHNICITY
All

Gender
All

age_category
All

Enrollment Status
All

Measure Names
Retention %
Success %

Choose 'AHC Data' to see data for the entire college. Choose 'Course Data' and pick a course to see individual course data.

Select a Sheet
AHC Data

course
None

Figure 6, above, reports EL course retention and success data from Spring 2015 through Fall 2017. With very few exceptions, course retention and success rates of students in the program meet or exceed those of AHC students overall. Data also reveal that only 35% of the courses in the discipline were offered in recent semesters.

Figure 7 and Figure 8, below, provide data sourced from LaunchBoard and report a 29% Term-to-Term Retention Rate and 10% Persistence Rate among AHC Electronics Technology students in 2016-17. These rates exactly mirror those for other Electronics and Electric Technology students at sister community colleges in the region. Scheduling issues combined with a high percentage of skills-builders served by EL course offerings help account for these rates.

Figure 7

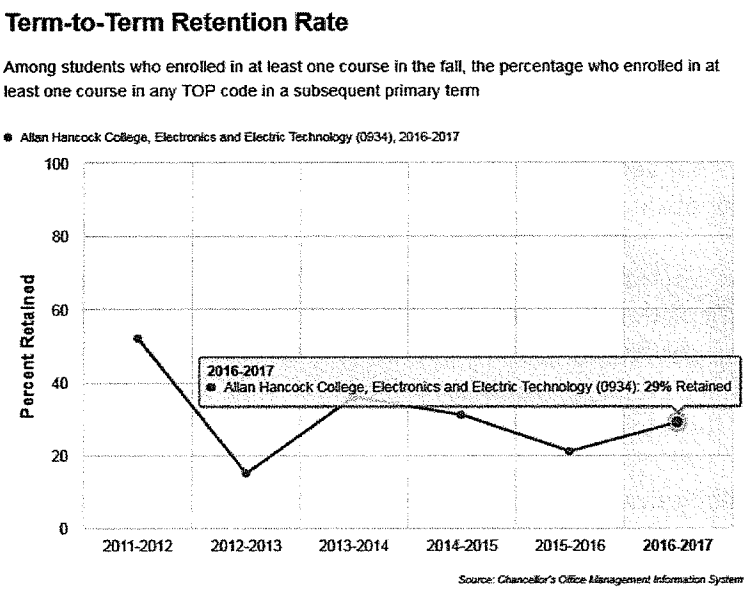
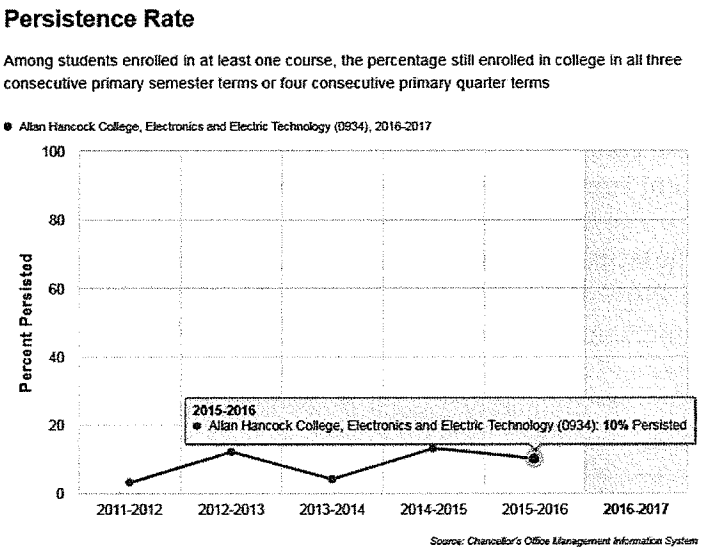


Figure 8



Course scheduling ideally should provide students with optimal access to meet their educational objectives. The Dean and a full-time Instructor need to work out a proposed schedule and rotation of classes. The program needs a full-time instructor for the day students to begin in the Fall Semester. They will continue with intermediate level classes in the Spring Semester. This scheduling pattern and the hiring a full-time instructor will alleviate the problems associated with small enrollment in the program. It is recognized, however, that it will take a number of years (possibly 3 to 5 years) to rebuild the enrollment in the program so that it is healthy and supports a strong schedule of classes for day and night students.

The full-time instructor should start discussions with the Math Department regarding recruiting Elementary and Intermediate Algebra students for the Electronics Technology

program. A strong background in basic algebra is essential to success and retention in the Electronics Technology program. Students who have had a successful experience with algebra should be good candidates for the program. Employing this "in-reach" strategy should also help build enrollments through improved retention rates.

Beginning classes for night students will be offered every semester; intermediate night classes will be offered once per year. Day and night students should merge into one cohort to make larger enrollments for advanced courses.

Course requisites in Electronics Technology are based upon certain beginning topics being fundamental to matriculation in more advanced subject matter. This sequential approach to learning is very structured within this subject area. A systematic schedule for course revisions will be established and requisites will be reviewed during the course revision cycle. Input will be sought from the Advisory Committee regarding course requisites.

Electronics Technology strives to provide the best training to our students and industry. Students come to our program looking for an education and training that will help them enter local and regional electronics and avionics industries as a technician. A majority of our adjunct faculty are from industry. Faculty focus on adult learning concepts, lesson instructional design, delivery strategies, and designing real-world training that supports critical thinking.

We are striving for up-to-date facilities that will provide the students with the best learning environment possible, which aligns with the Recommended Planning Principles – in particular, renovation of the O-300 Building – that is identified in the District's 2014-2024 Facilities Master Plan. We also continue to make improvements in our delivery methods and attempt to keep our equipment current with the latest trends in the industry.

Students enrolled in basic electronics courses are encouraged look beyond themselves, and faculty routinely engage, encourage, and connect students with programs outside the classroom environment. Partnership with Career/Job Placement Center staff to increase Cooperative Work Experiences and expand summer internships opportunitiesto enhance student retention, completion, and ultimately success in securing employment in a closely-related, high wage, high skill job.

VII. Trend Analyses/Outlook

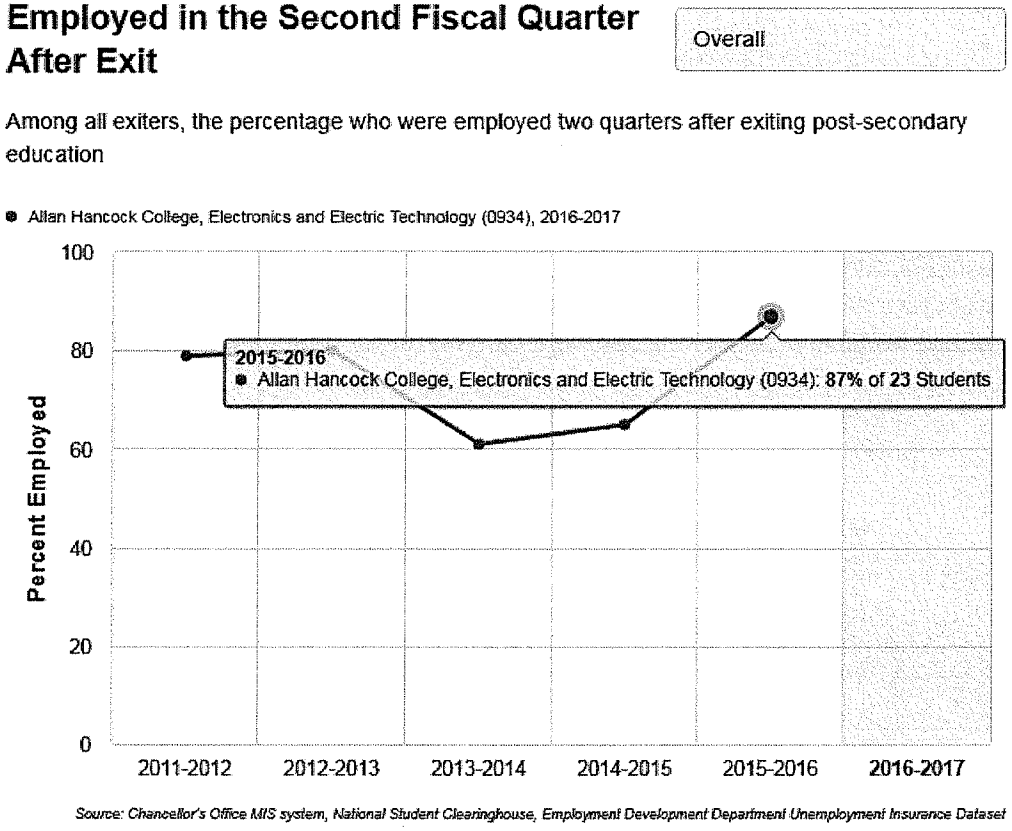
Using the information already gathered in the Annual Updates (e.g., enrollment and achievement data; student learning outcomes assessment and analysis; input by advisory boards; existing articulation agreements; labor market trends) summarize the major trends, challenges, and opportunities that have emerged in the program since the last comprehensive program review. Explain possible causes for any identified gaps or trends and actions taken or needed to address these.

LaunchBoard reports a projection of 138 openings every year through 2020 throughout our region in the most common middle-to-high skills jobs for the Electronics Technology program: Electronics Engineers; Electrical and Electronics Engineering Technicians; Electric Motor, Power Tool and Related Repairers; Electrical and Electronics Installers/Repairs for

Transportation Equipment; Electrical and Electronics Installers/Repairers for Commercial and Industrial Equipment; Electrical and Electronics Repairers for Powerhouse, Substation, and Relay; and Electrical and Electronics Equipment Assemblers. The demand for these projected 138 annual openings exceeds the annual supply of regional program graduates, which has only averaged 112 (and declining) in the region. LaunchBoard also reports *starting annual salaries* in our region for these positions, ranging from a low of $29,682 for assemblers to $65,749 for engineering technicians, and upwards of $87,360 for electrical and electronics repairers for powerhouse, substation and relay.

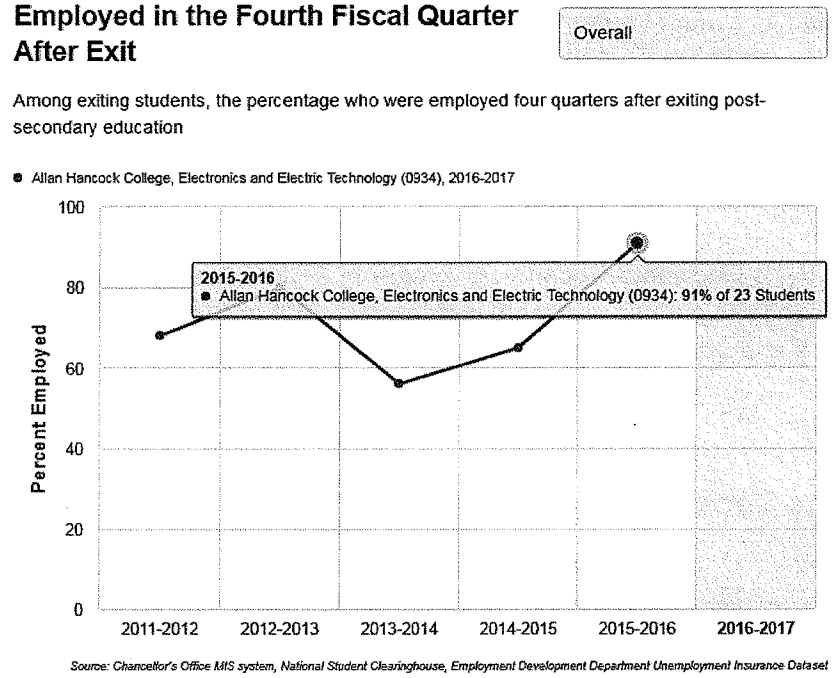
Upon exiting from AHC's Electronics Technology program, 87% of students were employed two fiscal quarters out, and the employment rate increased to 91% in the fourth fiscal quarter after exiting, as Figures 9 and 10, below, report.

Figure 9



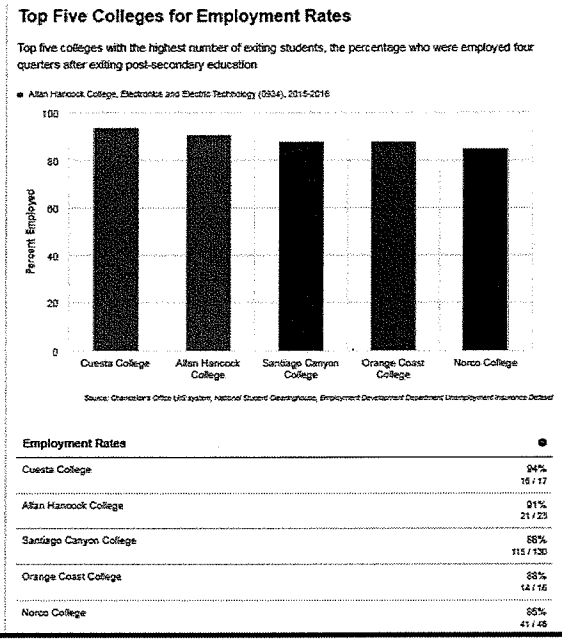
Source: Chancellor's Office MIS system, National Student Clearinghouse, Employment Development Department Unemployment Insurance Dataset

Figure 10



In 2015-16, the most recent year that LaunchBoard data for statewide employment outcomes, are available, Allan Hancock College was among the top five colleges with the highest employment rate of students four quarters after they exited the college (91%), second only to Cuesta College (94%) and surpassing Santiago Canyon (88%), Orange Coast (88%), and Norco Colleges (85%).

Figure 11



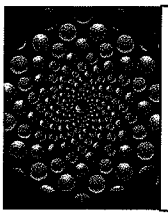
VIII. Long-Term Program Goals and Action Plans (Aligned With the College Educational Master Plan)

Describe the long-term plans for changing or developing new courses and programs, other actions being taken to enhance student success, and the need for professional development activities and other resources to implement program goals. Be sure to show how these plans are related to assessment results. (Plan should cover five- year period and include target dates and resources needed.)

The goals for the electronics technology program include:

- Hire a full-time faculty member to lead, champion, and galvanize the Electronics Technology program and boost enrollment.
- Remodel the electronics and networking labs to provide safe, attractive, and accessible environments than enhance the ability to teach and learn.
- Revitalize and expand the program's industry advisory committee to ensure workforce needs are met and ensure currency and adequacy of curricula and instructional resources.
- Monitor the labor market and respond effectively to community and industry growth trends, demands, and needs, such as in networking and cybersecurity.
- Hire a part-time instructional assistant for the electronics and networking labs to maintain and support students' experiences in clean, safe, and organized learning environments.
- Strengthen and streamline curricula to develop and execute two-year (or less) plans of program completion to increase student outcomes for retention, success, degree/certificate attainment, and employment in living wage jobs.
- With the assistance of Public Affairs and Communications, rebrand and refresh targeted program promotional and outreach materials to aid in recruiting and attracting new, diverse populations of students to the program.
- Maintain current and execute new agreements that advance articulation and concurrent enrollment.
- Collaborate with regional industry, K-16 faculty, supervising Dean, and other colleagues to develop, secure funding, and execute meaningful, innovative educational outreach events and activities to address equity gaps in access and engage and enthuse prospective new students in electronics technology and related career pathway exploration.

ASSESSMENT PLAN



ASSESSMENT SCHEDULE

6 Year

AHC Program Student Learning Outcomes

6 Year Assessment Schedule

The attached template provides a framework for a program/discipline to plan a 6 year schedule for assessing its student learning outcomes, completing the SLO assessment cycle and attaining the status of ***sustainable continuous quality improvement*** in institutional effectiveness. This plan may be updated over the next 6 years as new contingencies or interpretations arise.

PROGRAM: Electronics

Our program is pleased to present our ***plan*** to: assess our SLOs, review the results of that assessment; and discuss changes to our curriculum, pedagogy or operations based on the results.

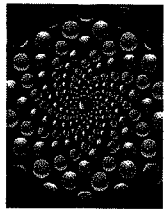
Program/ discipline coordinator or team leader Kevin Keinert (Name) _____ (Signature) 8/30/18 (Date)

I have reviewed this plan and agree that it provides sufficient detail and is a feasible approach to comprehensively assess the program SLOs.

Department chair Gabriel Marquez (Name) _____ (Signature) 8/29/18 (Date)

I have reviewed this plan and agree that it provides sufficient detail and is a feasible approach to comprehensively assess the program SLOs.

Dean Margaret Lau (Name) _____ (Signature) 9/4/18 (Date)



ASSESSMENT SCHEDULE **6 Year** Fall 18 – Spring 24	Program: Electronics Technology	Page 1 of 5

Use one row for each Program and Course SLO

SLO	To be assessed in semester:	Assessment method (s)	Team to review assessment results	Resources needed to conduct assessment	Individual responsible for assessment report	Date we expect to complete review
EL104 - Intro to Robotics & Mechatronics • EL104 SLO1 - Demonstrate an understanding of fundamental robotic and mechatronic characteristics, systems, and concepts.	Spring 2019	Test Score	Program SLOs Coordinator, Faculty, Instructor		Instructor of Record for that semester	
EL104 - Intro to Robotics & Mechatronics • EL104 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to design and evaluate mechatronic systems.	Spring 2020	Test Score	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL104 - Intro to Robotics & Mechatronics • EL104 SLO3 - Produce programs to perform mechatronic functions of automated control of systems	Spring 2021	Test Score	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL104 - Intro to Robotics & Mechatronics • EL104 SLO4 - Work effectively, individually, and as a member of a group in performing laboratory assignments	Spring 2022	Test Score	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL105 - PC Care and Upgrade • EL105 SLO1 - Identify, remove, install, and configure all major components that comprise a personal computer system	Fall 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL105 - PC Care and Upgrade • EL105 SLO2 - Perform preventative maintenance procedures (hardware and software) to personal computer systems	Fall 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	

EL105 - PC Care and Upgrade • EL105 SLO3 - Perform basic operating system and hardware configurations.	Fall 2021	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL106 - Networking Essentials 1 • EL106 SLO1 - Demonstrate an understanding of personal computer and networking devices	Spring 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL106 - Networking Essentials 1 • EL106 SLO2 - Demonstrate an understanding of fundamental networking concepts and basic troubleshooting methodology	Fall 2021	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL106 - Networking Essentials 1 • EL106 SLO3 - Construct several common networking cables following EIA/TIA 568B standards	Spring 2023	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL106 - Networking Essentials 1 • EL106 SLO4 - Design and construct a peer-to-peer and basic switched network	Fall 2025	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL107 - Networking Essentials 2 • EL107 SLO1 - Demonstrate an understanding of network router components	Fall 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL107 - Networking Essentials 2 • EL107 SLO2 - Demonstrate an understanding of fundamental router configuration and troubleshooting	Spring 2021	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL107 - Networking Essentials 2 • EL107 SLO3 - Evaluate and explain basic routing protocols	Fall 2023	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL107 - Networking Essentials 2 • EL107 SLO4 - Explain and apply basic router access lists for security and flow control	Spring 2025	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL108 - Networking Essentials 3 • EL108 SLO1 - Demonstrate an understanding of IPX networking	Spring 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL108 - Networking Essentials 3 • EL108 SLO2 - Demonstrate an understanding of fundamental LAN topologies with emphasis on Ethernet	Fall 2022	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL108 - Networking Essentials 3 • EL108 SLO3 - Explain basic network switching and switch configuration including VLAN networks	Spring 2024	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL109 - Networking Essentials 4 • EL109 SLO1 - Demonstrate an understanding of WAN Technologies	Spring 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	

EL109 - Networking Essentials 4 • EL109 SLO2 - Explain the fundamental concept of a point-to-point link and the supporting protocols	Fall 2022	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL109 - Networking Essentials 4 • EL109 SLO3 - Explain the fundamental concept of an ISDN link and the supporting protocols	Spring 2024	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL118 - Fundamentals of Circuit Analysis • EL118 SLO1 - Demonstrate an understanding of fundamental electronic concepts that pertain to direct and alternating	Fall 2018	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL118 - Fundamentals of Circuit Analysis • EL118 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to technical problem solving and troubleshooting methodology	Fall 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL118 - Fundamentals of Circuit Analysis • EL118 SLO3 - Recognize common electric components, waveforms, and electronic measuring instruments	Fall 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL119 - Fund of DC and AC Circuits Lab • EL119 SLO1 - Demonstrate basic safety procedures	Fall 2018	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL119 - Fund of DC and AC Circuits Lab • EL119 SLO2 - Correctly measure and interpret DC and AC circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology	Fall 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL119 - Fund of DC and AC Circuits Lab • EL119 SLO3 - Design and construct standard DC circuits	Fall 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL122 - Electronic Devices & Circuits • EL122 SLO1 - Demonstrate an understanding of fundamental analog and digital circuit and device concepts	Spring 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL122 - Electronic Devices & Circuits • EL122 SLO2 - Recognize common electric components and electronic measuring instruments	Spring 2021	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	

EL122 - Electronic Devices & Circuits • EL122 SLO3 - Apply basic mathematical, scientific, electronic and engineering concepts to technical problem solving and troubleshooting methodology	Spring 2023	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL123 - Electronic Devices & Circ Lab • EL123 SLO1 - Design and construct standard electronic circuits	Spring 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL123 - Electronic Devices & Circ Lab • EL123 SLO2 - Correctly measure and interpret electronic circuit measurements using standard semiconductor testing instruments and correct malfunctions using troubleshooting methodologies	Spring 2021	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL123 - Electronic Devices & Circ Lab • EL123 SLO3 - Apply basic mathematical, scientific, electronic, and engineering concepts to solve technical problems	Spring 2023	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL123 - Electronic Devices & Circ Lab • EL123 SLO4 - Recognize common electronic components, pin identification, and interpret manufactures data sheets	Spring 2025	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL125 - Digital Devices & Circuits • EL125 SLO1 - Apply basic mathematical, scientific, electronic, and engineering concepts to evaluate digital systems	Fall 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL125 - Digital Devices & Circuits • EL125 SLO2 - Demonstrate knowledge of technology applicable to the field of digital systems, and show a proficiency in appropriate software used in digital design	Fall 2022	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL125 - Digital Devices & Circuits • EL125 SLO3 - Analyze logic systems to determine their operating parameters for facilitating troubleshooting methodology	Fall 2024	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL126 - Digital Devices & Circuits Lab • EL126 SLO1 - Design, construct, and test standard digital logic circuits for proper operating parameters	Fall 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	

EL126 - Digital Devices & Circuits Lab • EL126 SLO2 - Correctly measure and interpret digital logic circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology	Fall 2022	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL126 - Digital Devices & Circuits Lab • EL126 SLO3 - Demonstrate knowledge of technology applicable to the field of digital systems, and show a proficiency in appropriate software used in digital design	Fall 2024	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL320 - A+ Certification • EL320 SLO1 - Demonstrate the understanding of basic computer maintenance concepts and procedures required for A+ certification	Spring 2019	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL320 - A+ Certification • EL320 SLO2 -Troubleshoot computer and network hardware and operating systems	Spring 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL370 - SkillsUSA • EL370 SLO1 - Gather data, research, evaluate, and use appropriate information to plan and complete a multi-faceted project	Fall 2020	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL370 - SkillsUSA • EL370 SLO2 - Enlist community support for educational projects	Fall 2022	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL370 - SkillsUSA • EL370 SLO3 - Assume responsibility for meeting deadlines, maintaining budgets and completing projects	Fall 2024	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	
EL370 - SkillsUSA. • EL370 SLO4 - Evaluate contest preparations for completeness, clarity, and presentation	Fall 2026	Lab Experiment	Program SLOs Coordinator Faculty, Instructor		Instructor of Record for that semester	

Review of Prerequisites, Co requisites, and Advisories

Course Prefix No	CURRENT Prerequisite/Co-requisite /Advisory/Limitation on Enrolment	LEVEL OF SCRUTINY (Statistics, Content Review, UC/CSU Comparison, Student Survey-list all)	RESULT (i.e., current PCA is established, should be dropped/modified or new PCA is established)	ACTION TO BETAKEN (None, APP-Major or Minor)
EL 104	None	Content Review	N/A	None
EL 105	None	Content Review	N/A	None
EL 106	Advisory: EL 105 & EL 125	Content Review	N/A	None
EL 107	Pre-Req: EL 106	Content Review	N/A	None
EL 108	Pre-Req: EL 106 or EL 107	Content Review	N/A	None
EL 109	Pre-Req: EL 108 or EL 106 or EL 107	Content Review	N/A	None
EL 118	Pre-Req: MATH 311 Co-Req: EL 119	Content Review	N/A	None
EL 119	Co-Req: EL 118	Content Review	N/A	None
EL 122	Advisory: Concurrent Enrollment EL 123 Pre-Req: EL 118 & EL 119	Content Review	N/A	None
EL 123	Advisory: Concurrent/Completion Enrollment EL 123 Pre-Req: EL 118 & EL 119	Content Review	N/A	None
EL 125	Advisory: Concurrent Enrollment EL 126 Pre-Req: EL 113/114 & EL 118/119	Content Review	N/A	None
EL 126	Advisory: Concurrent/Completion Enrollment EL 125 Pre-Req: EL 118/119	Content Review	N/A	None
EL 128	None	Content Review	N/A	None
EL 131	Pre-Req: EL 125 or CS 141	Content Review	N/A	None
EL 133	Pre-Req: ET 104 or CEL104 or EL104	Content Review	N/A	None
EL 135	Advisory: Concurrent Enrollment EL 136 Pre-Req: EL 122/123 & EL 125/EL 126	Content Review	N/A	None
EL 136	Pre-Req: EL 122/123 & EL 125/126 Co-Req: EL 135	Content Review	N/A	None
EL 139	EL 122 & EL 125	Content Review	N/A	None
EL 146	Pre-Req: EL 122 or EL 125	Content Review	N/A	None
EL 162	None	Content Review	N/A	None
EL 179, 379	None	Content Review	N/A	None
EL 189	None	Content Review	N/A	None
EL 399	None	Content Review	N/A	None
EL 320	Advisory: EL 105	Content Review	N/A	None
EL 332	None	Content Review	N/A	None
EL 333	Pre-Req: EL 106	Content Review	N/A	None
EL 370	None	Content Review	N/A	None

PLAN OF ACTION - PRE-VALIDATION
Six Year

DEPARTMENT: Industrial Technology PROGRAM: Electronics Technology

List below as specifically as possible the actions which the department plans to take as a result of this program review. Be sure to address any problem areas which you have discovered in your analysis of the program. Number each element of your plans separately and for each, please include a target date. Additionally, indicate by the number each institutional goal and objective which is addressed by each action plan. (See Institutional Goals and Objectives)

RECOMMENDATIONS TO IMPROVE **STUDENT LEARNING OUTCOMES** AND ACHIEVMENT	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Target Date**
Hire at least one and possibly two full-time instructors	Goal IE1: To identify the institutional capacity to fulfill the college mission.	Spring 2019
Hire a part-time instructional assistant for the electronics and networking labs.		Fall 2019
Develop a Survey of Electronics course designed to satisfy the General Education requirement in the Natural Sciences area.	SLS1: To ensure continuous improvement based on Student Learning Outcomes assessment data.	Spring 2020
Streamline the EL curriculum and develop two-year plans of completion.	SLS3: Ensure students are directed, help students clarify their aspirations, develop an educational focus they perceive as meaningful and develop a plan that moves them from enrollment to achievement of their goal.	Spring 2020
Relocate EL classrooms into renovated facilities in O-300.	IR4: To provide a safe, attractive, and accessible physical environment that enhances the ability to teach, learn, and work.	Fall 2019
Revitalize and expand the program's industry advisory committee to ensure workforce needs are met and to ensure currency and adequacy of curriculum and instructional resource (see attached list of identified equipment needs to meet state-of-the-industry standards).	Goal E1: Community Integration Partner with workforce and industry to expand pursuit of community partnerships and search out opportunities to tell our story to advance the mission of the college.	Spring 2020

RECOMMENDATIONS TO ACCOMMODATE CHANGES IN **STUDENT CHARACTERISTICS**	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Target Date**
Enrollment Changes		
Expand dual enrollment and articulation agreements with high schools and maintain and expand articulation agreements with 4-year institutions.	SLS1: To ensure continuous improvement based on Student Learning Outcomes assessment data.	Fall 2019
Rebrand and refresh targeted program promotional and outreach materials.	SLS2: To support student access, achievement and success.	Spring 2020
Demographic Changes		
Plan and execute educational outreach events and activities to engage students in career exploration and pathway awareness and enthuse prospective new students into the program to close equity gaps in access.	SLS2: To support student access, achievement and success.	Spring 2020

RECOMMENDATIONS TO IMPROVE THE **EDUCATIONAL ENVIRONMENT**	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Target Date**
Curricular Changes Reinstate an Electronics Calculations course to increase student success in all EL courses Develop a Survey of Electronics course designed to satisfy the General Education requirement in the Natural Sciences area.	SLS2: To support student access, achievement and success.	Spring 2020
Co-Curricular Changes N/A		
Neighboring College and University Plans N/A		
Related Community Plans N/A		

RECOMMENDATIONS THAT REQUIRE ADDITIONAL RESOURCES	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Resources Needed**	**Target Date**
Facilities Relocate EL classrooms into renovated facilities in O-300.	Goal IR3 To enhance and maintain currency in technology usage/application in support of students and faculty, staff efficiency and operational effectiveness.	N/A	Fall 2019
Equipment Purchase (25) Soldering Workstations Consider "2in1 862d+ SMD Hot Air Rework Station Soldering Iron Station LED Display W/4 Nozzle 110V New Version" Purchase (25) Fume Absorbers Consider "VALTCAN Solder Smoke Absorber Fume Remover Fan Carbon Filter ESD Safe FA400" Purchase (6) Power Supply Consider "B&K Precision 1902 Switching DC Bench Power Supplies 1-60V, 15A" Purchase (25) ESD Mat Kits Cannot determine model# until the work benches are set up.	IR4: To provide a safe, attractive, and accessible physical environment that enhances the ability to teach, learn, and work.	$2,200 (Total) $2,425 (Total) $5,880 (Total) $2,000 (Total)	Fall 2019 Fall 2018 Fall 2019 Fall 2019
Staffing			
Hire at least one and possibly two full-time instructors Hire a part-time instructional assistant for the electronics and networking labs.	Goal IE1: To identify the institutional capacity to fulfill the college mission.	Allocate funds to pay for salaries.	Spring 2019 Fall 2019

Employment Development Department
Labor Market Information Division
Published: May 2017

2014-2024 Occupational Employment Projections
Santa Maria-Santa Barbara Metropolitan Statistical Area
(Santa Barbara County)

SOC Code*	Occupational Title	Estimated Employment 2014**	Projected Employment 2024	Numeric Change 2014-2024 [1]	Percent Change 2014-2024	Annual Average Percent Change	Average Annual Job Openings			2016 First Quarter Wages [5]		Education and Training Levels [7]		
							New Jobs [2]	Replacement Needs [3]	Total Jobs [4]	Median Hourly	Median Annual	Entry Level Education	Work Experience	On-the-Job Training
17-0000	**Architecture and Engineering Occupations**	**4,730**	**5,910**	**1,180**	**24.9%**	**2.5%**	**120**	**116**	**236**	**$43.23**	**$89,925**			
17-2071	Electrical Engineers	240	290	50	20.8%	2.1%	5	5	10	$53.83	$111,959	3	None	None
17-2072	Electronics Engineers, Except Computer	420	560	140	33.3%	3.3%	14	9	23	$52.54	$109,291	3	None	None
17-3012	Electrical and Electronics Drafters	90	110	20	22.2%	2.2%	2	1	3	$23.38	$48,645	4	None	None
17-3023	Electrical and Electronics Engineering Technicians	290	340	50	17.2%	1.7%	5	7	12	$27.96	$58,161	4	None	None
49-0000	**Installation, Maintenance, and Repair Occupations**	**5,640**	**6,410**	**770**	**13.7%**	**1.4%**	**87**	**132**	**219**	**$22.13**	**$46,016**			
49-2011	Computer, Automated Teller, and Office Machine Repairers	100	110	10	10.0%	1.0%	0	2	2	$18.67	$38,826	6	None	ST OJT
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	110	140	30	27.3%	2.7%	3	2	5	$29.33	$61,004	5	None	LT OJT
51-2022	Electrical and Electronic Equipment Assemblers	540	690	150	27.8%	2.8%	16	7	23	$16.81	$34,971	7	None	MT OJT

* The Standard Occupational Classification (SOC) system is used by government agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data.

** Data sources: U.S. Bureau of Labor Statistics' Current Employment Statistics (CES) March 2015 benchmark, Quarterly Census of Employment and Wages (QCEW) industry employment, and Occupational Employment Statistics (OES) data.
Occupational employment projections include self-employed, private household workers, farm, and nonfarm employment.
N/A - Information is not available.
Occupations with employment below 50 in 2014 are excluded.
Occupation subtotals may not add to the totals due to rounding and the suppression of data.
The use of occupational employment projections as a time series is not encouraged due to changes in the occupational, industrial, and geographical classification systems; changes in the way data are collected; and changes in the OES survey reference period.

[1] Numerical employment change is the net difference between the base and projected year employment and reflects job growth or decline. The base and projected year employment are independently rounded to 10. Therefore, numerical change may not equal new jobs.

[2] New jobs are only openings due to growth and do not include job declines. If an occupation's employment change is negative, there is no job growth and new jobs are set to zero. New jobs may not equal numerical change.

[3] Replacement needs estimate the number of job openings created when workers retire or permanently leave an occupation and need to be replaced.

[4] Total jobs are the sum of new jobs and replacement needs.

[5] Median hourly and annual wages are the estimated 50th percentile of the distribution of wages; 50 percent of workers in an occupation earn wages below, and 50 percent earn wages above the median wage. The wages are from 2016 first quarter and do not include self-employed or unpaid family workers.

[6] In occupations where workers do not work full-time all year-round, it is not possible to calculate an hourly wage.

[7] The Bureau of Labor Statistics develops and assigns education and training categories to each occupation (see tables below). For more information please see

http://www.bls.gov/emp/ep_education_training_system.htm

Entry Level Education
1- Doctoral or professional degree
2- Master's degree
3- Bachelor's degree
4- Associate's degree
5- Postsecondary non-degree award
6- Some college, no degree
7- High school diploma or equivalent
8- No formal educational credential

Work Experience Codes	
≥5 years	5 years or more experience in a related occupation or field is common.
<5 years	Less than 5 years experience in a related occupation or field is common.
None	No work experience is typically required.

On-the-Job Training	
I/R	Internship/Residency
APP	Apprenticeship
LT OJT	Long-term on-the-job training
MT OJT	Moderate-term on-the-job
ST OJT	Short-term on-the-job training
None	None

EXHIBITS

STUDENT DATA SUMMARY

Data analysis is a critical component of program review. The three categories below should be used as guidelines in developing a summary of the student data.

State at least three positive factors about the discipline/program identified by students. Include the number (or percentage) of students responding and any implications for planning.

In July 2018, a survey of former and current EL students, from 2010 to present, was conducted. Fifty-three (53) responded to the survey, with fair representation among program alumni and recent and current students:

#	Answer	%	Count
1	2010-2012	26%	14
2	2013-2015	25%	13
3	2016-2018	36%	19
4	Presently enrolled	13%	7
	Total	100%	53

Based on this survey, respondents identified the following positive factors about the EL program:

1. Contribution towards intellectual growth (78% satisfied, including 67% highly satisfied)
2. Quality of instruction within the program (74% satisfied, including 61% who were highly satisfied)
3. Clarity of course goals and learning objectives (79% satisfied, including 57% who were highly satisfied)

State at least three negative factors about the discipline/program identified by students. Include the number (or percentage) of students responding and any implications for planning.

1. Availability of courses offered in Electronics Technology (30% dissatisfied, including 16% who were highly dissatisfied)
2. Coordination of courses offered in Electronics Technology and courses offered in other departments that may be required for your major (34% dissatisfied, including 13% who were highly dissatisfied)
3. Advise about the program from counselors (25% dissatisfied, including 11% who were highly dissatisfied)
4. The physical facilities and space (21% dissatisfied, including 4% who were highly dissatisfied)

State any other information (use responsive numbers) that you obtained from student data (e.g. focus groups, questionnaires, or SGIDs) that may be of special interest to the self study team. What planning implications will result from this information.

1. According to data reported in LaunchBoard, a preponderance of students enrolled in Electronics Technology attend identify as Skills Builders and attend part-time, and nearly a fourth have previously earned a certificate or degree:

EL/CEL Students (TOP Code 0934)	2014-2015	2015-2016	2016-2017
Skills Builders	16%	19%	Data Unavailable
Part-time	88%	90%	90%
Previously earned a certificate or degree	26%	19%	24%

Data are consistent with course EL scheduling patterns since 2010 which, without full-time faculty and lack of qualified part-time faculty available to teach during the day, have been limited to face-to-face, evenings-only offerings.

2. Results of the student survey conducted in July 2018 show that, in comparing students' attitudes about the Electronics Technology program prior to and after after having taken an EL course, 80% of the 46 respondents reported their attitudes had either improved (39%) or remained the same (41%).

    a. 80% of survey respondents would recommend taking courses in the program, including 56% of whom who strongly recommend doing so.

    b. 55% of survey respondents either somewhat (25%) or strongly agree (30%) that they plan to take additional courses in the program.

Program Review - Electronics Technology Program

July 30th 2018

When were you last enrolled in an Electronics Technology Course?

#	Answer	%	Count
1	2010-2012	26%	14
2	2013-2015	25%	13
3	2016-2018	36%	19
4	Presently enrolled	13%	7
	Total	100%	53

Part I. Answer to the best of your ability the following questions. Please indicate how satisfied you are, in general, with the following aspects of the Electronics Technology Program.

#	Question	Highly satisfied		Somewhat satisfied		Neither satisfied nor dissatisfied		Somewhat dissatisfied		Highly dissatisfied		Total
1	Quality of instruction within the program	61%	28	13%	6	11%	5	13%	6	2%	1	46
2	The way textbooks and other materials used in courses within the program help me learn	41%	19	35%	16	17%	8	4%	2	2%	1	46
3	Advice about the program from counselors	30%	11	16%	6	30%	11	14%	5	11%	4	37
4	The way this program meets your educational goals	50%	24	21%	10	10%	5	13%	6	6%	3	48
5	Contribution towards your intellectual growth	67%	30	11%	5	11%	5	4%	2	7%	3	45
6	Clarity of course goals and learning objectives	57%	26	22%	10	9%	4	7%	3	7%	3	46
7	Feedback and assessment of progress towards learning objectives	49%	22	24%	11	13%	6	9%	4	4%	2	45
8	The availability of courses offered in the Electronics Technology Program	27%	12	30%	13	14%	6	14%	6	16%	7	44

9	The content of courses offered in the Electronics Technology Program	40%	18	33%	15	11%	5	16%	7	0%	0	45
10	The coordination of courses offered in the Electronics Technology Program and courses offered in other departments that may be required for your major	34%	13	21%	8	11%	4	21%	8	13%	5	38
11	The physical facilities and space (e.g., classrooms, labs)	37%	17	20%	9	22%	10	17%	8	4%	2	46
12	Instructional equipment (e.g., computers, lab equipment)	25%	11	39%	17	20%	9	9%	4	7%	3	44
13	Presentation of classes via the college's Canvas course management system	28%	10	36%	13	25%	9	6%	2	6%	2	36
14	Course assistance through tutorial services (e.g through the Tutorial Center, Math Lab, Writing Center)	33%	12	19%	7	33%	12	3%	1	11%	4	36
15	Availability of appropriate resources in the libraries	30%	10	12%	4	30%	10	18%	6	9%	3	33

Which of the following best describes your reason for taking this and other courses in Electronics Technology Program?

#	Answer	%	Count
1	Recommended by a counselor	11%	5
2	Recommended by a friend	2%	1
3	To meet general education requirements	20%	9
4	Offered at a convenient time	11%	5
6	Don't know/ Don't remember	4%	2
5	Other, please specify:	52%	24
	Total	100%	46

Other, please specify:

Other, please specify: - Text
Specfic career goal
Wanted to learn
For transfer into computer science at UCSB
Wanted to expand my knowledge on computers
To Increase my knowledge used in my profession.
I was interested in exploring this field
For career advancement
Continuing education to familiarize myself with electronics
My own curiosity.
Personal interest and offered at a convenient time
To help with work.
required for degree

job related information

Increase knowledge

Improve my career

Getting ready for the future.

Recommended by an employee at a company that I wanted to work for.

Get my degree in it

meets interests

Previous field of work in the military

Wanted to be a network administrator, but no enough money to take CCNA exam.

To obtain a degree in the electronics technology field

Electrical Engineering major

To work towards electrical engineering degree

Compared to beginning your coursework in Electronics Technology Program, your attitude about the Electronics Technology Program has

#	Answer	%	Count
1	Improved	39%	18
2	Remained the same	41%	19
3	Decreased	13%	6
4	Don't know/Don't remember	7%	3
	Total	100%	46

Please answer the following questions.

#	Question	Strongly agree		Somewhat agree		Neither agree nor disagree		Somewhat disagree		Strongly disagree		Total
1	I would recommend taking courses in Electronics Technology Program	56%	25	24%	11	11%	5	9%	4	0%	0	45
2	I plan on taking additional courses in Electronics Technology Program	30%	13	25%	11	27%	12	5%	2	14%	6	44

Which of the following courses have you taken in Electronics Technology Program? (Check all that apply)

#	Answer	Count
3	EL 106 Network Essentials 1	19
7	EL 118 Fundamentals of DC and AC Circuit Analysis	17
8	EL 119 Fundamentals of DC and AC Circuit Analysis Lab	16
2	EL 105 PC Preventative Maintenance and Upgrading	14
4	EL 107 Network Essentials 2	13
1	EL 104 Intro to Robotics and Mechatronics	10
28	Don't know/Don't remember what courses I took in Electronics Technology Program	10
9	EL 122 Electronic Devices and Circuits	7
5	EL 108 Network Essentials 3	7
11	EL 125 Digital Devices and Circuits	6
10	EL 123 Electronic Devices and Circuits Lab	6
24	EL 320 A+ Certification	5
6	EL 109 Network Essentials 4	5
12	EL 126 Digital Devices and Circuits Lab	4
19	EL 146 Electrical Product Design/Fabrication	3
14	EL 131 Programmable Logic Controllers and Control Design	2
17	EL 136 Electronic Measurement and Instrument Lab	2
26	EL 333 Intro to Network Security	2
16	EL 135 Electronic Measurement and Instrument	2
13	EL 128 Renewable Energy	1
25	EL 332 Wireless Network Administrator	1
27	EL 370 SkillsUSA	1
23	EL 399 Special Topics in Electronics	0
22	El 189 Independent Projects in Electronics	0
20	El 162 Fluid Power and Control	0
21	EL 179, 379 Experimental Courses in Electronics	0
15	El 133 Mechatronic Systems 1	0
18	EL 139 Electrical Power, Motors and Controls	0
	Total	153

How many units have you completed at Allan Hancock College?

#	Answer	%	Count
1	0-15 units	21%	9
2	16-30 units	12%	5
3	31-45 units	7%	3
4	46-60 units	24%	10
5	61 or more units	36%	15
	Total	100%	42

In how many units are you currently enrolled?

#	Answer	%	Count
1	less than 5 units	20%	9
2	5 - 8.5 units	18%	8
3	9 - 11.5 units	4%	2
4	12 or more units	4%	2
5	Not currently enrolled	53%	24
	Total	100%	45

What is your final academic goal?

#	Answer	%	Count
1	Certificate	2%	1
2	AA/AS	22%	10
3	Bachelors	16%	7
4	Masters or higher	13%	6
5	Not certain	16%	7
6	I have completed my goal of	27%	12
7	Other	4%	2
	Total	100%	45

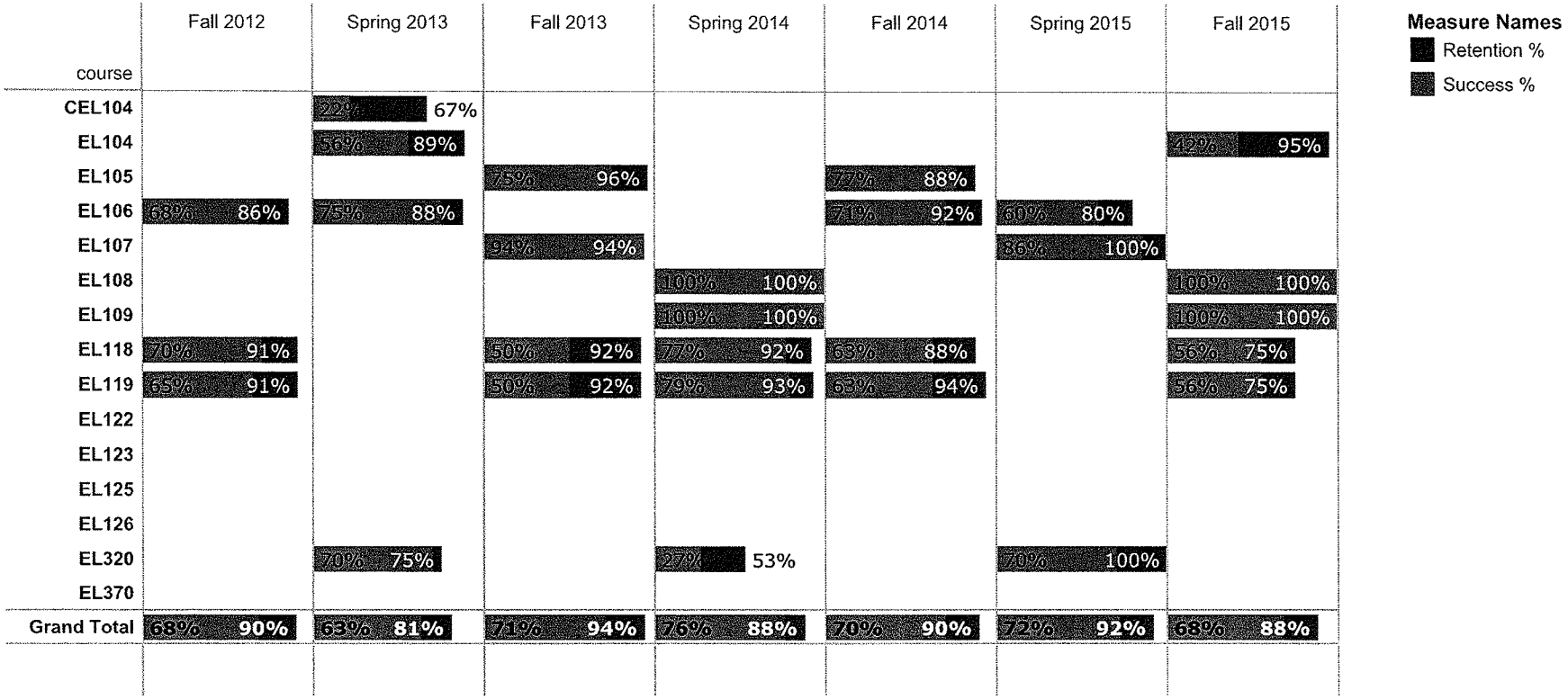
Fall 2012, Spring 2013, Fall 2013 and 8 more Demographics CEL & EL

	Fall 2012		Spring 2013		Fall 2013		Spring 2014		Fall 2014		Spring 2015		Fall 2015		Spring 2016		Fall 2016
age_category	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..
Under 19	6.00	1.18	6.00	0.91	5.00	1.00	10.00	1.68	5.00	1.18	3.00	1.20	6.00	1.67	4.00	0.74	10.00
20-24	8.00	1.64	21.00	3.11	15.00	3.35	9.00	2.12	18.00	4.48	8.00	1.28	16.00	3.10	23.00	5.02	10.00
25-29	7.00	2.12	11.00	1.52	14.00	3.30	7.00	1.50	14.00	4.60	10.00	2.19	11.00	2.83	18.00	3.99	11.00
30-34	10.00	2.26	7.00	1.32	3.00	0.98	7.00	0.59	8.00	1.52	8.00	1.84	5.00	1.36	5.00	1.03	5.00
35-39	2.00	0.33	1.00	0.06	3.00	0.51	2.00	0.27	2.00	0.34	1.00	0.06	4.00	1.02	3.00	0.84	8.00
40-49	5.00	1.32	8.00	0.94	2.00	0.34	4.00	1.05	4.00	0.69	3.00	0.97	3.00	0.55	4.00	0.89	4.00
50+	4.00	0.83	4.00	0.58	8.00	1.52	4.00	1.12	5.00	0.86	6.00	1.50	3.00	0.55	3.00	0.54	4.00

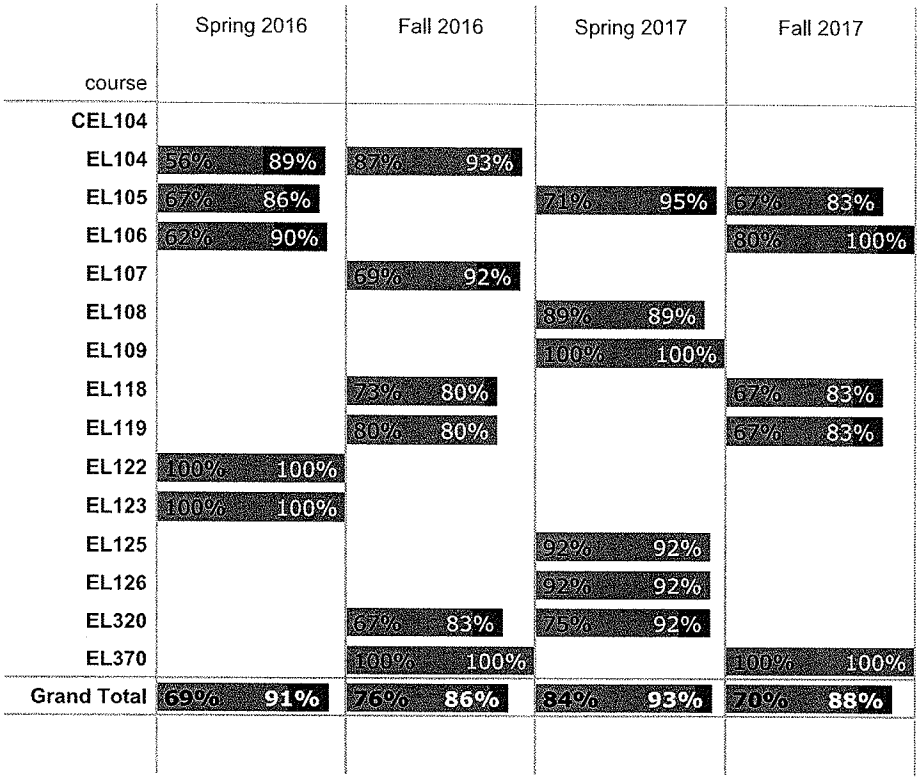
Fall 2012, Spring 2013, Fall 2013 and 8 more Demographics CEL & EL

	Fall 2016		Spring 2017		Fall 2017	
age_category	FTES	Headc..	FTES	Headc..	FTES
Under 19	2.99	3.00	0.51	6.00	1.27
20-24	2.53	11.00	2.28	16.00	3.77
25-29	2.75	8.00	2.06	7.00	2.15
30-34	1.45	9.00	1.87	12.00	2.84
35-39	2.28	9.00	2.23	6.00	1.32
40-49	0.95	6.00	1.14	9.00	1.69
50+	0.65	4.00	0.65	1.00	0.32

Fall 2012, Spring 2013, Fall 2013 and 8 more Retention & Success CEL & EL



Fall 2012, Spring 2013, Fall 2013 and 8 more Retention & Success CEL & EL



Measure Names

- Retention %
- Success %

Fall 2012, Spring 2013, Fall 2013 and 8 more Demographics CEL & EL

	Fall 2012		Spring 2013		Fall 2013		Spring 2014		Fall 2014		Spring 2015		Fall 2015		Spring 2016		Fall 2016
Gender	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..	FTES	Headc..
Female	4.00	0.67	5.00	0.54	8.00	1.54	1.00	0.20	5.00	1.03	4.00	0.93	3.00	0.69	11.00	2.46	4.00
Male	38.00	9.01	53.00	7.91	42.00	9.47	42.00	8.13	51.00	12.63	35.00	8.12	45.00	10.38	49.00	10.58	48.00
Grand Total	42.00	9.68	58.00	8.44	50.00	11.02	43.00	8.33	56.00	13.66	39.00	9.05	48.00	11.07	60.00	13.04	52.00

Fall 2012, Spring 2013, Fall 2013 and 8 more Demographics CEL & EL

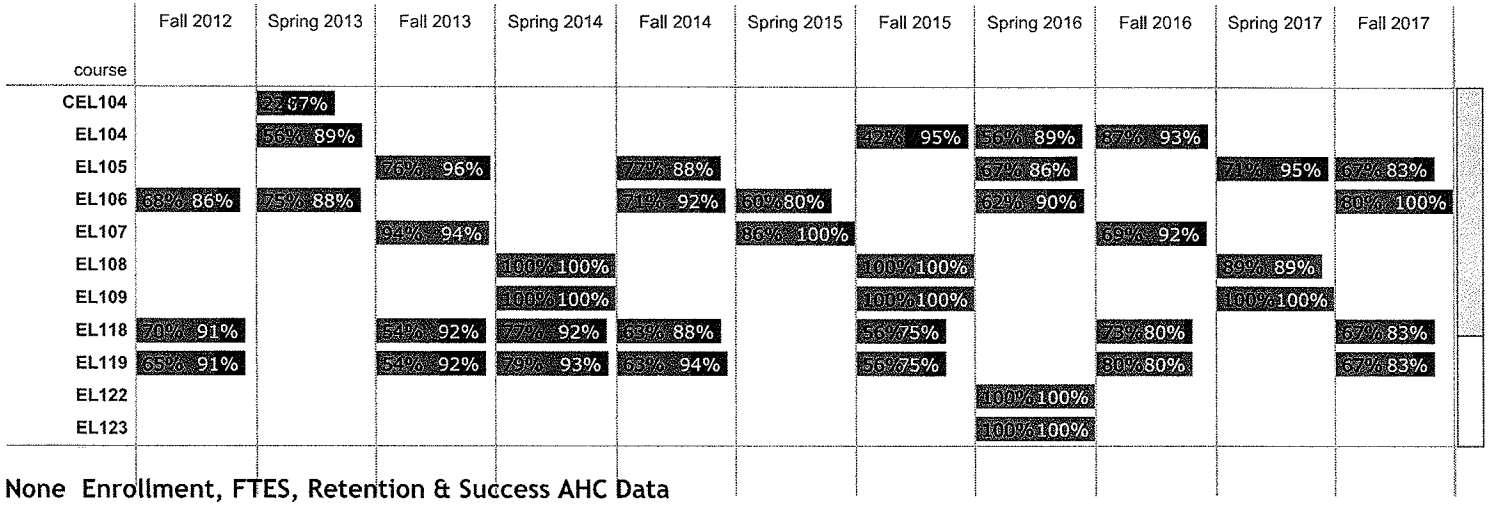
	Fall 2016		Spring 2017		Fall 2017	
Gender	FTES	Headc..	FTES	Headc..	FTES	
Female	1.27	8.00	1.48	12.00	2.64	
Male	12.34	42.00	9.26	45.00	10.72	
Grand Total	13.61	50.00	10.74	57.00	13.36	

Multi Term Display

Fall 2012, Spring 2013, Fall 2013 and 8 more CEL & EL Outcomes

	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
Sections	5.00	4.00	4.00	5.00	4.00	3.00	5.00	5.00	6.00	6.00	5.00
Headcount	42.00	58.00	51.00	43.00	56.00	39.00	48.00	60.00	52.00	50.00	57.00
Enrollment	68.00	62.00	69.00	72.00	82.00	39.00	78.00	74.00	71.00	74.00	81.00
retained	61.00	50.00	65.00	63.00	74.00	36.00	69.00	67.00	61.00	69.00	71.00
Retention %	89.71%	80.65%	94.20%	87.50%	90.24%	92.31%	88.46%	90.54%	85.92%	93.24%	87.65%
success	46.00	39.00	50.00	55.00	57.00	28.00	53.00	51.00	54.00	62.00	57.00
Success %	67.65%	62.90%	72.46%	76.39%	69.51%	71.79%	67.95%	68.92%	76.06%	83.78%	70.37%
FTES	9.68	8.44	11.50	8.33	13.66	9.05	11.07	13.04	13.61	10.74	13.36

Fall 2012, Spring 2013, Fall 2013 and 8 more Retention & Success



None Enrollment, FTES, Retention & Success AHC Data

	Fall 20..	Spring ..	Summ..	Fall 20..	Spring ..	Summ..	Fall 20..	Spring ..	Summ..	Fall 20..	Spring ..	Summ..	Fall 20..	Spring ..	Summ..	Fall 20..
Sections	1,004	1,087	285	1,069	1,141	306	1,141	1,209	355	1,177	1,220	357	1,184	1,214	333	1,168
Headcount	10,883	11,361	5,421	10,922	11,293	5,185	11,084	11,249	5,593	10,982	11,341	4,354	12,111	11,636	5,306	11,889
Enrollment	28,559	29,609	8,455	28,612	29,369	8,168	29,153	28,984	8,789	28,471	28,153	8,305	29,268	28,161	8,052	28,754
Retention %	86.62%	86.17%	89.13%	86.97%	85.23%	89.37%	86.83%	85.44%	89.56%	86.43%	89.39%	90.38%	87.95%	88.10%	90.34%	86.99%
Success %	69.63%	70.38%	77.46%	70.56%	70.22%	77.69%	69.80%	71.38%	77.44%	70.25%	73.22%	79.57%	71.46%	74.04%	80.29%	71.46%
FTES	3,775	3,813	978	3,852	3,868	944	3,900	4,048	1,009	3,807	3,715	967	4,197	4,020	900	4,126

Term
Multiple values

subject_code
Multiple values

Credit Status
Multiple values

ETHNICITY
All

Gender
All

age_category
All

Enrollment Status
All

Measure Names
Retention %
Success %

Choose 'AHC Data' to see data for the entire college. Choose 'Course Data' and pick a course to see individual course data.

Select a Sheet
AHC Data

course
None

Retention & Success by Demographics CEL & EL

Retention % Success %

	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
Headcount	42.00	58.00	51.00	43.00	56.00	39.00	48.00	60.00	52.00	50.00	57.00
FTES	9.68	8.44	11.50	8.33	13.66	9.05	11.07	13.04	13.61	10.74	13.36

age_category	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
Under 19	57% 86%	67% 67%	89% 100%	78% 87%	43% 100%	33% 100%	20% 80%	50% 100%	69% 77%	83% 100%	63% 88%
20-24	58% 100%	64% 91%	75% 100%	94% 94%	59% 78%	63% 88%	68% 91%	64% 96%	71% 79%	67% 87%	70% 87%
25-29	71% 100%	83% 92%	65% 95%	85% 100%	79% 100%	70% 100%	75% 85%	70% 87%	77% 100%	100% 100%	62% 92%
30-34	67% 89%	67% 67%	50% 100%	38% 63%	67% 89%	75% 75%	56% 78%	67% 67%	100% 100%	100% 100%	82% 100%
35-39	100% 100%	0%	67% 67%	67% 67%	100% 100%	0% 100%	100% 100%	100% 100%	64% 71%	87% 93%	75% 75%
40-49	56% 56%	63% 75%	100% 100%	43% 71%	75% 75%	100% 100%	100% 100%	80% 80%	100% 100%	89% 89%	80% 90%
50+	100% 100%	75% 75%	78% 78%	100% 100%	100% 100%	100% 100%	80% 100%	67% 100%	75% 100%	60% 80%	0%

Gender	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
Female	67% 100%	60% 60%	89% 89%	100% 100%	100% 100%	75% 100%	80% 80%	57% 71%	57% 71%	90% 90%	81% 88%
Male	68% 89%	63% 82%	68% 95%	76% 87%	67% 89%	71% 91%	67% 89%	72% 95%	78% 88%	83% 94%	68% 88%

Enrollment Status	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
First Time Student	86% 100%	60% 80%	100% 100%	0% 50%	60% 100%		40% 60%	100% 100%	57% 71%	100% 100%	67% 83%
First Time Transfer	58% 92%	33% 67%	33% 100%	50% 100%	100% 100%	100% 100%	57% 100%	67% 100%	63% 75%	100% 100%	100% 100%
Continuing	72% 90%	63% 80%	77% 96%	85% 87%	69% 85%	68% 90%	70% 88%	70% 93%	77% 86%	88% 94%	72% 89%
Returning	60% 85%	71% 86%	57% 86%	45% 91%	68% 95%	83% 100%	83% 100%	56% 67%	89% 100%	50% 83%	56% 81%
Concurrent			100% 100%	100% 100%					100% 100%	50% 100%	

ETHNICITY	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
Asian	50% 100%	0% 100%	100% 100%	50% 100%	100% 100%	100% 100%	100% 100%	75% 100%	100% 100%	80% 100%	83% 100%
Black		50% 50%		0%	100% 100%		0% 100%	50% 100%	0% 50%	100%	100% 100%
Filipono	67% 100%	67% 67%	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%
Hispanic	61% 96%	56% 78%	58% 92%	67% 81%	62% 86%	60% 87%	58% 85%	66% 91%	76% 82%	81% 91%	61% 81%
Native Am	0%		0% 100%		0% 50%		100% 100%	80% 100%	100% 100%	67% 67%	50% 100%
Pacific Islander	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%	0%			100% 100%	100% 100%
White	77% 83%	70% 85%	79% 94%	82% 90%	74% 94%	74% 95%	76% 94%	68% 86%	77% 90%	88% 96%	78% 90%
Grand Total	68% 90%	63% 81%	72% 94%	76% 88%	70% 90%	72% 92%	68% 88%	69% 91%	76% 86%	84% 93%	70% 88%

Multi Term Display Demographics

Term
Multiple values

subject_code
Multiple values

course
All

Credit Status
Multiple values

Ethnicity or Age
Age

Gender or Enrollment Status
Gender

ETHNICITY
Multiple values

Gender
Multiple values

age_category
All

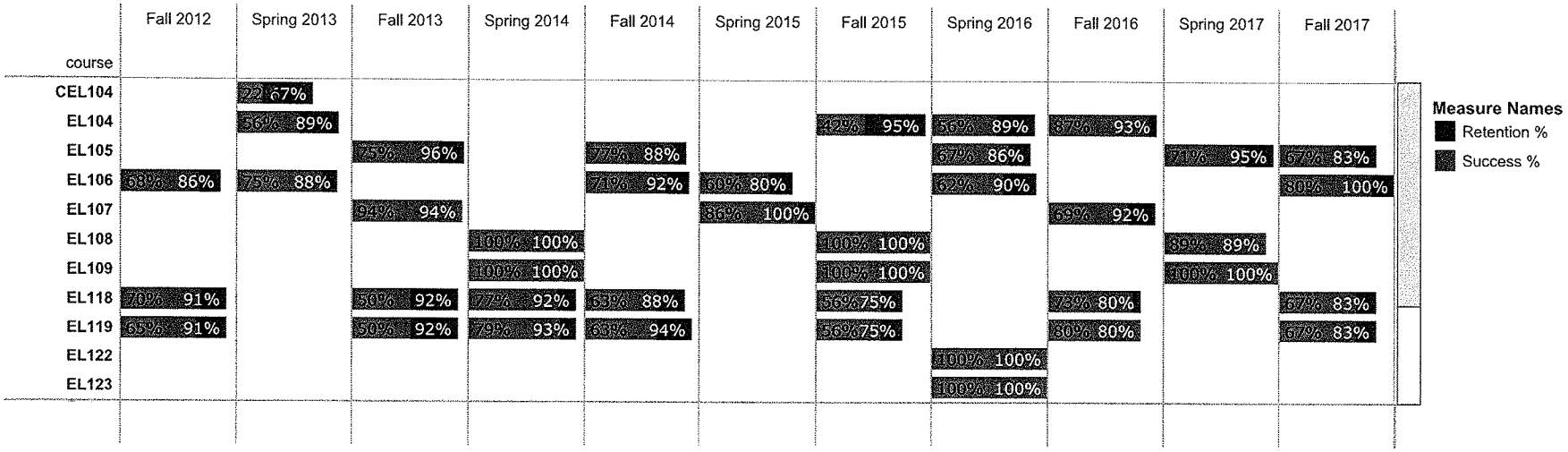
Enrollment Status
All

Use two filters above to choose between displaying the four demographic options.

	Fall 2012		Spring 2013		Fall 2013		Spring 2014		Fall 2014		Spring 2015		Fall 2015		Spring 2016		Fall 2016		Spring 2017		Fall 2017	
age_category	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES
Under 19	6.00	1.18	6.00	0.91	5.00	1.00	10.00	1.68	5.00	1.18	3.00	1.20	6.00	1.67	4.00	0.74	10.00	2.99	3.00	0.51	6.00	1.27
20-24	8.00	1.64	21.00	3.11	15.00	3.35	9.00	2.12	18.00	4.48	8.00	1.28	16.00	3.10	23.00	5.02	10.00	2.53	11.00	2.28	16.00	3.77
25-29	7.00	2.12	11.00	1.52	14.00	3.30	7.00	1.50	14.00	4.60	10.00	2.19	11.00	2.83	18.00	3.99	11.00	2.75	8.00	2.06	7.00	2.15
30-34	10.00	2.26	7.00	1.32	3.00	0.98	7.00	0.59	8.00	1.52	8.00	1.84	5.00	1.36	5.00	1.03	5.00	1.45	9.00	1.87	12.00	2.84
35-39	2.00	0.33	1.00	0.06	3.00	0.51	2.00	0.27	2.00	0.34	1.00	0.06	4.00	1.02	3.00	0.84	8.00	2.28	9.00	2.23	6.00	1.32
40-49	5.00	1.32	8.00	0.94	2.00	0.34	4.00	1.05	4.00	0.69	3.00	0.97	3.00	0.55	4.00	0.89	4.00	0.95	6.00	1.14	9.00	1.69
50+	4.00	0.83	4.00	0.58	8.00	1.52	4.00	1.12	5.00	0.86	6.00	1.50	3.00	0.55	3.00	0.54	4.00	0.65	4.00	0.65	1.00	0.32

	Fall 2012		Spring 2013		Fall 2013		Spring 2014		Fall 2014		Spring 2015		Fall 2015		Spring 2016		Fall 2016		Spring 2017		Fall 2017	
Gender	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES	Head..	FTES
Female	4.00	0.67	5.00	0.54	8.00	1.54	1.00	0.20	5.00	1.03	4.00	0.93	3.00	0.69	11.00	2.46	4.00	1.27	8.00	1.48	12.00	2.64
Male	38.00	9.01	53.00	7.91	42.00	9.47	42.00	8.13	51.00	12.63	35.00	8.12	45.00	10.38	49.00	10.58	48.00	12.34	42.00	9.26	45.00	10.72
Grand Total	42.00	9.68	58.00	8.44	50.00	11.02	43.00	8.33	56.00	13.66	39.00	9.05	48.00	11.07	60.00	13.04	52.00	13.61	50.00	10.74	57.00	13.36

Fall 2012, Spring 2013, Fall 2013 and 8 more Retention & Success CEL & EL



Degrees & Certificates

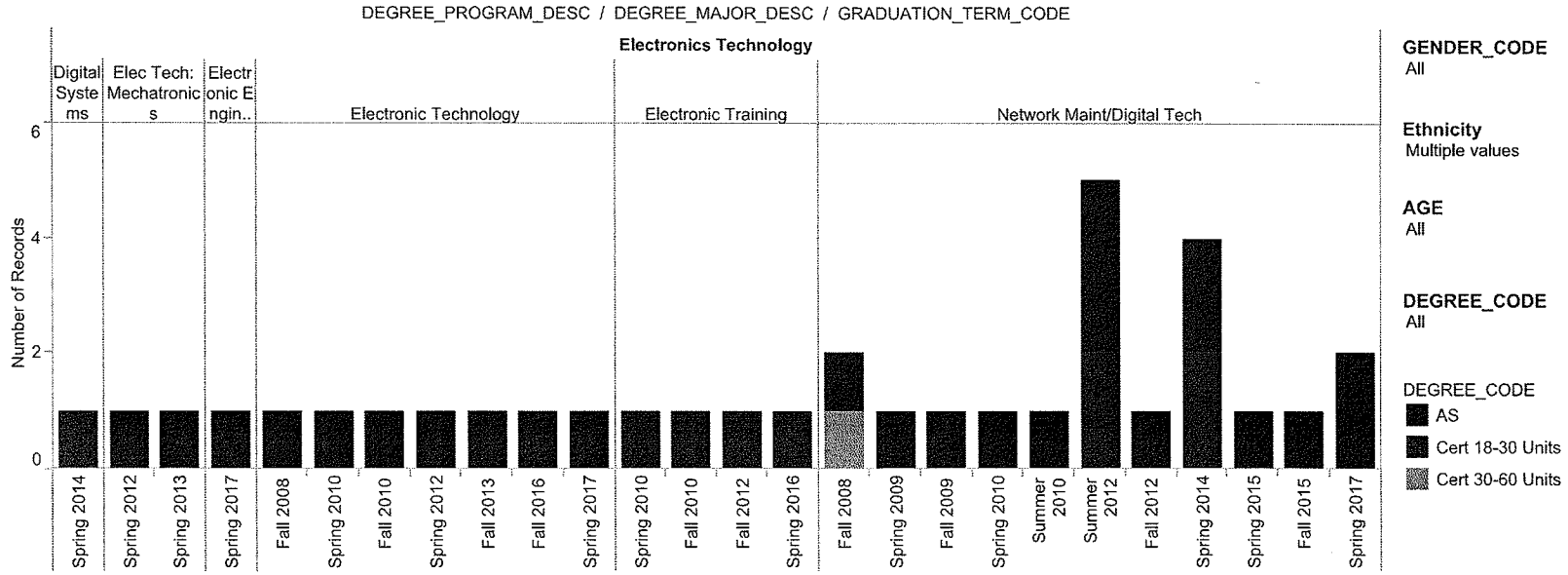
			GRADUATION_TERM_CODE																	
DEGREE_PRO..	DEGREE_M..	DEGREE_CODE	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Summer 20..	Fall 2010	Spring 2012	Summer 20..	Fall 2012	Spring 20..	Fall 2013	Spring 2014	Spring 20..	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Grand Total
Electronics Technology	Digital Syste..	Cert 18-30 Units												1						1
	Elec Tech: M..	AS							1			1								2
	Electronic En..	AS																	1	1
	Electronic Te..	AS	1			1		1	1				1					1	1	7
	Electronic Tra..	Cert 18-30 Units				1		1			1						1			4
	Network Maint/Digital Tech	AS	1	1	1	1	1			3	1			2	1	1			2	15
		Cert 18-30 Units								2				2						4
		Cert 30-60 Units	1																	1

GRADUATION_TERM_CODE
Multiple values

DEGREE_PROGRAM_DESC
Electronics Technology

DEGREE_MAJOR_DESC
All

Degrees & Certificates



GENDER_CODE
All

Ethnicity
Multiple values

AGE
All

DEGREE_CODE
All

DEGREE_CODE
- AS
- Cert 18-30 Units
- Cert 30-60 Units

Degrees & Certificates

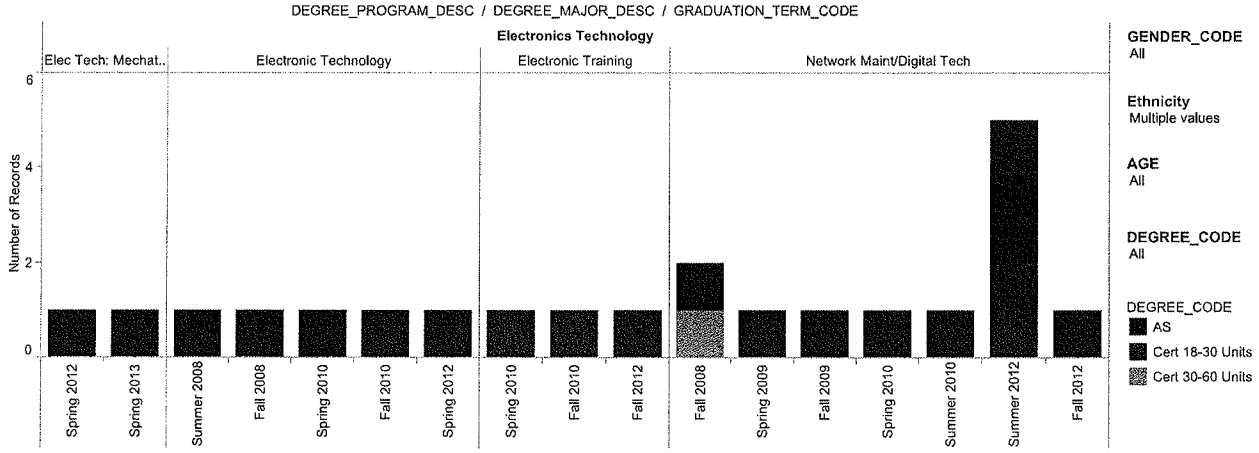
			GRADUATION_TERM_CODE											
DEGREE_PRO..	DEGREE_MAJOR_D..	DEGREE_CODE	Summer 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Summer 2010	Fall 2010	Spring 2012	Summer 2012	Fall 2012	Spring 2013	Grand Total
Electronics Technology	Elec Tech: Mechatron..	AS								1			1	2
	Electronic Technology	AS	1	1			1		1	1				5
	Electronic Training	Cert 18-30 Units					1		1			1		3
	Network Maint/Digital Tech	AS		1	1	1	1	1			3	1		9
		Cert 18-30 Units									2			2
		Cert 30-60 Units		1										1
	Total		1	3	1	1	3	1	2	2	5	2	1	22
Grand Total			1	3	1	1	3	1	2	2	5	2	1	22

GRADUATION_TERM_CODE
Multiple values

DEGREE_PROGRAM_DESC
Electronics Technology

DEGREE_MAJOR_DESC
All

Degrees & Certificates



GENDER_CODE
All

Ethnicity
Multiple values

AGE
All

DEGREE_CODE
All

DEGREE_CODE
- AS
- Cert 18-30 Units
- Cert 30-60 Units

Degrees & Certificates

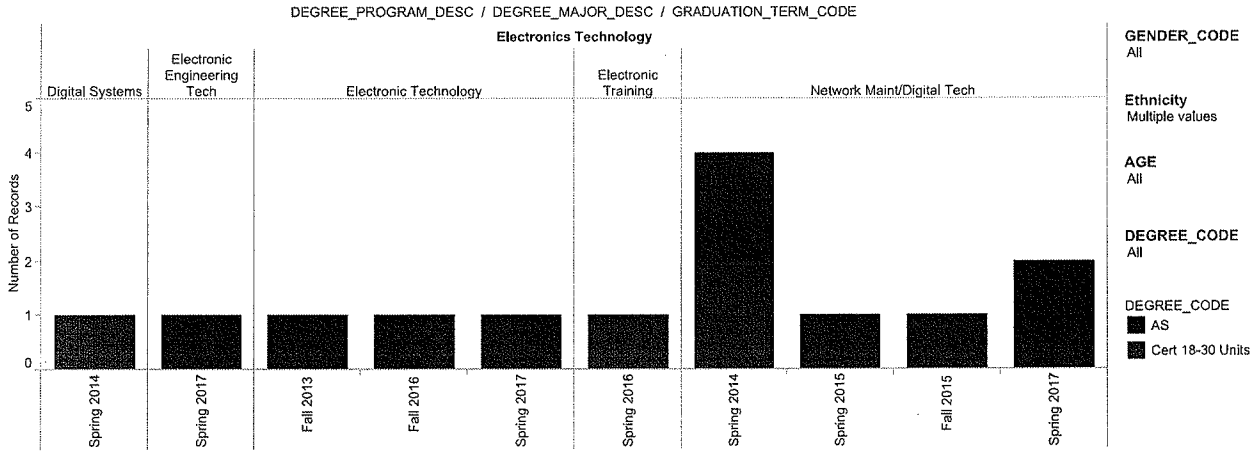
			GRADUATION_TERM_CODE							
DEGREE_PRO..	DEGREE_MAJOR_DESC	DEGREE_CODE	Fall 2013	Spring 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Grand Total
Electronics Technology	Digital Systems	Cert 18-30 Units		1						1
	Electronic Engineering Tech	AS							1	1
	Electronic Technology	AS	1					1	1	3
	Electronic Training	Cert 18-30 Units					1			1
	Network Maint/Digital Tech	AS		2	1	1			2	6
		Cert 18-30 Units		2						2
	Total		1	5	1	1	1	1	4	14
Grand Total			1	5	1	1	1	1	4	14

GRADUATION_TERM_CODE
Multiple values

DEGREE_PROGRAM_DESC
Electronics Technology

DEGREE_MAJOR_DESC
All

Degrees & Certificates



GENDER_CODE
All

Ethnicity
Multiple values

AGE
All

DEGREE_CODE
All

DEGREE_CODE
AS
Cert 18-30 Units

Allan Hancock College

SLO Performance Report

by Department with SLO

Department: Electronics
Courses: All Courses
Terms: Spring 2017, Fall 2016, Summer 2016

SLOs: PSLO Class Electronics Program Outcomes
Date: 03/15/2018

Department: Electronics

PSLO: EL PSLO - Demonstrate a fundamental mastery of knowledge and the use of electronic equipment in electrical, digital and analog circuits.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	20	21.28%	68	72.34%	6	6.38%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	20	21.28%	68	72.34%	6	6.38%	Includes sections w/o rosters

PSLO: EL PSLO - Use computer simulation and design software to conduct, analyze and interpret electrical, digital and analog circuits.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

PSLO: EL PSLO - Make calculations involving various electrical laws, formulas and principles for predicting circuit parameters using algebra and trigonometry required for electronics.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	11	47.83%	9	39.13%	3	13.04%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	11	47.83%	9	39.13%	3	13.04%	Includes sections w/o rosters

PSLO: EL PSLO - Use research strategies to acquire information pertinent to the solution of electronic circuits and systems.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

PSLO: EL PSLO - Write technical laboratory reports with conclusions.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

PSLO: EL PSLO - Demonstrate learned skills with a capstone project requiring you to design, build and evaluate a piece of electronic equipment.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

PSLO: EL PSLO - Demonstrate understanding of how computers communicate with each other and the methods employed to ensure that the communications is reliable.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	2	20.00%	7	70.00%	1	10.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	7	87.50%	1	12.50%	Includes sections w/o rosters
Overall	2	11.11%	14	77.78%	2	11.11%	Includes sections w/o rosters

PSLO: EL PSLO - Modify operating parameters of infrastructure network devices to meet network requirements.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	7	87.50%	1	12.50%	Includes sections w/o rosters
Overall	0	0.00%	7	87.50%	1	12.50%	Includes sections w/o rosters

PSLO: EL PSLO - Apply current knowledge and adapt to emerging applications of automation and control.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

PSLO: EL PSLO - Build and analyze a modern computer system using subsystems.

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Spring 2017	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
Overall	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

Overall by Term for Department: Electronics

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
Summer 2016	0	0.00%	0	0.00%	0	0.00%	0
Fall 2016	33	25.98%	84	66.14%	10	7.87%	Includes sections w/o rosters
Spring 2017	0	0.00%	14	87.50%	2	12.50%	Includes sections w/o rosters

Overall by PSLO for Department: Electronics

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
EL PSLO - Demonstrate a fundamental mastery of knowledge and the use of electronic equipment in electrical, digital and analog circuits.	20	21.28%	68	72.34%	6	6.38%	Includes sections w/o rosters
EL PSLO - Use computer simulation and design software to conduct, analyze and interpret electrical, digital and analog circuits.	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
EL PSLO - Make calculations involving various electrical laws, formulas and principles for predicting circuit parameters using algebra and trigonometry required for electronics.	11	47.83%	9	39.13%	3	13.04%	Includes sections w/o rosters
EL PSLO - Use research strategies to acquire information pertinent to the solution of electronic circuits and systems.	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

	Institutional Exceeds Standards		Institutional Meets Standards		Institutional Below Standards		Total Enrolled Students
EL PSLO - Write technical laboratory reports with conclusions.	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
EL PSLO - Demonstrate learned skills with a capstone project requiring you to design, build and evaluate a piece of electronic equipment.	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
EL PSLO - Demonstrate understanding of how computers communicate with each other and the methods employed to ensure that the communications is reliable.	2	11.11%	14	77.78%	2	11.11%	Includes sections w/o rosters
EL PSLO - Modify operating parameters of infrastructure network devices to meet network requirements.	0	0.00%	7	87.50%	1	12.50%	Includes sections w/o rosters
EL PSLO - Apply current knowledge and adapt to emerging applications of automation and control.	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters
EL PSLO - Build and analyze a modern computer system using subsystems.	0	0.00%	0	0.00%	0	0.00%	Includes sections w/o rosters

Allan Hancock College

Context Statistics And Evidence

Electronics

Date: 03/15/2018

Terms: Spring 2017, Fall 2016, Summer 2016

Summary

Statistic	Number of Courses	Courses
Courses in the Department	14	EL104, EL105, EL106, EL107, EL108, EL109, EL118, EL119, EL122, EL123, EL125, EL126, EL320, EL370
Courses with CSLOs	14	EL104, EL105, EL106, EL107, EL108, EL109, EL118, EL119, EL122, EL123, EL125, EL126, EL320, EL370
Courses without CSLOs	0	
Courses with CSLOs mapped to PSLOs	6	EL106, EL107, EL108, EL109, EL118, EL119
Courses without CSLOs mapped to PSLOs	8	EL104, EL105, EL122, EL123, EL125, EL126, EL320, EL370
Courses with direct assessment of PSLOs	0	
Courses with CSLOs mapped to ILOs	6	EL106, EL107, EL108, EL109, EL118, EL119
Courses without CSLOs mapped to ILOs	8	EL104, EL105, EL122, EL123, EL125, EL126, EL320, EL370
Courses with direct assessment of ILOs	0	
Courses with at least one planned Assessment	9	EL104, EL107, EL108, EL109, EL118, EL119, EL125, EL126, EL320
Courses with planned Assessments scored	9	EL119, EL104, EL108, EL109, EL125, EL126, EL320, EL118, EL107
Courses with some Assessments scored	0	
Courses without any Assessment scored	0	
Courses with no planned Assessments	5	EL105, EL106, EL122, EL123, EL370
Courses with at least one planned Action Plan	12	EL104, EL105, EL106, EL107, EL108, EL109, EL118, EL119, EL122, EL123, EL320, EL370
Courses with Action Plan Responses	0	
Courses with some Action Plan Responses	2	EL106, EL107
Courses without Action Plan Responses	10	EL122, EL119, EL123, EL104, EL105, EL108, EL109, EL320, EL118, EL370
Courses with no planned Action Plans	2	EL125, EL126

EL104 - Intro to Robotics & Mechatroni

SLOs

CSLOs	» EL104 SLO1 - Demonstrate an understanding of fundamental robotic and mechatronic characteristics, systems, and concepts. » EL104 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to design and evaluate mechatronic systems. » EL104 SLO3 - Produce programs to perform mechatronic functions of automated control of systems. » EL104 SLO4 - Work effectively, individually, and as a member of a group in performing laboratory assignments.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Assessments

Fall 2016

Assessment

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL104 SLO1 - Demonstrate an understanding of fundamental robotic and mechatronic characteristics, systems, and concepts.	0 of 14	0%	0%	0%	0
EL104 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to design and evaluate mechatronic systems.	13 of 14	0%	100%	0%	1
EL104 SLO3 - Produce programs to perform mechatronic functions of automated control of systems.	0 of 14	0%	0%	0%	0
EL104 SLO4 - Work effectively, individually, and as a member of a group in performing laboratory assignments.	0 of 14	0%	0%	0%	0

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL104 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL104 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL105 - PC Care and Upgrade

SLOs

CSLOs	» EL105 SLO1 - Identify, remove, install, and configure all major components that comprise a personal computer system. » EL105 SLO2 - Perform preventative maintenance procedures (hardware and software) to personal computer systems. » EL105 SLO3 - Perform basic operating system and hardware configurations.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL105 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL105 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL106 - Networking Essentials 1

SLOs

CSLOs	» EL106 SLO1 - Demonstrate an understanding of personal computer and networking devices. » EL106 SLO2 - Demonstrate an understanding of fundamental networking concepts and basic troubleshooting methodology. » EL106 SLO3 - Construct several common networking cables following EIA/TIA 568B standards. » EL106 SLO4 - Design and construct a peer-to-peer and basic switched network.
Mapped PSLOs	**Electronics Program Outcomes** Electronics Program Outcomes » EL PSLO - Demonstrate understanding of how computers communicate with each other and the methods employed to ensure that the communications is reliable.
Mapped ILOs	**ILO** ILO 4 - Information & Technology Literacy » ILO 4A - Information Literacy: Define what information is needed to solve a real-life issue and locate, access, evaluate and manage the information. ILO 2 - Critical Thinking & Problem Solving » ILO 2 - Critical Thinking & Problem Solving: Explore issues through various information sources; evaluate the credibility and significance of both the information and the source to arrive at a reasoned conclusion.

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL106 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL106 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL107 - Networking Essentials 2

SLOs

CSLOs	» EL107 SLO1 - Demonstrate an understanding of network router components. » EL107 SLO2 - Demonstrate an understanding of fundamental router configuration and troubleshooting. » EL107 SLO3 - Evaluate and explain basic routing protocols. » EL107 SLO4 - Explain and apply basic router access lists for security and flow control.
Mapped PSLOs	**Electronics Program Outcomes** Electronics Program Outcomes » EL PSLO - Demonstrate understanding of how computers communicate with each other and the methods employed to ensure that the communications is reliable. » EL PSLO - Modify operating parameters of infrastructure network devices to meet network requirements.
Mapped ILOs	**ILO** ILO 4 - Information & Technology Literacy » ILO 4A - Information Literacy: Define what information is needed to solve a real-life issue and locate, access, evaluate and manage the information. ILO 2 - Critical Thinking & Problem Solving » ILO 2 - Critical Thinking & Problem Solving: Explore issues through various information sources; evaluate the credibility and significance of both the information and the source to arrive at a reasoned conclusion.

Assessments

Fall 2016

EL107 SLO1 - Demonstrate an understanding of network router components.

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL107 SLO1 - Demonstrate an understanding of network router components.	10 of 12	20%	70%	10%	2

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL107 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL107 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL108 - Networking Essentials 3

SLOs

CSLOs	» EL108 SLO1 - Demonstrate an understanding of IPX networking. » EL108 SLO2 - Demonstrate an understanding of fundamental LAN topologies with emphasis on Ethernet. » EL108 SLO3 - Explain basic network switching and switch configuration including VLAN networks.

Mapped PSLOs	**Electronics Program Outcomes** Electronics Program Outcomes » EL PSLO - Demonstrate understanding of how computers communicate with each other and the methods employed to ensure that the communications is reliable. » EL PSLO - Modify operating parameters of infrastructure network devices to meet network requirements.
Mapped ILOs	**ILO** ILO 4 - Information & Technology Literacy » ILO 4A - Information Literacy: Define what information is needed to solve a real-life issue and locate, access, evaluate and manage the information.

Assessments

Spring 2017

EL108 SLO3 - Explain basic networking switching and switch configuration including VLAN networks.

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL108 SLO3 - Explain basic network switching and switch configuration including VLAN networks.	8 of 8	0%	87.5%	12.5%	0

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL108 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL108 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Any other comments?	No action type		No Action Taken		

EL109 - Networking Essentials 4

SLOs

CSLOs	» EL109 SLO1 - Demonstrate an understanding of WAN Technologies. » EL109 SLO2 - Explain the fundamental concept of a point-to-point link and the supporting protocols. » EL109 SLO3 - Explain the fundamental concept of an ISDN link and the supporting protocols.
Mapped PSLOs	**Electronics Program Outcomes** Electronics Program Outcomes » EL PSLO - Demonstrate understanding of how computers communicate with each other and the methods employed to ensure that the communications is reliable.
Mapped ILOs	**ILO** ILO 4 - Information & Technology Literacy » ILO 4A - Information Literacy: Define what information is needed to solve a real-life issue and locate, access, evaluate and manage the information. » ILO 4B - Technology Literacy: Proficiency in a technology and the ability to choose the appropriate tools.

Assessments

Spring 2017

EL109 SLO1 - Demonstrate an understanding of WAN Technologies.

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL109 SLO1 - Demonstrate an understanding of WAN Technologies.	8 of 8	0%	87.5%	12.5%	0

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL109 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL109 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL118 - Fundamentals of Circuit Analysis

SLOs

CSLOs	» EL118 SLO1 - Demonstrate an understanding of fundamental electronic concepts that pertain to direct and alternating current electronics. » EL118 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to technical problem solving and troubleshooting methodology. » EL118 SLO3 - Recognize common electric components, waveforms, and electronic measuring instruments.
Mapped PSLOs	**Electronics Program Outcomes** Electronics Program Outcomes » EL PSLO - Demonstrate a fundamental mastery of knowledge and the useof electronic equipment in electrical, digital and analog circuits. » EL PSLO - Make calculations involving various electrical laws, formulasand principles for predicting circuit parameters using algebraand trigonometry required for electronics.
Mapped ILOs	**ILO** ILO 4 - Information & Technology Literacy » ILO 4A - Information Literacy: Define what information is needed to solve a real-life issue and locate, access, evaluate and manage the information. » ILO 4B - Technology Literacy: Proficiency in a technology and the ability to choose the appropriate tools. ILO 2 - Critical Thinking & Problem Solving » ILO 2 - Critical Thinking & Problem Solving: Explore issues through various information sources; evaluate the credibility and significance of both the information and the source to arrive at a reasoned conclusion.

Assessments

Fall 2016

Understand fundamental Electronic Concepts

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL118 SLO1 - Demonstrate an understanding of fundamental electronic concepts that pertain to direct and alternating current electronics.	12 of 12	33.33%	50%	16.67%	0
EL118 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to technical problem solving and troubleshooting methodology.	12 of 12	41.67%	41.67%	16.67%	0
EL118 SLO3 - Recognize common electric components, waveforms, and electronic measuring instruments.	12 of 12	41.67%	41.67%	16.67%	0

Final Exam

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL118 SLO1 - Demonstrate an understanding of fundamental electronic concepts that pertain to direct and alternating current electronics.	11 of 12	54.55%	36.36%	9.09%	1
EL118 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to technical problem solving and troubleshooting methodology.	11 of 12	54.55%	36.36%	9.09%	1
EL118 SLO3 - Recognize common electric components, waveforms, and electronic measuring instruments.	11 of 12	45.45%	45.45%	9.09%	1

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL118 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL118 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL119 - Fund of DC and AC Circuits Lab

SLOs

CSLOs	» EL119 SLO1 - Demonstrate basic safety procedures. » EL119 SLO2 - Correctly measure and interpret DC and AC circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology. » EL119 SLO3 - Design and construct standard DC circuits.
Mapped PSLOs	**Electronics Program Outcomes** Electronics Program Outcomes » EL PSLO - Demonstrate a fundamental mastery of knowledge and the use of electronic equipment in electrical, digital and analog circuits.
Mapped ILOs	**ILO** ILO 4 - Information & Technology Literacy » ILO 4A - Information Literacy: Define what information is needed to solve a real-life issue and locate, access, evaluate and manage the information. » ILO 4B - Technology Literacy: Proficiency in a technology and the ability to choose the appropriate tools. ILO 2 - Critical Thinking & Problem Solving » ILO 2 - Critical Thinking & Problem Solving: Explore issues through various information sources; evaluate the credibility and significance of both the information and the source to arrive at a reasoned conclusion.

Assessments

Fall 2016

slo2

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL119 SLO2 - Correctly measure and interpret DC and AC circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology.	12 of 12	0%	100%	0%	0

labs

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL119 SLO1 - Demonstrate basic safety procedures.	12 of 12	0%	100%	0%	0
EL119 SLO2 - Correctly measure and interpret DC and AC circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology.	12 of 12	0%	100%	0%	0
EL119 SLO3 - Design and construct standard DC circuits.	12 of 12	0%	100%	0%	0

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL119 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL119 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL122 - Electronic Devices & Circuits

SLOs

CSLOs	» EL122 SLO1 - Demonstrate an understanding of fundamental analog and digital circuit and device concepts. » EL122 SLO2 - Recognize common electric components and electronic measuring instruments. » EL122 SLO3 - Apply basic mathematical, scientific, electronic and engineering concepts to technical problem solving and troubleshooting methodology.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL122 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL122 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL123 - Electronic Devices & Circ Lab

SLOs

CSLOs	» EL123 SLO1 - Design and construct standard electronic circuits. » EL123 SLO2 - Correctly measure and interpret electronic circuit measurements using standard semiconductor testing instruments and correct malfunctions using troubleshooting methodologies. » EL123 SLO3 - Apply basic mathematical, scientific, electronic, and engineering concepts to solve technical problems. » EL123 SLO4 - Recognize common electronic components, pin identification, and interpret manufactures data sheets.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL123 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL123 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL125 - Digital Devices & Circuits

SLOs

CSLOs	» EL125 SLO1 - Apply basic mathematical, scientific, electronic, and engineering concepts to evaluate digital systems. » EL125 SLO2 - Demonstrate knowledge of technology applicable to the field of digital systems, and show a proficiency in appropriate software used in digital design. » EL125 SLO3 - Analyze logic systems to determine their operating parameters for facilitating troubleshooting methodology.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Assessments

Spring 2017

test

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL125 SLO1 - Apply basic mathematical, scientific, electronic, and engineering concepts to evaluate digital systems.	11 of 11	100%	0%	0%	0

EL126 - Digital Devices & Circuits Lab

SLOs

CSLOs	» EL126 SLO1 - Design, construct, and test standard digital logic circuits for proper operating parameters. » EL126 SLO2 - Correctly measure and interpret digital logic circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology. » EL126 SLO3 - Demonstrate knowledge of technology applicable to the field of digital systems, and show a proficiency in appropriate software used in digital design.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Assessments

Spring 2017

experiments

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL126 SLO1 - Design, construct, and test standard digital logic circuits for proper operating parameters.	11 of 11	63.64%	36.36%	0%	0

EL320 - A+ Certification

SLOs

CSLOs	» EL320 SLO1 - Demonstrate the understanding of basic computer maintenance concepts and procedures required for A+ certification. » EL320 SLO2 -Troubleshoot computer and network hardware and operating systems.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Assessments

Fall 2016

PC Pro Certification Exam (Class Final Exam)

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL320 SLO2 -Troubleshoot computer and network hardware and operating systems.	8 of 10	75%	0%	25%	2

Spring 2017

PC Pro Certification Exam (Class Final Exam)

SLO	Scored	Institutional Exceeds Standards	Institutional Meets	Institutional Below	N/A
EL320 SLO2 -Troubleshoot computer and network hardware and operating systems.	11 of 11	81.82%	0%	18.18%	0

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL320 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL320 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

EL370 - SkillsUSA

SLOs

CSLOs	» EL370 SLO1 - Gather data, research, evaluate, and use appropriate information to plan and complete a multi-faceted project. » EL370 SLO2 - Enlist community support for educational projects. » EL370 SLO3 - Assume responsibility for meeting deadlines, maintaining budgets and completing projects. » EL370 SLO4 - Evaluate contest preparations for completeness, clarity, and presentation.
Mapped PSLOs	(None)
Mapped ILOs	(None)

Action Plans

Fall 2016

Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL370 - Fall 2016					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		
What changes have you made/do you plan to make based on the data? What resources would you need, if any, to make these changes?	No action type		No Action Taken		

Spring 2017

2017 Course Improvement Plan

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
Allan Hancock College >> Electronics >> EL370 - Spring 2017					
What did the assessment data indicate about the strengths of your course?	No action type		No Action Taken		
What did the assessment data indicate about the weaknesses of your course?	No action type		No Action Taken		

Expected Action	Action Type	Respondent	Action Taken	Date	Resource Request
What changes have you made/do you plan to make based on the data?	No action type		No Action Taken		
What resources are required to make these changes or to maintain your progress?	No action type		No Action Taken		
Any other comments?	No action type		No Action Taken		

Electronics Curriculum Agreements

Articulation Agreement by Department
Effective during the 16-17 Academic Year

To: **Cal Poly San Luis Obispo**			From: **Allan Hancock College**		
15-17 General Catalog	Quarter		16-17 General Catalog	Semester	
		====Electronics====			
IT 137	Electrical/Electronic Systems	(4)	EL 118 **&**	Fund of DC and AC Circuits	(3)
			EL 119	Fund of AC and DC Circuits Lab	(2)

END OF DEPARTMENT

Articulation Agreement by Department
Effective during the 16-17 Academic Year

To: **CSU Fresno**			From: **Allan Hancock College**		
16-17 General Catalog	Semester		16-17 General Catalog	Semester	
====Electronics====					
IT 52 Electricity and Electronics	(3)		EL 118 & Fund of DC and AC Circuits	(3)	
Same as: MEAG 53			EL 119 & Fund of AC and DC Circuits Lab	(2)	
OR					
MEAG 53 Electricity and Electronics	(3)		EL 122 & Electronic Devices and Circuits	(3)	
Same as: IT 52			EL 123 Electronic Devices and Circuits Lab	(2)	

END OF DEPARTMENT

Articulation Agreement by Department
Effective during the 16-17 Academic Year

To: **CSU Sacramento**		From: **Allan Hancock College**	
16-17 General Catalog	Semester	16-17 General Catalog	Semester

====Electronics====

CPE 64	INTRO TO LOGIC DESIGN	(4)	EL 125	Digital Devices and Circuits (3)
Same as: EEE 64			**AND**	
			EL 126	Digital Devices and Circuits Lab (2)

END OF DEPARTMENT

The above Major Preparation Agreement is subject to periodic change and revision. Please check with a counselor every semester to obtain current information about possible changes in the articulated courses.

Articulation Agreement by Department
Effective during the 16-17 Academic Year

To: **Cal Poly Pomona** 16-18 General Catalog	Quarter	From: **Allan Hancock College** 16-17 General Catalog	Semester
====Electronics====			
ETE 102 & D-C Circuit Analysis	(3)	EL 118 & Fund of DC and AC Circuits	(3)
ETE 102L & D-C Circuit Analysis Lab	(1)		
ETE 103 & A-C Circuit Analysis	(3)	EL 119 Fund of AC and DC Circuits Lab	(2)
ETE 103L A-C Circuit Analysis Lab	(1)		
ETE 204 & Semiconductor Devices and Circuits	(3)	EL 122 & Electronic Devices and Circuits	(3)
ETE 204L Semiconductor Devices and Circuits Lab	(1)	EL 123 Electronic Devices and Circuits Lab	(2)
ETE 230 Introduction to Digital Logic	(3)	EL 125 Digital Devices and Circuits	(3)
ETE 230L Introduction to Digital Logic Lab	(1)	EL 126 Digital Devices and Circuits Lab	(2)
ETE 272 & Electronic Manufacturing, PCB Fabrication	(3)	EL 146 Electronic Product Design, Fabrication and Documentation	(2)
ETE 272L Electronic Manufacturing, PCB Fabrication Laboratory	(1)		

END OF DEPARTMENT

Review of
COURSE REVIEW VERIFICATION

Discipline: **Electronics Technology** Year: **2018**

As part of the program evaluation process, the self-study team has reviewed the course outlines supporting the discipline/program curriculum. The review process has resulted in the following recommendations:

1. The following course outlines are satisfactory as written and do not require modification (list all such courses):
   All EL Courses with the exceptions listed below

2. The following courses require minor modification to ensure currency. The self-study team anticipates submitting such modifications to the AP&P, FALL 20____ SPRING 20____:
   None

3. The following courses require major modification. The self-study team anticipates submitting such modifications to the AP&P committee, FALL 2018 SPRING 20____:
   EL 105, EL 146 and EL 333

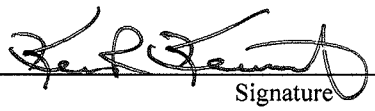
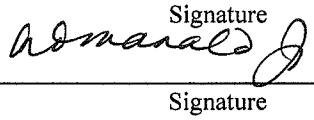
GRADUATION REQUIREMENTS: General Education (GE), Multicultural/Gender Studies (MCGS) and Health & Safety (H&W) Courses.

The following courses were reviewed as meeting an **AHC GE** requirement. The AP&P GE Criteria and Category Definitions (GE Learning Outcomes) forms were submitted to the AP&P for review on: _____

The following courses were reviewed as meeting the **MCGS** requirement. The AP&P MCGS Criteria and Category Definitions (MCGS Learning Outcomes – To Be Developed) forms were submitted to the AP&P for review on: _____

The following courses were reviewed as meeting the **H&W** requirement. The AP&P H&W Studies Criteria (To Be Developed) and Category Definitions (H&W Learning Outcomes – To Be Developed) forms were submitted to the AP&P chair for review on:
_____

Course Review Team Members:

Name	Signature	Date
Kevin Keinert		8/30/18
Larry Manalo AP&P Chair		9/4/2018
Margaret Lau Academic Dean		9/4/18

COURSE REVIEW VERIFICATION (CROSS LISTED)

The table below contains several cross-listed EL courses

Course Prefix No	Title	Cross Listed
EL 104	Intro to Robotics & Mechatronics	CEL 104, ET 104
EL 105	Pc Preventative Maintenance and Upgrading	CS 105
EL 106	Network Essentials 1	CS 106
EL 107	Network Essentials 2	CS 107
EL 108	Networking Essentials 3	CS 108
EL 109	Network Essentials 1	CS 109
EL 118	Fundamentals of DC and AC Circuit Analysis	
EL 119	Fundamentals of DC and AC Circuit Analysis Lab	
EL 122	Electronic Devices & Circuits	
EL 123	Electronic Devices & Circuits Lab	
EL 125	Digital Devices & Circuits	
EL 126	Digital Devices & Circuits Lab	
EL 128	Renewable Energy	ET 128, CEL 128
EL 131	PLCs & Industrial Control Design	CEL 131, ET 131
EL 133	Mechatronic Systems 1	
EL 135	Electronic Measurement and Instrument	
EL 136	Electronic Measurement and Instrument Lab	
EL 139	Electrical Power, Motors, and Controls	CEL 139, ET 139
EL 146	Electronic Product Design/Fabrication	
EL 162	Fluid Power & Control	CEL 162, ET 162
EL 179, 379	Experimental Courses in Electronics	
EL 189	Independent Projects in Electronics	
EL 399	Special Topics in Electronics	
EL 320	A+ Certification	CS 320
EL 332	Wireless Network Administrator	CS 332
EL 333	Intro to Network Security	
EL 370	SkillsUSA	ARCH 370, AB 370, AT 370, ET 370, MT 370, WLDT 370

APPENDICES

COURSE OUTLINES
(ACTIVE)

Board Approval: 05/16/2006
PCA Established: 05/16/2006
DL Conversion:
Date Reviewed: Fall 2017
Catalog Year: 2018/2019

Allan Hancock College
Course Outline

Discpline Placement: Electronics -1
Department: Industrial Technology
Prefix and Number: EL 104
Catalog Course Title: Introduction to Robotics and Mechatronics
Banner Course Title: Intro to Robotics & Mechatronics

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

None

Entrance Skills

None

Catalog Description

An introduction to robotic control applications. Basic electronics including digital, analog, and microcontroller devices, sensors and transducers, and actuators will be emphasized for automation control. Topics include Basic, Assembly and C language programming for robotic control; interfacing of indicators, switches, sensors and transducers; controlling motion and motors; monitoring and measurement of rotation; measuring light, temperature and conductance; application of navigation and measurement techniques; remote control applications; mechanical systems; and the control of frequency and sound. This course is not open to students who are enrolled in or have received credit for CEL 104 or ET 104.

Course Content

Lecture

1. Introduction to the BASIC Stamp2 and 68HC11 Microcontollers
2. Introduction to PBasic, Assembly, and C language Programming
3. Basic Electronics for interfacing analog and digital devices with signal conditioning
4. Introductory elements to Motors and Controls
5. Introductory elements for Applied Sensors
6. Introductory elements of Industrial Controls
7. Introductory Remote Control applications for automation and robotics

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Course Objectives

At the end of the course, the student will be able to:

1. explain the concept and characteristics of a signal source.
2. select and configure proper circuits to achieve desired interfacing requirements between a signal source and a downstream device such as a microcontroller or data acquisition system.
3. explain the practical limitations of operational amplifiers and estimate the effects of these limitations on output voltage and current of the op-amp.

4. design and analyze the performance of RC low-pass and high-pass filter circuits.
5. explain the basic operation of bipolar and MOS field-effect transistors and design with them to activate solenoids, relays, motors, etc. from signal sources.
6. explain the input/output characteristics of digital logic devices and design a logic circuit that accomplishes a given task.
7. explain the underlying operational principles of servo motors.
8. determine the torque and speed requirements for a given motion control application considering system inertia, external forces or torques, and motion profiles and select an appropriate motor.
9. explain the basic structure of the BASIC Stamp2 and 68HC11 microcontrollers.
10. write PBASIC, Assembly, and C language programs to successfully perform digital input and output functions from a microcontroller port.
11. explain the common analog-to-digital-conversion (A/D) methods.
12. develop a program to successfully perform A/D conversion using the BASIC Stamp2 and 68HC11 microcontrollers.
13. explain the digital-to-analog (DAC) conversion process.
14. write programs to successfully interface analog and digital devices, such as sensors and actuators, to the BASIC Stamp2 and 68HC11 microcontrollers.
15. function effectively, as a team member, in carrying out laboratory assignments and open-ended project.
16. document, in written form, laboratory experiments and projects clearly and completely.

Methods of Instruction

- **Demonstration**
- **Lab**
- **Lecture**

Outside Assignments

- **Other Assignments**

  Cooperative learning group projects; presentations; short papers; research; and the following:

  1. readings from adopted text and instructor handouts; evaluate sample problems and work end of chapter problems.
  2. use computer applications to expand upon circuit analysis and comprehension.
  3. use the Internet, as an information resource, to support topics studied in this course.

4. online practice quizzes and take-home exams covering assigned and related topics.
5. design projects assigned stressing application of learned concepts and theories.

Sample writing assignments:
1. Explain the principle of electromagnetic induction.
2. Compile a list of different types of electric motors found in household devices and automobiles. Describe the reasons why you think the particular type of motor is used for each example listed.
3. Explain how to use a FOR...NEXT loop with an ON...GOSUB command to cycle through a list of subroutines.
3. When should you test subsystems individually before trying to make them work as a system? Why?

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Papers**
- **Projects**
- **Group Projects**
- **Lab Activities**
- **Other**

1. Comprehensive written examinations for each major study area. Exams will include problem solving techniques and word type problems. The exams will be graded for accuracy and techniques used for problem solutions.
2. End of chapter problems are assigned as homework and graded for accuracy.
3. Design group projects, presentations, and short papers are assigned and graded for quality of research, techniques applied and presented, and for proper engineering practices.
4. Comprehensive final exam. Exam graded for accuracy and applied techniques.
5. Laboratory reports are graded for accuracy and content. Reports consist of:
a. text study information
b. mathematical evaluations of each experimental circuit studied
c. component diagrams for each circuit
d. design problem solutions
e. procedures and data collection
f. end of experiment questions and conclusion

Sample essay questions:
1. For the field of electronics, explain the interrelationships of the following circuit

parameters: charge, potential difference, current, resistance, and power.
2. Explain how you access a particular element in a variable array?
3. Explain what you can do to increase or decrease the current passing through a transistor and power MOSFET devices.

Adopted Texts and Other Instructional Materials

Textbooks

1. Gilliland *The Microcontroller Applications Cookbook* 2000 -

Other Texts

1. D. Alciatore. Introduction to Mechatronics and Measurement Systems. 4th ed. McGraw Hill. 2011
2. W. Bolton. Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering, 6th ed. Prentice Hall. 2016
3. J. Rehg. Industrial Electronics. Prentice Hall. 2006
4. P. Spasov. Microcontroller Technology The 68HC11 and 68HC12. 2004, Prentice Hall
5. C. Kuhnel. Basic Stamp. 2nd ed. Newnes. 2000
6. E. Wise. Applied Robotics II. Prompt. 2002
7. S. Yalamanchili. VHDL A Starter's Guide. 2nd ed. Prentice Hall. 2005

Instructional Materials

1. User's manuals for software tools
2. Manufacturer's reference and data manuals
3. Learning management system website for tutorials and supplements
4. Microcontroller Development Boards (supplied by instructor)
5. Programmable Logic Device Prototyping Boards (Xilinx and Altera)
6. Software Design Tools (supplied by instructor)
7. Scientific Calculator
8. Graph paper and normal school supplies
9. Instructor handouts
10. Data Storage Device (Thumb Drive)

Student Learning Outcomes

1. EL104 SLO1 - Demonstrate an understanding of fundamental robotic and mechatronic characteristics, systems, and concepts.
2. EL104 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to design and evaluate mechatronic systems.
3. EL104 SLO3 - Produce programs to perform mechatronic functions of automated control of systems.
4. EL104 SLO4 - Work effectively, individually, and as a member of a group in performing laboratory assignments.

Distance Learning

This course is not Distance Learning.

Generated on: 11/22/2017 4:09:59 PM

Board Approval: 04/16/1996
PCA Established:
DL Conversion: 05/13/2003
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 105
Catalog Course Title: PC Preventive Maintenance and Upgrading
Banner Course Title: PC Care And Upgrade

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

None

Entrance Skills

None

Catalog Description

Necessary skills and information needed to make an informed purchase, maintain, upgrade, and evaluate personal computer systems. The student will receive hands-on instruction for performing basic preventive maintenance and the installation of simple upgrades such as adding RAM, installing hard drives, sound cards, etc. Included is the study of soldering techniques, electronic part identification, and safety and system operation. Emphasis will be placed on the student's ability to keep personal computers running at their best performance levels.

Course Content

Lecture

1. Basic Skills
    a. safety
    b. hand tool usage
    c. component identification
    d. soldering desoldering techniques
2. Operating Systems
    a. using floppy disks
    b. files
    c. editors
    d. utilities
3. Preventive Maintenance
    a. system teardown and assembly
    b. power supplies, drives, printers
    c. monitors
4. Subsystem Replacements
    a. RAM
    b. Drives
    c. Upgrades, including CD-ROM and modems
5. Performance Tests and Failure Recovery

Course Objectives

At the end of the course, the student will be able to:

1. identify the major components found in a personal computer.
2. perform common preventive maintenance procedures to extend the life of a personal computer.
3. correctly remove and reinsert IC's (RAM) in a personal computer.
4. solder and desolder electronic components and wire from printed circuit boards.
5. create an CONFIG.SYS and AUTOEXEC.BAT files that will properly startup a PC.
6. install and set-up both hard and floppy disk drives.

7. determine if the hard drive has been set-up for the most efficient system operation.
8. backup and restore data on a hard disk drive.
9. configure the system parameters and store the information in CMOS memory.
10. configure a video display for different screen resolutions and displayed colors.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Sample Assignment(s)**
  Example: From laboratory written report
  Referring to computer switching power supplies, explain and indicate how the following terms are related: current, voltage, and power.
- **Outside Assignments**
  1. Readings from adopted text and instructor handouts, evaluate sample problems and work end of chapter problems.
  2. Study and perform laboratory experiments.
  3. Prepare laboratory written reports.
  4. Participate in post-lab evaluation discussions.

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Home Work**
- **Lab Activities**
- **Other**
  1. Written and performance-based examinations for each major study area. These examinations are graded for accuracy.
  2. Assigned homework problems will be graded for accuracy.
  3. Laboratory reports are graded for accuracy and content.
  4. A final laboratory examination evaluating the student's abilities to correctly perform preventive maintenance on a computer system will be administered. A comprehensive written final examination will also be graded for accuracy and applied techniques.

  Example: Explain how to reduce the effects of EMI (RFI) on your computer.

Adopted Texts and Other Instructional Materials

Textbooks

1. Meyers, Mike *CompTIA A+ Guide to Managing and Troubleshooting PCs* Edition: 4th 2012

Other Texts

1. Data storage device (USB)
2. Graph paper/school supplies
3. Scientific calculator
4. 3-ring binder
5. Richard Stanley, Data Communications and Networks, Heath Company.
6. Roger Kersey, Personal Computer Operation and Troubleshooting, Prentice Hall.

Instructional Materials
None

Student Learning Outcomes

1. EL105 SLO1 - Identify, remove, install, and configure all major components that comprise a personal computer system.
2. EL105 SLO2 - Perform preventative maintenance procedures (hardware and software) to personal computer systems.
3. EL105 SLO3 - Perform basic operating system and hardware configurations.

Distance Learning

This course is not Distance Learning.

Generated on: 4/16/2018 9:38:42 AM

Board Approval: 04/20/1999
PCA Established:
DL Conversion:
Date Reviewed: Spring 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 106
Catalog Course Title: Networking Essentials 1
Banner Course Title: Networking Essentials 1

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade or Pass/No Pass

Requisites

Advisories
EL 105 PC Preventive Maintenance and Upgrading
and

Advisories
EL 125 Digital Devices and Circuits

Entrance Skills

Upon entering this course, the student should be able to:

EL 105 - PC Preventive Maintenance and Upgrading

- identify the major components found in a personal computer.
- perform common preventive maintenance procedures to extend the life of a personal computer.
- correctly remove and reinsert IC's (RAM) in a personal computer.
- solder and desolder electronic components and wire from printed circuit boards.
- create an CONFIG.SYS and AUTOEXEC.BAT files that will properly startup a PC.
- install and set-up both hard and floppy disk drives.

- determine if the hard drive has been set-up for the most efficient system operation.
- backup and restore data on a hard disk drive.
- configure the system parameters and store the information in CMOS memory.
- configure a video display for different screen resolutions and displayed colors.

EL 125 - Digital Devices and Circuits

- model digital circuits using Boolean algebra.
- derive an equivalent logic circuit from a Boolean expression.
- design and analyze counters, registers, and dividers using bi-stable devices.
- properly interface logic families that have different operational parameters.
- design logic systems for a stated problem using standard engineering practices.
- analyze logic systems to determine their operating parameters.

Catalog Description

First course in a series designed to provide students with knowledge of and laboratory experiences with current and emerging computer networking technology. Focus will be on LANs, WANs, OSI models, IP addressing, cabling, CompTIA Network+, and network standards; the theory behind the various kinds of network architectures and data transmission methods, and the use of decision-making and problem-solving techniques in applying science, mathematics, and communication concepts to solve networking problems. Instruction and training are provided in the proper care, maintenance, and use of networking software, tools, and equipment. Emphasis will be placed on the Cisco System Certification. Not open to students who have received credit for CEL 106.

Course Content

Lecture

1. PC Hardware and Software; Journal; Networking: Layered Communications
2. The OSI Model; Encapsulation; Layer 1
3. IP Addressing
4. ARP and RARP (Address Resolution Protocol)
5. Cabling Media and Design with Labs
6. Network Topology
7. Structured Cabling with Labs
8. Electronics
9. Network Management and Trouble Shooting

Course Objectives

At the end of the course, the student will be able to:

1. explain the basic electrical and electronic devices used in a PC and networking environment.
2. identify and explain the basic operation of PC hardware.
3. explain the concept of networking.
4. explain and identify the OSI model.
5. explain and identify IP addressing.
6. describe the function of routers, switches, and hubs.
7. demonstrate the processes of laying and terminating networking media.
8. design and install a local area network.
9. describe various troubleshooting tools and techniques of LAN maintenance.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Other Assignments**
  1. Read 15 online study units and take end of unit exams from Cisco Systems courseware (requires Internet connection from laboratory stations for taking online exams).
  2. Readings from adopted text and instructor handouts, evaluate sample problems and work end of chapter problems.
  3. Study laboratory experiments.
  4. Prepare laboratory written reports.
  5. Participate in post-lab evaluation discussions.
  6. Quizzes and exams covering assigned and related topics.

  Writing Assignment Example: As a network administrator for a growing firm, you want to design your network to run efficiently now and in the future. Currently, you are planning to implement a server-based Windows NT network. Although you currently support only 20 users on one floor of one building, management is rumored to be planning an acquisition, which would effectively double your method or network size. Highlight your current and future requirements, and choose the protocol(s) and channel access method best-suited to this situation. Then, explain why you chose those protocols and access methods.

Methods of Evaluation

1. Exam reports for each study unit from Cisco Systems.
2. Written and performance based examinations for each major study area. Examinations will include problem-solving techniques and word-type problems. Examinations are graded for accuracy.
3. Class project will be graded for accuracy, content, and applied techniques.
4. Assigned homework problems will be graded for accuracy.
5. Laboratory reports are graded for accuracy and content.
6. A comprehensive written final examination will be administered and graded for accuracy and applied techniques as well as a laboratory examination evaluating the student's abilities in applying networking concepts.

Sample Essay Question: Your network consists of two buildings with computers on all three floors in both buildings. The buildings are connected by fiber-optic cable, with each of the floors wired with Cat 5 cabling. Your SNMP manager notifies you that no networking components are responding from the outer building. In addition to an SNMP manager, you have a Network General Sniffer and a cable tester at your disposal.

Adopted Texts and Other Instructional Materials

Textbooks

1. Cisco Press *Introduction to Networks Companion Guide* Edition: 1 2014

Other Texts

1. USB Storage Device
2. Graph paper and normal school supplies
3. Scientific Calculator
4. Three-Ring Binder
5. Jenkins, N. Understanding Local Area Networks, SAMS.
6. Derfler, F. Get a Grip on Network Cabling, ZD Press.
7. Lewis, C. Cisco TCP/IP Routing Professional Reference, McGraw Hill.
8. Palmer, M. Hands-On Microsoft Windows NT Server with Projects, Course Technology.

Instructional Materials
None

Student Learning Outcomes

1. EL106 SLO1 - Demonstrate an understanding of personal computer and networking devices.
2. EL106 SLO2 - Demonstrate an understanding of fundamental networking concepts and basic troubleshooting methodology.
3. EL106 SLO3 - Construct several common networking cables following EIA/TIA 568B standards.
4. EL106 SLO4 - Design and construct a peer-to-peer and basic switched network.

Distance Learning

This course is not Distance Learning.

Generated on: 6/21/2018 5:30:18 PM

Board Approval: 04/20/1999
PCA Established: 04/20/1999
DL Conversion:
Date Reviewed: Spring 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics [Cisco certification]
Department: Industrial Technology
Prefix and Number: EL 107
Catalog Course Title: Networking Essentials 2
Banner Course Title: Networking Essentials 2

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade or Pass/No Pass

Requisites

Prerequisite
EL 106 Networking Essentials 1

Entrance Skills

Upon entering this course, the student should be able to:

EL 106 - Networking Essentials 1

- explain the basic electrical and electronic devices used in a PC and networking environment.
- identify and explain the basic operation of PC hardware.
- explain the concept of networking.
- explain and identify the OSI model.
- explain and identify IP addressing.
- describe the function of routers, switches, and hubs.
- demonstrate the processes of laying and terminating networking media.
- design and install a local area network.
- describe various troubleshooting tools and techniques of LAN maintenance.

Catalog Description

Second course in a series designed to provide students with knowledge of and laboratory experiences with current and emerging computer networking technology. Focus will be on LANs, WANs, OSI models, IP addressing and router programming; and the theory behind the various kinds of network architectures and data transmission methods including network troubleshooting. Emphasis will be placed on the Cisco System Certification. This course is not open to students who have received credit for CS 107.

Course Content

Lecture

1. The OSI Model; Layers 1,2,3,4,5,6, and 7; WANs
2. Routing concepts and routing using routers and *CIM tools (Labs)
3. Router Components
4. Router Startup, setup, and router configuration (Labs)
5. IOS
6. TCP/IP and IP addressing (Labs)
7. Routing Protocols (Labs)
8. Course Review and Practice for Final Exam and Laboratory

*CIM - Lab simulations using the Cisco Interactive Mentor (CIM) tool.

Course Objectives

At the end of the course, the student will be able to:

1. examine router elements (RAM, ROM, CDP, show).
2. define flow control and describe the three basic methods used in networking.
3. identify the functions of the TCP/IP transport-layer protocols.
4. control router passwords,identification, and banner.
5. check an initial configuration using the setup command.
6. configure and use telnet applications for accessing routers.
7. use ping and trace programs to troubleshoot network problems.
8. log into a router in both user and privileged modes.
9. load Cisco IOS software from: flash memory, a TFTP server, or ROM.
10. list problems that each routing type encounters when dealing with topology changes, and describe techniques to reduce the number of these problems.
11. configure IP addresses.
12. prepare the initial configuration of a router and enable IP.
13. add RIP and IGRP routing protocol to the configuration.
14. configure extended access lists to filter IP traffic.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Outside Assignments**
  1. Read online study units and take end of unit exams from Cisco Systems courseware (requires Internet connection from laboratory stations for taking online exams).
  2. Readings from adopted text and instructor handouts, evaluate sample problems and work end of chapter problems.
  3. Study laboratory experiments.
  4. Prepare laboratory written reports.
  5. Participate in post-lab evaluation discussions.
  6. Quizzes and Exams covering assigned and related topics.
- **Sample Assignment(s)**
  Sample Writing Assignment: Allan Hancock College is planning to add a new client/server system (with new hardware), so that all of the department chairs and administrators and administrative assistants (total of 134 clients) can view the status of their budgets. How would you plan for the resulting impact on the network?

Methods of Evaluation

1. Exam reports for each study unit from Cisco Systems.
2. Written and performance based examinations for each major study area. Examinations will include problem solving techniques and word type problems. Examinations are graded for accuracy.
3. Class project will be graded for accuracy, content, and applied techniques.
4. Assigned homework problems will be graded for accuracy.
5. Laboratory reports are graded for accuracy and content.
6. A comprehensive written final examination will be administered and graded for accuracy and applied techniques as well as a laboratory examination evaluating the student's abilities in applying networking concepts.

Sample Essay Question: What is capacity planning? Why is it important for a network manager to perform capacity planning?

Adopted Texts and Other Instructional Materials

Textbooks

1. Cisco Press *Routing and Switching Essentials Companion Guide* Edition: 1 2014

Other Texts

1. USB Storage Device
2. Graph paper and normal school supplies
3. Scientific Calculator
4. Three-Ring Binder
5. Jenkins, N. Understanding Local Area Networks
6. Tittlel, E. A Guide to Networking Essentials, Course Technology.
7. Palmer, M. A Guide to Microsoft Windows NT Server,Course Technology.
8. Palmer, M. Hands-On Microsoft Windows NT Server with Projects, Course Technology.

Instructional Materials
None

Student Learning Outcomes

1. EL107 SLO1 - Demonstrate an understanding of network router components.
2. EL107 SLO2 -Demonstrate an understanding of fundamental router configuration and troubleshooting.
3. EL107 SLO3 -Evaluate and explain basic routing protocols.
4. EL107 SLO4 -Explain and apply basic router access lists for security and flow control.

Distance Learning

This course is not Distance Learning.

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Board Approval:
PCA Established:
DL Conversion:
Date Reviewed: Fall 2015
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 108
Catalog Course Title: Networking Essentials 3
Banner Course Title: Networking Essentials 3

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	1.500	24.0 - 27.0	1.5
Lab	1.500	24.0 - 27.0	0.5
Total Hours	3.0	48.0 - 54.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade or Pass/No Pass

Requisites

Prerequisite
EL 106 Networking Essentials 1
or

Prerequisite
EL 107 Networking Essentials 2

Entrance Skills

Upon entering this course, the student should be able to:

EL 106 - Networking Essentials 1

- explain the basic electrical and electronic devices used in a PC and networking environment.
- identify and explain the basic operation of PC hardware.
- explain the concept of networking.
- explain and identify the OSI model.
- explain and identify IP addressing.
- describe the function of routers, switches, and hubs.

- demonstrate the processes of laying and terminating networking media.
- design and install a local area network.
- describe various troubleshooting tools and techniques of LAN maintenance.

EL 107 - Networking Essentials 2

- examine router elements (RAM, ROM, CDP, show).
- define flow control and describe the three basic methods used in networking.
- identify the functions of the TCP/IP transport-layer protocols.
- control router passwords,identification, and banner.
- check an initial configuration using the setup command.
- configure and use telnet applications for accessing routers.
- use ping and trace programs to troubleshoot network problems.
- log into a router in both user and privileged modes.
- load Cisco IOS software from: flash memory, a TFTP server, or ROM.
- list problems that each routing type encounters when dealing with topology changes, and describe techniques to reduce the number of these problems.
- configure IP addresses.
- prepare the initial configuration of a router and enable IP.
- add RIP and IGRP routing protocol to the configuration.
- configure extended access lists to filter IP traffic.

Catalog Description

Third course in a series designed to provide students with knowledge of and laboratory experiences with current and emerging computer networking technology. Focus will be on LANs, WANs, OSI models, IP addressing and router programming; and the theory behind the various kinds of network architectures and data transmission methods. Emphasis will be placed on the Cisco System Certification. This course is not open to students who are enrolled in or have received credit for CS 108.

Course Content

Lecture

1. LAN Switching
2. VLANs
3. LAN Design
4. Routing Protocols
5. Novell IPX

Course Objectives

At the end of the course, the student will be able to:

1. configure IPX access lists and SAP filters to control basic Novell traffic.
2. monitor Novell IPX operation on a router.
3. describe the advantages of LAN segmentation.

4. describe LAN segmentation using bridges, routers, and switches.
5. describe full- and half-duplex Ethernet operations.
6. describe the guidelines and distance limitations of Fast Ethernet.
7. distinguish between cut-through and store-and-forward LAN switching.
8. describe the operation of the Spanning Tree Protocol and its benefits.
9. describe the benefits of virtual LANs.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Other Assignments**
  1. Read online study units and take end of unit exams from Cisco Systems courseware (requires Internet connection from laboratory stations for taking online exams).
  2. Readings from adopted text and instructor handouts, evaluate sample problems and work end of chapter problems.
  3. Study laboratory experiments.
  4. Prepare laboratory written reports.
  5. Participate in post-lab evaluation discussions.
  6. Quizzes and Exams covering assigned and related topics.

  Sample Writing Assignment: Your company has two TCP/IP networks in two buildings, Building L and Building M that are 200 meters apart. The appropriate conduit runs are already in existence between the two buildings and are terminated in large equipment rooms. Building L has 36 machines using IP addresses 128.230.61.1 through 128.230.61.16 and Building M has 20 machines with IP addresses 128.230.61.100 through 128.230.61.120. The network mask for all machines is 255.255.255.0. Develop a design: explain where and why you would implement Routers, Bridges, Repeater, or Amplifiers in your design. If you want to segment the network in Building L with that of Building M, explain how you would accomplish this task and elaborate on why you might want to segment the building networks.

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Papers**
- **Projects**
- **Simulation**
- **Group Projects**
- **Class Participation**
- **Class Work**
- **Home Work**
- **Lab Activities**
- **Class Performance**
- **Writing Requirements**
- **Other**
  1. Exam reports for each study unit from Cisco Systems.
  2. Written and performance based examinations for each major study area. Examinations will include problem solving techniques and word type problems. Examinations are graded for accuracy.
  3. Class project will be graded for accuracy, content, and applied techniques.
  4. Assigned homework problems will be graded for accuracy.
  5. Laboratory reports are graded for accuracy and content.
  6. A comprehensive written final examination will be administered and graded for accuracy and applied techniques as well as a laboratory examination evaluating the student's abilities in applying

networking concepts.

Sample Essay Question: Use the design you developed for connecting building L's 36 machines and building M's 20 machines, explain how you would modify the design to segment the two building networks. Elaborate on why you might want the two building networks segmented.

Adopted Texts and Other Instructional Materials

Textbooks

1. Cisco Press *Scaling Networks Companion Guide.* Edition: 1 2015

Other Texts

1. Graph paper and normal school supplies
2. Scientific Calculator
3. Three-Ring Binder
4. Jenkins, N. Understanding Local Area Networks, SAMS. 1998
5. Tittlel, E. A guide to Networking Essentials, Course Technology, 1998
6. Palmer, M. A Guide to Microsoft Windows NT Server 4.0, Course Technology. 1998
7. Palmer, M. Hands-On Microsoft Windows NT 4.0 Server with Projects, Course Technology. 1997
8. USB flash drive

Instructional Materials

None

Student Learning Outcomes

1. EL108 SLO1 - Demonstrate an understanding of IPX networking.
2. EL108 SLO2 - Demonstrate an understanding of fundamental LAN topologies with emphasis on Ethernet.
3. EL108 SLO3 - Explain basic network switching and switch configuration including VLAN networks.

Distance Learning

This course is not Distance Learning.

Generated on: 6/21/2018 5:30:55 PM

Board Approval: 04/20/1999
PCA Established: 04/28/2016
DL Conversion:
Date Reviewed: Spring 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 109
Catalog Course Title: Networking Essentials 4
Banner Course Title: Networking Essentials 4

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	1.500	24.0 - 27.0	1.5
Lab	1.500	24.0 - 27.0	0.5
Total Hours	3.0	48.0 - 54.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade or Pass/No Pass

Requisites

Prerequisite
EL 108 Networking Essentials 3
or

Prerequisite
EL 106 Networking Essentials 1
or

Prerequisite
EL 107 Networking Essentials 2

Entrance Skills

Upon entering this course, the student should be able to:

EL 108 - Networking Essentials 3

- configure IPX access lists and SAP filters to control basic Novell traffic.
- monitor Novell IPX operation on a router.

- describe the advantages of LAN segmentation.
- describe LAN segmentation using bridges, routers, and switches.
- describe full- and half-duplex Ethernet operations.
- describe the guidelines and distance limitations of Fast Ethernet.
- distinguish between cut-through and store-and-forward LAN switching.
- describe the operation of the Spanning Tree Protocol and its benefits.
- describe the benefits of virtual LANs.

EL 106 - Networking Essentials 1

- explain the basic electrical and electronic devices used in a PC and networking environment.
- identify and explain the basic operation of PC hardware.
- explain the concept of networking.
- explain and identify the OSI model.
- explain and identify IP addressing.
- describe the function of routers, switches, and hubs.
- demonstrate the processes of laying and terminating networking media.
- design and install a local area network.
- describe various troubleshooting tools and techniques of LAN maintenance.

EL 107 - Networking Essentials 2

- examine router elements (RAM, ROM, CDP, show).
- define flow control and describe the three basic methods used in networking.
- identify the functions of the TCP/IP transport-layer protocols.
- control router passwords,identification, and banner.
- check an initial configuration using the setup command.
- configure and use telnet applications for accessing routers.
- use ping and trace programs to troubleshoot network problems.
- log into a router in both user and privileged modes.
- load Cisco IOS software from: flash memory, a TFTP server, or ROM.
- list problems that each routing type encounters when dealing with topology changes, and describe techniques to reduce the number of these problems.
- configure IP addresses.
- prepare the initial configuration of a router and enable IP.
- add RIP and IGRP routing protocol to the configuration.
- configure extended access lists to filter IP traffic.

Catalog Description

The final course in a series designed to provide students with knowledge of and laboratory experiences with current and emerging computer networking technology. Focus will be on LANs, WANs, OSI models, IP addressing and router programming; and the theory behind the various kinds of network architectures and data transmission methods. Emphasis will be placed on the Cisco System Certification. This course is not open to students who are enrolled in or have received credit for CS 109.

Course Content

Lecture

1. Wide Area Networking (WAN)
2. WAN Design
3. Point-to-Point Protocol (PPP)

4. Integrated Services Digital Networks (ISDN)
5. Frame Relay

Course Objectives

At the end of the course, the student will be able to:

1. Differentiate between the following services: LAPB, Frame Relay, ISDN/LAPD, HDLC, PPP, and DDR.
2. Recognize key Frame Relay terms and features.
3. Identify PPP operations to encapsulate WAN data on Cisco routers.
4. Identify ISDN protocols, function groups, reference points, and channels.
5. Describe Integrated Service Digital Networks.
6. Describe WAN Design.
7. Demonstrate how Point-to-Point Protocol (PPP) works.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Other Assignments**
  1. Read online study units and take end of unit exams from Cisco Systems courseware (requires Internet connection from laboratory stations for taking online exams).
  2. Readings from adopted text and instructor handouts, evaluate sample problems and work end of chapter problems.
  3. Study laboratory experiments.
  4. Prepare laboratory written reports.
  5. Participate in post-lab evaluation discussions.
  6. Quizzes and Exams covering assigned and related topics.

  Sample Writing Assignment: Compare and contrast the differences between the following services: Frame Relay, ISDN, and PPP.

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Papers**
- **Projects**
- **Simulation**
- **Class Participation**
- **Class Work**
- **Home Work**
- **Lab Activities**
- **Class Performance**
- **Writing Requirements**
- **Other**

1. Exam reports for each study unit from Cisco Systems.
2. Written and performance based examinations for each major study area. Examinations will include problem solving techniques and word type problems. Examinations are graded for accuracy.
3. Class project will be graded for accuracy, content, and applied techniques.
4. Assigned homework problems will be graded for accuracy.
5. Laboratory reports are graded for accuracy and content.
6. A comprehensive written final examination will be administered and graded for accuracy and applied techniques as well as a laboratory examination evaluating the student's abilities in applying networking concepts.

Sample Essay Question: As a network administrator, you are experiencing a puzzling problem with your network. There are both NetWare and Windows NT servers, and clients running Windows 3.11, Windows 95, and Windows NT. Outline some of the Internet resources you might use to isolate and remedy this problem.

Adopted Texts and Other Instructional Materials

Textbooks

1. Cisco Press *Connecting Networks Companion Guide* Edition: 1 2014

Other Texts

1. Graph paper and normal school supplies
2. Scientific Calculator
3. Three-Ring Binder

Instructional Materials

None

Student Learning Outcomes

1. EL109 SLO1 - Demonstrate an understanding of WAN Technologies.
2. EL109 SLO2 - Explain the fundamental concept of a point-to-point link and the supporting protocols.
3. EL109 SLO3 - Explain the fundamental concept of an ISDN link and the supporting protocols.

Distance Learning

This course is not Distance Learning.

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Board Approval: 03/17/1992
PCA Established: 12/13/2016
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 118
Catalog Course Title: Fundamentals of DC and AC Circuits Analysis
Banner Course Title: Fund of DC and AC Circuits Ana

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	3.000	48.0 - 54.0	3.0
Lab	0.000	0.0 - 0.0	0.0
Total Hours	3.0	48.0 - 54.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Corequisite
EL 119 Fundamentals of DC and AC Circuits Analysis Laboratory

Prerequisite
MATH 311 Algebra 1

Entrance Skills

Upon entering this course, the student should be able to:

EL 119 - Fundamentals of DC and AC Circuits Analysis Laboratory

- demonstrate basic safety procedures.
- construct DC and AC circuits from a schematic drawing.
- correctly measure all DC and AC parameters in resistive and reactive circuits, using standard test instruments.
- interpret circuit parameters, diagnose and correct malfunctions in electronic circuits.
- design DC and AC circuits using standard engineering practices.
- construct Thevenin equivalents to operating DC and AC circuits.

- develop graphs indicating relationships of electronic parameters.
- evaluate the operation and circuit parameters for all experimental circuits.

MATH 311 - Algebra 1

- state, use and identify the basic real number axioms.
- evaluate and simplify variable expressions.
- solve linear equations in one variable.
- solve and graph solutions to linear inequalities in one variable.
- graph linear equations in two variables using slope and intercept methods.
- add, subtract, multiply and divide polynomials.
- factor polynomials
- use factoring to simplify, multiple, and divided rational expressions.
- use factoring to solve quadratic equations.
- solve word problems at the elementary algebra level.
- evaluate and simplify expressions involving square roots

Entrance Skills Other (Legacy)

The student must have the ability to manipulate algebraic expressions. graph linear and quadratic equations. find the inverse of a given relation and solve linear systems of equations.

Catalog Description

An introductory study of the nature of electricity; the processes employed in the analysis and documentation of DC and AC electric circuits, and the use of basic electronics testing instruments. Topics include: current voltage, resistance, power, reactance, admittance, resonance, Ohm's law, series parallel and bridge resistive and reactive circuits, Kirchhoff's voltage and current laws, loading effects of meters and supplies, capacitators, inductors, filters, RC and RL time constants, applications of Kirchhoff laws to multiple source series-parallel circuits, complex numbers, and network theorems.

Course Content

Lecture

1. SI Units, Atomic Structure, Engineering Notation, Basic Components
2. Ohm's law; Series, Parallel, and Series Parallel resistive circuit analysis
3. Voltage and Current sources
4. Kirchhoff's laws and Network theorems
5. Magnetism, Electromagnetism, Induction and Electrostatistics
6. Inductor and Capacitors in DC circuits; RC and RL time constants
7. Introduction to Alternating Current Voltage, Ohm's and Kirchhoff's Laws
8. Phasors and Complex Numbers
9. Capacitor and Inductors in AC circuits
10. RC and RL circuits; series, parallel, and series-parallel
11. RLC circuits and Resonance

12. Low-Pass, High-Pass, Band-Pass, Band-Stop filters
13. Circuit Theorems in AC circuits

Course Objectives

At the end of the course, the student will be able to:

1. recognize common electric components and measuring instruments.
2. recite the basic structure of atoms and to recognize, at the atomic level, the characteristics of conductors, semiconductors, and insulators.
3. evaluate the interrelationships among current, voltage, resistance, and power.
4. define energy and power.
5. determine current direction in DC circuits and calculate its value.
6. apply Kirchoff's voltage divider and/or current divider.
7. design circuits for use as a voltage divider and/or current divider.
8. evaluate unbalanced bridge circuits.
9. describe the characteristics of a current source.
10. convert a current source to a voltage source (Millman's theorem).
11. apply the superposition theorem to simplify a circuit for analysis.
12. apply Thevenin's theorem to simplify a circuit for analysis.
13. apply the maximum power transfer theorem to determine the value of load resistance.
14. write circuit equations and solve circuit parameters using determinants to solve simultaneous equations and using mesh analysis to determine circuit values.
15. explain the principles of a magnetic field.
16. explain the principle of electromagnetic induction.
17. explain how a capacitor and an inductor store charge.
18. write equations for the charging and discharging curves for RC and RL circuits.
19. identify a sinusoidal waveform and measure its characteristics.
20. describe how sine waves are generated.
21. determine the various voltage and current values of a sine wave (measurement quantities).
22. describe angular relationships of sine waves.
23. find instantaneous values using the sine wave formula.
24. apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
25. identify the characteristics of basic nonsinusoidal waveforms.
26. use a phasor to represent a sine wave.
27. use complex numbers to express phasor quantities.
28. describe the basic construction and characteristics of a capacitor and of an inductor.
29. analyze series and parallel combination of capacitors and inductors in AC circuits.
30. explain mutual inductance and how a transformer is constructed and how it operates.
31. determine the effect of a resistive load across the secondary winding of a transformer.
32. describe the relationship between current and voltage in RC, RL, and RLC circuits.
33. determine the impedance, phase angle, and power in series, parallel, and series-parallel, RC, RL and RLC circuits.
34. describe how RC, RL circuits operate as a filter.
35. analyze a circuit for series and parallel resonance.
36. determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
37. analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
38. apply the superposition theorems to AC circuit analysis.
39. apply Thevenin's power transfer theorem to AC circuits for analysis.
40. apply the maximum power transfer theorem to AC circuits for analysis.
41. comprehend troubleshooting methodology and approaches for solving problems in DC and AC circuits.

Methods of Instruction

- **Lecture**

Outside Assignments

- **Outside Assignments**
  Cooperative learning groups' projects; presentations; short papers; research; and the following:
  1. Readings from adopted text and instructor handouts; evaluate sample problems and work end of chapter problems.
  2. Use computer applications to expand upon circuit analysis and comprehension.
  3. Use the internet, as an information resource, to support topics studied in this course.
  4. Quizzes and exams covering assigned and related topics.
  5. Design projects assigned stressing application of learned concepts and theories.
- **Sample Assignment(s)**
  Describe the relationship between current and voltage in RC, RL and RLC circuits.

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Projects**
- **Home Work**
- **Other**
  1. Comprehensive written examinations for each major study area. Exams will include problem solving techniques and word type problems. The exams will be graded for accuracy and techniques used for problem solutions.

  2. End of chapter problems are assigned as homework and graded for accuracy.

  3. Design project assigned and graded for quality of research, techniques applied and for proper engineering practices.

  4. Comprehensive final exam. Exam graded for accuracy and applied techniques.

  Sample Essay Question:
  Explain the principals of electromagnetic induction.

Adopted Texts and Other Instructional Materials

Textbooks

1. Floyd, T. *Principles of Electric Circuits* Edition: 11 2015

Other Texts

1. Appropriate Readings:
   Newspapers
   Magazines
   Internet resources
   Owners/operators manuals

2. Other Materials:
   Graph paper/school supplies
   Instructor handouts
   Computer application software (supplied by publisher/instructor)

Three-ring binder
Scientific calculator (i.e. Texas Instruments model 36 or equivalent)
Internet access (in the lab, library, and/or home)

Instructional Materials
None

Student Learning Outcomes

1. EL118 SLO1 - Demonstrate an understanding of fundamental electronic concepts that pertain to direct and alternating current electronics.
2. EL118 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to technical problem solving and troubleshooting methodology.
3. EL118 SLO3 - Recognize common electric components, waveforms, and electronic measuring instruments.

Distance Learning

This course is not Distance Learning.

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Board Approval: 05/18/2004
PCA Established: 12/13/2016
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 119
Catalog Course Title: Fundamentals of DC and AC Circuits Analysis Laboratory
Banner Course Title: Fund of DC and AC Circuits Lab

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	0.000	0.0 - 0.0	0.0
Lab	6.000	96.0 - 108.0	2.0
Total Hours	6.0	96.0 - 108.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Corequisite
EL 118 Fundamentals of DC and AC Circuits Analysis

Entrance Skills

Upon entering this course, the student should be able to:

EL 118 - Fundamentals of DC and AC Circuits Analysis

- recognize common electric components and measuring instruments.
- recite the basic structure of atoms and to recognize, at the atomic level, the characteristics of conductors semiconductors, and insulators.
- evaluate the interrelationships among current, voltage, resistance, and power.
- define energy and power.
- determine current direction in DC circuits and calculate its value.
- apply Kirchoff's voltage divider and/or current divider.
- design circuits for use as a voltage divider and/or current divider.
- evaluate unbalanced bridge circuits.
- describe the characteristics of a current source.

- convert a current source to a voltage source (Millman's theorem).
- apply the superposition theorem to simplify a circuit for analysis.
- apply Thevenin's theorem to simplify a circuit for analysis.
- apply the maximum power transfer theorem to determine the value of load resistance.
- write circuit equations and solve circuit parameters using determinants to solve simultaneous equations and using mesh analysis to determine circuit values.
- explain the principles of a magnetic field.
- explain the principle of electromagnetic induction.
- explain how a capacitor and an inductor store charge.
- write equations for the charging and discharging curves for RC and RL circuits.
- identify a sinusoidal waveform and measure its characteristics.
- describe how sine waves are generated.
- determine the various voltage and current values of a sine wave (measurement quantities).
- describe angular relationships of sine waves.
- find instantaneous values using the sine wave formula.
- apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
- identify the characteristics of basic nonsinusoidal waveforms.
- use a phasor to represent a sine wave.
- use complex numbers to express phasor quantities.
- describe the basic construction and characteristics of a capacitor and of an inductor.
- analyze series and parallel combination of capacitors and inductors in AC circuits.
- explain mutual inductance and how a transformer is constructed and how it operates.
- determine the effect of a resistive load across the secondary winding of a transformer.
- describe the relationship between current and voltage in RC, RL, and RLC circuits.
- determine the impedance, phase angle, and power in series, parallel, and series-parallel, RC, RL and RLC circuits.
- describe how RC, RL circuits operate as a filter.
- analyze a circuit for series and parallel resonance.
- determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
- analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
- apply the superposition theorems to AC circuit analysis.
- apply Thevenin's power transfer theorem to AC circuits for analysis.
- apply the maximum power transfer theorem to AC circuits for analysis.
- comprehend troubleshooting methodology and approaches for solving problems in DC and AC circuits.

Catalog Description

Provides the student practical experience for the comprehension of DC and AC electrical concepts introduced in EL 118 (Fundamentals of Circuit Analysis) and also presents the proper use of electronic test instrumentation for the measurement of circuit parameters.

Course Content

Lecture

1. Electronic Text Equipment and Measurements
2. Electronic Components (DC and AC)
3. Electronic Circuits and Networks (DC and AC)
4. Electronic Laws and Theorems Including Complex Forms

Course Objectives

At the end of the course, the student will be able to:

1. demonstrate basic safety procedures.
2. construct DC and AC circuits from a schematic drawing.
3. correctly measure all DC and AC parameters in resistive and reactive circuits, using standard test instruments.
4. interpret circuit parameters, diagnose and correct malfunctions in electronic circuits.
5. design DC and AC circuits using standard engineering practices.
6. construct Thevenin equivalents to operating DC and AC circuits.
7. develop graphs indicating relationships of electronic parameters.
8. evaluate the operation and circuit parameters for all experimental circuits.

Methods of Instruction

- **Lab**

Outside Assignments

- **Outside Assignments**
  1. Study laboratory experiments, evaluate sample problems and circuits.
  2. Participate in post-lab evaluation discussions.
  3. Mathematically evaluate the operation of each experimental circuit.
  4. Draw a component diagram for each experimental circuit.
  5. Answer a series of questions designed so that students can express in writing the conclusions they have developed from performing each experiment.
  6. Study instructor handouts on selected topics.
  7. Use computer application software for tutorial purposes and evaluation of circuit parameters.
- **Sample Assignment(s)**
  Sample Problem:
  What circuit properties determines the accuracy of measurements made with the experimental resistance bridge?

Methods of Evaluation

- **Lab Activities**
- **Other**
  1. Laboratory reports are graded for accuracy and content. Reports consist of: A. text study information B. mathematical evaluations of each circuit studied in the experiment C. component diagrams for each circuit D. design problem solutions E. procedures and data collection F. end of experiment questions and conclusions

  2. Mid-term laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, interpret their data to determine DC electrical concepts. A written examination is also given emphasizing DC circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.

  3. A final laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, interpret their data to determine AC electrical concepts. A written examination is also given emphasizing AC circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.

  Sample Essay Questions:
  1. Compare Thevenin's theorem techniques and superposition techniques for the solution of circuit

operating parameters of a three source series parallel network.
2. Explain the electrostatic operation of a capacitor when it is excited by a 300 Hz wave form.

Adopted Texts and Other Instructional Materials

Textbooks

1. ZBAR *Basic Electricity* Edition: 7 2001

Other Texts

1. Manufacturers Instruction and Service manuals for test instruments used in this laboratory
2. Circuitmaker (Software) EL 119/LAB.
3. Graph paper/school supplies
4. Instructor handouts
5. Computer application programs
6. Computer storage device
7. Electronic parts and proto boards
8. Three ring binder
9. Veley, V. Modern Electronics: A First Course. Prentice-Hall.
10. Floyd, T. Principles of Electric Circuits. Merril Publishing Co.
11. Jackson, H. Introduction to Electric Circuits. Prentice-Hall.
12. Savant, C. Electronic Circuit Design: An Engineering Approach. Benjamin/Cummings.

Instructional Materials

None

Student Learning Outcomes

1. EL119 SLO1 - Demonstrate basic safety procedures.
2. EL119 SLO2 - Correctly measure and interpret DC and AC circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology.
3. EL119 SLO3 - Design and construct standard DC circuits.

Distance Learning

This course is not Distance Learning.

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Board Approval: 03/17/1992
PCA Established: 04/20/2010
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 122
Catalog Course Title: Electronic Devices and Circuits
Banner Course Title: Electronic Devices & Circuits

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	3.000	48.0 - 54.0	3.0
Lab	0.000	0.0 - 0.0	0.0
Total Hours	3.0	48.0 - 54.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 118 Fundamentals of DC and AC Circuits Analysis
and

Prerequisite
EL 119 Fundamentals of DC and AC Circuits Analysis Laboratory

Advisories
Concurrent enrollment in

Advisories
EL 123 Electronic Devices and Circuits Laboratory

Entrance Skills

Upon entering this course, the student should be able to:

EL 118 - Fundamentals of DC and AC Circuits Analysis

- recognize common electric components and measuring instruments.
- recite the basic structure of atoms and to recognize, at the atomic level, the characteristics of conductors semiconductors, and insulators.
- evaluate the interrelationships among current, voltage, resistance, and power.
- define energy and power.
- determine current direction in DC circuits and calculate its value.
- apply Kirchoff's voltage divider and/or current divider.
- design circuits for use as a voltage divider and/or current divider.
- evaluate unbalanced bridge circuits.
- describe the characteristics of a current source.
- convert a current source to a voltage source (Millman's theorem).
- apply the superposition theorem to simplify a circuit for analysis.
- apply Thevenin's theorem to simplify a circuit for analysis.
- apply the maximum power transfer theorem to determine the value of load resistance.
- write circuit equations and solve circuit parameters using determinants to solve simultaneous equations and using mesh analysis to determine circuit values.
- explain the principles of a magnetic field.
- explain the principle of electromagnetic induction.
- explain how a capacitor and an inductor store charge.
- write equations for the charging and discharging curves for RC and RL circuits.
- identify a sinusoidal waveform and measure its characteristics.
- describe how sine waves are generated.
- determine the various voltage and current values of a sine wave (measurement quantities).
- describe angular relationships of sine waves.
- find instantaneous values using the sine wave formula.
- apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
- identify the characteristics of basic nonsinusoidal waveforms.
- use a phasor to represent a sine wave.
- use complex numbers to express phasor quantities.
- describe the basic construction and characteristics of a capacitor and of an inductor.
- analyze series and parallel combination of capacitors and inductors in AC circuits.
- explain mutual inductance and how a transformer is constructed and how it operates.
- determine the effect of a resistive load across the secondary winding of a transformer.
- describe the relationship between current and voltage in RC, RL, and RLC circuits.
- determine the impedance, phase angle, and power in series, parallel, and series-parallel, RC, RL and RLC circuits.
- describe how RC, RL circuits operate as a filter.
- analyze a circuit for series and parallel resonance.
- determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
- analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
- apply the superposition theorems to AC circuit analysis.
- apply Thevenin's power transfer theorem to AC circuits for analysis.
- apply the maximum power transfer theorem to AC circuits for analysis.
- comprehend troubleshooting methodology and approaches for solving problems in DC and AC circuits.

EL 119 - Fundamentals of DC and AC Circuits Analysis Laboratory

- demonstrate basic safety procedures.
- construct DC and AC circuits from a schematic drawing.
- correctly measure all DC and AC parameters in resistive and reactive circuits, using standard test instruments.
- interpret circuit parameters, diagnose and correct malfunctions in electronic circuits.
- design DC and AC circuits using standard engineering practices.
- construct Thevenin equivalents to operating DC and AC circuits.
- develop graphs indicating relationships of electronic parameters.
- evaluate the operation and circuit parameters for all experimental circuits.

EL 123 - Electronic Devices and Circuits Laboratory

- determine component types and lead or pin indentifications.
- interpret semiconductor manufactures data sheets and characteristics curves.
- operate semiconductor testers and curve tracers.
- design properly biased transistor or linear amplifier circuits.
- construct a circuit and collect the necessary measurements required to determine voltage, current and power gains, input and output impedances, and frequency response.
- design and construct linear integrated circuits.

Entrance Skills Other (Legacy)

1. correctly analyze and solve electronic circuits.
2. identify the average, effective, peak, peak-to-peak values of AC waveforms.
3. predict the frequency and period of AC waveforms.
4. interpret circuit parameters.
5. design DC and AC circuits using standard engineering practices.
6. devlop graphs indicating relationships of electronic parameters.

Catalog Description

Introductory study of semiconductor devices and systems. A detailed analysis of diodes; bipolar junction translators and field-effect transistors; blasing techniques, active circuits, thyristors and optoelectronic components and linear integrated circuits.

Course Content

Lecture

1. Semiconductor Materials, Diodes and Applications
2. Transistors and Thyristors
3. Amplifiers and Oscillators
4. Operational Amplifiers
5. Op-amp Responses
6. Basic Op-amp Circuits
7. Active Filters
8. Signal Generators and Timers
9. Power Supplies

Course Objectives

At the end of the course, the student will be able to:

1. describe the electrical characteristics of semiconductor materials.
2. explain in writing how semiconductor devices operate.
3. differentiate the schematic symbols that are used to represent a wide variety of semiconductor devices.
4. interpret device specifications using manufacturer's data sheets.
5. analyze transistor amplifier circuits, describe their operation and list the characteristics for each.
6. identify and explain the operation of power supply rectifiers, filters, and regulation circuits.
7. evaluate the effects of negative and positive feedback on integrated circuits.
8. analyze the basic operation of common linear integrated circuit systems

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Methods of Instruction

- **Lecture**

Outside Assignments

- **Outside Assignments**
  1. Readings from adopted text and instructor handouts on selected topics, evaluate sample problems, work end of chapter problems.
  2. Solutions of word problems stressing mathematical modeling and formulations.
  3. Use computer applications software to expand circuit analysis formulations and concepts.
  4. Quizzes and tests for assigned and related topics.
  5. Design projects assigned stressing application of learned concepts and theories.
- **Sample Assignment(s)**
  1. A certain transistor has an IC = 25mA and an IB = 200 uA. Determine Beta dc.
  2. Explain the importance of evaluating phase margin in a high frequency linear amplifier.

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Home Work**
- **Other**
  1. Comprehensive written examinations for each major study area. Examinations are to include problem solving techniques and word type problems. These examinations are graded for accuracy and the techniques used in solving the problems.
  2. Assigned homework problems will be graded for accuracy.
  3. Design projects will be graded for techniques that were applied and for proper engineering practices.
  4. Comprehensive final examination will be graded for accuracy and applied techniques.

  Sample essay questions:
  1. Describe the overall operation of the circuit and the function of each component. In discussing the general operation and basic purpose of each component, identify the negative feedback loop, the type of op-amp configuration, which components determine the voltage gain, which components set the lower critical frequency, and the purpose of each of the capacitors.

Adopted Texts and Other Instructional Materials

Textbooks

1. Floyd *Electronic Devices (Electron Flow Version)* Edition: 9th 2012

Other Texts

1. Intusoft Newsletter. Intusoft Newsletter Series.
2. IS-Spice Home Page. Internet address:
3. Scientific calculator.
4. Graph paper/school supplies.
5. Instructor handouts.
6. Computer application programs.
7. Frederiksen, Thomas. Intuitive IC Op Amps. National Semiconductor Tech Series 1.
8. Intusoft Newsletter. Intusoft Newsletter Series. Current issues.

Instructional Materials
None

Student Learning Outcomes

1. EL122 SLO1 - Demonstrate an understanding of fundamental analog and digital circuit and device concepts
2. EL122 SLO2 - Recognize common electric components and electronic measuring instruments.
3. EL122 SLO3 - Apply basic mathematical, scientific, electronic and engineering concepts to technical problem solving and troubleshooting methodology.

Distance Learning

This course is not Distance Learning.

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Board Approval: 03/17/1992
PCA Established: 12/13/2016
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 123
Catalog Course Title: Electronic Devices and Circuits Laboratory
Banner Course Title: Electronic Devices & Circ Lab

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	0.000	0.0 - 0.0	0.0
Lab	6.400	102.0 - 115.0	2.0
Total Hours	6.0	102.0 - 115.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 118 Fundamentals of DC and AC Circuits Analysis
and

Prerequisite
EL 119 Fundamentals of DC and AC Circuits Analysis Laboratory

Advisories
Completion of or concurrent enrollment in EL 122

Entrance Skills

Upon entering this course, the student should be able to:

EL 118 - Fundamentals of DC and AC Circuits Analysis

- recognize common electric components and measuring instruments.
- recite the basic structure of atoms and to recognize, at the atomic level, the characteristics of conductors semiconductors, and insulators.

- evaluate the interrelationships among current, voltage, resistance, and power.
- define energy and power.
- determine current direction in DC circuits and calculate its value.
- apply Kirchoff's voltage divider and/or current divider.
- design circuits for use as a voltage divider and/or current divider.
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- apply the maximum power transfer theorem to determine the value of load resistance.
- write circuit equations and solve circuit parameters using determinants to solve simultaneous equations and using mesh analysis to determine circuit values.
- explain the principles of a magnetic field.
- explain the principle of electromagnetic induction.
- explain how a capacitor and an inductor store charge.
- write equations for the charging and discharging curves for RC and RL circuits.
- identify a sinusoidal waveform and measure its characteristics.
- describe how sine waves are generated.
- determine the various voltage and current values of a sine wave (measurement quantities).
- describe angular relationships of sine waves.
- find instantaneous values using the sine wave formula.
- apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
- identify the characteristics of basic nonsinusoidal waveforms.
- use a phasor to represent a sine wave.
- use complex numbers to express phasor quantities.
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- analyze series and parallel combination of capacitors and inductors in AC circuits.
- explain mutual inductance and how a transformer is constructed and how it operates.
- determine the effect of a resistive load across the secondary winding of a transformer.
- describe the relationship between current and voltage in RC, RL, and RLC circuits.
- determine the impedance, phase angle, and power in series, parallel, and series-parallel, RC, RL and RLC circuits.
- describe how RC, RL circuits operate as a filter.
- analyze a circuit for series and parallel resonance.
- determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
- analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
- apply the superposition theorems to AC circuit analysis.
- apply Thevenin's power transfer theorem to AC circuits for analysis.
- apply the maximum power transfer theorem to AC circuits for analysis.
- comprehend troubleshooting methodology and approaches for solving problems in DC and AC circuits.

EL 119 - Fundamentals of DC and AC Circuits Analysis Laboratory

- demonstrate basic safety procedures.
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- correctly measure all DC and AC parameters in resistive and reactive circuits, using standard test instruments.
- interpret circuit parameters, diagnose and correct malfunctions in electronic circuits.
- design DC and AC circuits using standard engineering practices.
- construct Thevenin equivalents to operating DC and AC circuits.
- develop graphs indicating relationships of electronic parameters.
- evaluate the operation and circuit parameters for all experimental circuits.

Entrance Skills Other (Legacy)

1. describe the electrical characteristics of semiconductor materials.
2. explain in writing how semiconductor devices operate.
3. differentiate the schematic symbols that are used to represent a wide variety of semiconductor devices.
4. interpret device specifications using manufacturer's data sheets.
5. analyze transistor amplifier circuits, describe their operation and list the characteristics for each.
6. identify and explain the operation of power supply rectifiers, filters, and regulation circuits.
7. evaluate the effects of negative and positive feedback on integrated circuits.
8. analyze the basic operation of common linear integrated circuit systems

Catalog Description

Provides the opportunity for the student to apply theoretical semiconductor concepts in a laboratory environment. Major areas of emphasis include diodes, bipolar junction transistors, field-effct transistors, thyristers, optoelectronic devices, and linear integrated circuits.

Course Content

Lecture

1. Introduction to Laboratory Equipment
2. Diode Circuits
3. Transistor Testing and Biasing
4. Transistor Circuits
5. Amplifier Frequency Response and Bode Plots
6. Thyrister and Optoelectronic Devices
7. Operational Amplifiers

8. Operational Amplifier Circuits
9. Signal Generators and Timers
10. Power Supplies

Course Objectives

At the end of the course, the student will be able to:

1. determine component types and lead or pin indentifications.
2. interpret semiconductor manufactures data sheets and characteristics curves.
3. operate semiconductor testers and curve tracers.
4. design properly biased transistor or linear amplifier circuits.
5. construct a circuit and collect the necessary measurements required to determine voltage, current and power gains, input and output impedances, and frequency response.
6. design and construct linear integrated circuits.

Methods of Instruction

- **Lab**

Outside Assignments

- **Outside Assignments**
  1. Study laboratory experiments, evaluate sample problems and circuits.
  2. Participate in post-lab evaluation discussion.
  3. Mathematically evaluate the operation of each experimental circuit.
  4. Draw a component diagram for each experimental circuit.
  5. Answer a series of questions designed so that students can express in writing the conclusions they have developed from performing each experiment.
  6. Study instructor handouts on selected topics.
  7. Use computer application software for tutorial purposes and evaluation of circuit parameters.
- **Sample Assignment(s)**
  Sample Problems:
  1. Is the input and output signal voltage of the common collector circuit in phase? Explain your answer.
  2. What is the voltage gain of a non-inverting op-amp with a feedback resistor RF of 10 kohms and an R1 of 2.2 kohms?

Methods of Evaluation

- **Projects**
- **Lab Activities**
- **Other**
  1. Laboratory reports are graded for accuracy and content. Reports consist of: A. text study information B. mathematical evaluations of each circuit studied in the experiment C. component diagrams for each circuit D. design problem solutions E. procedures and data collection F. end of experiment questions and conclusions
  2. Mid term laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, and interpret their data to determine

electrical concepts. A written examination is also given emphasizing circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.
3. A final laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, and interpret their data to determine electrical concepts. A written examination is also given emphasizing circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.

Sample essay question:
1. Describe the overall operation of the circuit and the function of each component. In discussing the general operation and basic purpose of each component, identify the negative feedback loop, the type of op-amp configuration, which components determine the voltage gain, which components set the lower critical frequency, and the purpose of each of the capacitors.

Adopted Texts and Other Instructional Materials

Textbooks

1. Berube *Computer Stimulated Experiments for Electronic Devices Using Electronic Workbench* Edition: 3rd 2004

Other Texts

1. Intusoft Newsletter. Intusoft Newsletter Series. Current issues.
2. IS-Spice Home Page. Internet address:
3. Scientific calculator
4. Graph paper and normal school supplies
5. Instructor handouts
6. Electronic parts and protoboards
7. Frederiksen, Thomas. Intuitive IC Op Amps. National Semiconductor Tech Series 1, 1984

Instructional Materials

None

Student Learning Outcomes

1. EL123 SLO1 - Design and construct standard electronic circuits.
2. EL123 SLO2 - Correctly measure and interpret electronic circuit measurements using standard semiconductor testing instruments and correct malfunctions using troubleshooting methodologies.
3. EL123 SLO3 - Apply basic mathematical, scientific, electronic, and engineering concepts to solve technical problems.
4. EL123 SLO4 - Recognize common electronic components, pin identification, and interpret manufacturer's data sheets.

Distance Learning

This course is not Distance Learning.

Board Approval: 03/17/1992
PCA Established:
DL Conversion:
Date Reviewed: Fall 2007
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics and
Department: Industrial Technology
Prefix and Number: EL 125
Catalog Course Title: Digital Devices and Circuits
Banner Course Title: Digital Devices & Circuits

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	3.000	48.0 - 54.0	3.0
Lab	0.000	0.0 - 0.0	0.0
Total Hours	3.0	48.0 - 54.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 113 Fundamentals of AC Circuit Analysis
CR C
and

Prerequisite
EL 114 Fundamentals of AC Circuit Analysis Lab
CR C
or

Prerequisite
EL 118 Fundamentals of DC and AC Circuits Analysis
CR C
and

Prerequisite
EL 119 Fundamentals of DC and AC Circuits Analysis Laboratory
CR C

Entrance Skills

Upon entering this course, the student should be able to:

EL 113 - Fundamentals of AC Circuit Analysis

- recognize common electronic components and measuring instruments.
- identify a sinusoidal waveform and measure its characteristics.
- describe how sine waves are generated.
- determine the various voltage and current values of a sine wave (measurement quantities).
- describe angular relationships of sine waves.
- find instantaneous values using the sine waves.
- apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
- identify the characteristics of basic nonsinusoidal waveforms.
- use a phasor to represent a sine wave.
- use complex numbers to express phasor quantities.
- describe the basic construction and characteristics of a capacitor and of an inductor.
- analyze series and parallel combination of capacitors and inductors in AC circuits.
- explain mutual inductance and how a transformer is constructed and how it operates.
- determine the effect of a resistive load across the secondary winding of a transformer.
- describe the relationship between current and voltage in RC, RL, and RLC circuits.
- determine the impedance, phase angle, and power in series, parallel, series-parallel, series-parallel, RC, RL, and RLC circuits.
- describe how RC, RL circuits operate as a filter.
- analyze a circuit for series and parallel resonance.
- determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
- analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
- apply the superposition, theorems to AC circuit analysis.
- apply the Thevenin's theorem to simplify AC circuits for analysis.
- apply the maximum power transfer theorem to AC circuits for analysis.
- comprehend troubleshooting methodology and approaches for solving problems in AC circuits.

EL 114 - Fundamentals of AC Circuit Analysis Lab

- demonstrate basic laboratory safety procedures.
- identify common electronic components and measuring instruments.
- identify a sinusoidal waveform and measure its characteristics.
- describe how sine waves are generated.
- determine the various voltage and current values of a sine wave (measurement quantities).
- describe angular relationships of sine waves.
- find instantaneous values using the sine waves.
- apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
- identify the characteristics of basic nonsinusoidal waveforms.
- use a phasor to represent a sine wave.
- use complex numbers to express phasor quantities.
- describe the basic construction and characteristics of a capacitor and of an inductor.
- analyze series and parallel combination of capacitors and inductors in AC circuits.
- explain mutual inductance and how a transformer is constructed and how it operates.
- determine the effect of a resistive load across the secondary winding of a transformer.
- describe the relationship between current and voltage in RC, RL, and RLC circuits.
- determine the impedance, phase angle, and power in series, parallel, series-parallel, series-parallel, RC, RL, and RLC circuits.
- describe how RC, RL circuits operate as a filter.
- analyze a circuit for series and parallel resonance.
- determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
- analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
- apply the superposition, theorems to AC circuit analysis.
- apply the Thevenin's theorem to simplify AC circuits for analysis.

- apply the maximum power transfer theorem to AC circuits for analysis.
- comprehend troubleshooting methodology and approaches for solving problems in AC circuits.

EL 118 - Fundamentals of DC and AC Circuits Analysis

- recognize common electric components and measuring instruments.
- recite the basic structure of atoms and to recognize, at the atomic level, the characteristics of conductors semiconductors, and insulators.
- evaluate the interrelationships among current, voltage, resistance, and power.
- define energy and power.
- determine current direction in DC circuits and calculate its value.
- apply Kirchoff's voltage divider and/or current divider.
- design circuits for use as a voltage divider and/or current divider.
- evaluate unbalanced bridge circuits.
- describe the characteristics of a current source.
- convert a current source to a voltage source (Millman's theorem).
- apply the superposition theorem to simplify a circuit for analysis.
- apply Thevenin's theorem to simplify a circuit for analysis.
- apply the maximum power transfer theorem to determine the value of load resistance.
- write circuit equations and solve circuit parameters using determinants to solve simultaneous equations and using mesh analysis to determine circuit values.
- explain the principles of a magnetic field.
- explain the principle of electromagnetic induction.
- explain how a capacitor and an inductor store charge.
- write equations for the charging and discharging curves for RC and RL circuits.
- identify a sinusoidal waveform and measure its characteristics.
- describe how sine waves are generated.
- determine the various voltage and current values of a sine wave (measurement quantities).
- describe angular relationships of sine waves.
- find instantaneous values using the sine wave formula.
- apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
- identify the characteristics of basic nonsinusoidal waveforms.
- use a phasor to represent a sine wave.
- use complex numbers to express phasor quantities.
- describe the basic construction and characteristics of a capacitor and of an inductor.
- analyze series and parallel combination of capacitors and inductors in AC circuits.
- explain mutual inductance and how a transformer is constructed and how it operates.
- determine the effect of a resistive load across the secondary winding of a transformer.
- describe the relationship between current and voltage in RC, RL, and RLC circuits.
- determine the impedance, phase angle, and power in series, parallel, and series-parallel, RC, RL and RLC circuits.
- describe how RC, RL circuits operate as a filter.
- analyze a circuit for series and parallel resonance.
- determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
- analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
- apply the superposition theorems to AC circuit analysis.
- apply Thevenin's power transfer theorem to AC circuits for analysis.
- apply the maximum power transfer theorem to AC circuits for analysis.
- comprehend troubleshooting methodology and approaches for solving problems in DC and AC circuits.

EL 119 - Fundamentals of DC and AC Circuits Analysis Laboratory

- demonstrate basic safety procedures.
- construct DC and AC circuits from a schematic drawing.
- correctly measure all DC and AC parameters in resistive and reactive circuits, using standard test instruments.
- interpret circuit parameters, diagnose and correct malfunctions in electronic circuits.
- design DC and AC circuits using standard engineering practices.

- construct Thevenin equivalents to operating DC and AC circuits.
- develop graphs indicating relationships of electronic parameters.
- evaluate the operation and circuit parameters for all experimental circuits.

Entrance Skills Other (Legacy)

1. correctly analyze and solve electronic circuits.
2. identify the average, peak, peak-to-peak values of AC waveforms.
3. predict the frequency and period of AC waveforms.
4. interpret circuit parameters.
5. design DC and AC circuits using standard engineering practices.
6. develop graphs indicating relationships of electronic parameters.

Catalog Description

Study of modern logic devices, circuits and design techniques emphasizing logic families, implementation of devices, combinational and sequential logic circuits, number systems and codes, A/D and D/A conversion, ALU's, digital computer math techniques, memories, system design and troubleshooting practices.

Course Content

Lecture

1. Basics of Logic Devices and IC Technologies
2. Number Systems and Codes
3. Boolean Algebra and Mapping Techniques
4. Combinational Logic and Functions
5. Bi-stable Devices, Circuits and Applications
6. Registers and Memories
7. Interfacing and Data Transmission
8. Arithmetic Processes

Course Objectives

At the end of the course, the student will be able to:

1. model digital circuits using Boolean algebra.
2. derive an equivalent logic circuit from a Boolean expression.

3. design and analyze counters, registers, and dividers using bi-stable devices.
4. properly interface logic families that have different operational parameters.
5. design logic systems for a stated problem using standard engineering practices.
6. analyze logic systems to determine their operating parameters.

Methods of Instruction

- **Lecture**

Outside Assignments

- **Other Assignments**
  1. Readings from adopted text and instructor handouts on selected topics, evaluate sample problems and work end of chapter problems.
  2. Solutions of word problems stressing mathematical modeling and formulations.
  3. Use computer applications software to expand circuit analysis formulations and concepts.
  4. Design projects assigned stressing application of learned concepts and theories.

  Sample Assignments:
  1. Design the logic circuits required to produce and interrupt control signal to a computer system that monitors a series of traffic lights used at an intersection for malfunctioning conditions.
  2. Determine the binary code output of the three-bit simultaneous A/D converter for the analog input signal in figure 11-22 and the sampling pulses shown. Vref = +l8V.
  3. Explain the differences between totem-pole outputs and open-collector outputs. Use schematic diagrams to support your answer.

Methods of Evaluation

1. Comprehensive written examinations for each major study area. Exams are to include problem solving techniques and word type problems. These examinations will be graded for accuracy and the techniques used in solving the problems.
2. Assigned homework problems will be graded for accuracy.
3. Design projects will be graded for techniques that were applied and for proper engineering practices.
4. Comprehensive final examination will be graded for accuracy and applied techniques.

Sample essay questions:
1. Explain the advantages of data lock-out flip-flops compared to edge-triggered devices.
2. Which interface requires additional circuitry, CMOS to TTL or TTL to CMOS. What is required and why?

Adopted Texts and Other Instructional Materials

Textbooks
None

Other Texts

1. Scientific calculator.
2. Graph paper and normal school supplies.
3. Instructor handouts.
4. Computer application programs.
5. Computer data diskettes.
6. Three ring binder.
7. Fletcher, W. An Engineering Approach to Digital Design. Prentice-Hall. l980.
8. Greenfield, J. Practical Digital Design Using IC's. Wiley. l983.
9. Roth, C. Fundamentals of Logic Design. West. l985.
10. Floyd, T. Digital Fundamentals. Prentice Hall. 2006

Instructional Materials
None

Student Learning Outcomes

1. EL125 SLO1 - Apply basic mathematical, scientific, electronic, and engineering concepts to evaluate digital systems.
2. EL125 SLO2 - Demonstrate knowledge of technology applicable to the field of digital systems, and show a proficiency in appropriate software used in digital design.
3. EL125 SLO3 - Analyze logic systems to determine their operating parameters for facilitating troubleshooting methodology.

Distance Learning

Delivery Methods

- Internet

Instructor Initiated Contact Hours Per Week: 3.000

Contact Types

1. Email Communcation (group and/or individual communications)
2. Discussion Board
3. Telephone Contacts
4. Other (please specify)
   Fax homework & exams; attend office hour or group tutorial sessions if necessary
5. Orientation Sessions
6. Group Meetings
7. Review Session

Adjustments to Assignments
No adjustments will be made

Adjustments to Evaluation Tools
None

Strategies to Make Course Accessible to Disabled Students
yes

Inform Students
In-person orientation session and through announcements via Blackboard.

Additional Comments
None

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Board Approval: 03/17/1992
PCA Established: 12/13/2016
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 126
Catalog Course Title: Digital Devices and Circuits Lab
Banner Course Title: Digital Devices & Circuits Lab

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	0.000	0.0 - 0.0	0.0
Lab	6.000	96.0 - 108.0	2.0
Total Hours	6.0	96.0 - 108.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Advisories
Completion of or concurrent enrollment in EL 125

Prerequisite
EL 118 Fundamentals of DC and AC Circuits Analysis
and

Prerequisite
EL 119 Fundamentals of DC and AC Circuits Analysis Laboratory

Entrance Skills

Upon entering this course, the student should be able to:

EL 118 - Fundamentals of DC and AC Circuits Analysis

- recognize common electric components and measuring instruments.
- recite the basic structure of atoms and to recognize, at the atomic level, the characteristics of conductors semiconductors, and insulators.

- evaluate the interrelationships among current, voltage, resistance, and power.
- define energy and power.
- determine current direction in DC circuits and calculate its value.
- apply Kirchoff's voltage divider and/or current divider.
- design circuits for use as a voltage divider and/or current divider.
- evaluate unbalanced bridge circuits.
- describe the characteristics of a current source.
- convert a current source to a voltage source (Millman's theorem).
- apply the superposition theorem to simplify a circuit for analysis.
- apply Thevenin's theorem to simplify a circuit for analysis.
- apply the maximum power transfer theorem to determine the value of load resistance.
- write circuit equations and solve circuit parameters using determinants to solve simultaneous equations and using mesh analysis to determine circuit values.
- explain the principles of a magnetic field.
- explain the principle of electromagnetic induction.
- explain how a capacitor and an inductor store charge.
- write equations for the charging and discharging curves for RC and RL circuits.
- identify a sinusoidal waveform and measure its characteristics.
- describe how sine waves are generated.
- determine the various voltage and current values of a sine wave (measurement quantities).
- describe angular relationships of sine waves.
- find instantaneous values using the sine wave formula.
- apply the basic circuit laws (Ohm's and Kirchhoff's) to AC resistive, RC, and RL circuits.
- identify the characteristics of basic nonsinusoidal waveforms.
- use a phasor to represent a sine wave.
- use complex numbers to express phasor quantities.
- describe the basic construction and characteristics of a capacitor and of an inductor.
- analyze series and parallel combination of capacitors and inductors in AC circuits.
- explain mutual inductance and how a transformer is constructed and how it operates.
- determine the effect of a resistive load across the secondary winding of a transformer.
- describe the relationship between current and voltage in RC, RL, and RLC circuits.
- determine the impedance, phase angle, and power in series, parallel, and series-parallel, RC, RL and RLC circuits.
- describe how RC, RL circuits operate as a filter.
- analyze a circuit for series and parallel resonance.
- determine the bandwidth of resonant circuits, define half-power frequency, Q, and selectivity.
- analyze low-pass, high-pass, band-pass, and notch filters, determine critical frequencies, roll-offs, and generate Bode plots.
- apply the superposition theorems to AC circuit analysis.
- apply Thevenin's power transfer theorem to AC circuits for analysis.
- apply the maximum power transfer theorem to AC circuits for analysis.
- comprehend troubleshooting methodology and approaches for solving problems in DC and AC circuits.

EL 119 - Fundamentals of DC and AC Circuits Analysis Laboratory

- demonstrate basic safety procedures.
- construct DC and AC circuits from a schematic drawing.
- correctly measure all DC and AC parameters in resistive and reactive circuits, using standard test instruments.
- interpret circuit parameters, diagnose and correct malfunctions in electronic circuits.
- design DC and AC circuits using standard engineering practices.
- construct Thevenin equivalents to operating DC and AC circuits.
- develop graphs indicating relationships of electronic parameters.
- evaluate the operation and circuit parameters for all experimental circuits.

Entrance Skills Other (Legacy)

1. model digital circuits using Boolean algebra.
2. derive an equivalent logic circuit from a Boolean expression.
3. design and analyze counters, registers, and dividers using bi-stable devices.
4. properly interface logic families that have different operational parameters.
5. design logic systems for a stated problem using standard engineering practices.
6. analyze logic systems to determine their operating parameters.

7. correctly analyze and solve electronic circuits.

8. identify the average, peak, peak-to-peak values of AC waveforms.

9. predict the frequency and period of AC waveforms.

10. interpret circuit parameters.

11. design DC and AC circuits using standard engineering practices.

12. develop graphs indicating relationships of electronic parameters.

Catalog Description

Digital electronics laboratory designed to parallel Digital Devices and Circuits (EL 125). Emphasizes device operation in circuits and networks and the proper use of standard digital logic test instruments used in the process of troubleshooting and verifying proper circuit operations.

Course Content

Lecture

1. Basic of Logic Devices and IC Technologies
2. Number Systems and Codes
3. Boolean Algebra and Mapping
4. Combinational Logic and Functions
5. Bi-stable Devices, Circuits and Applications
6. Registers and Memories
7. Interfacing and Data Transmission Techniques
8. ALU's

Course Objectives

At the end of the course, the student will be able to:

1. construct a logic circuit from a schematic diagram using digital logic integrated circuits.
2. test and analyze constructed logic circuits for proper operating parameters.
3. use modern testing instruments to gather information necessary in defect analysis of logic circuits.
4. design logic circuits and networks to solve assigned projects using standard engineering practices.

Methods of Instruction

- **Lab**

Outside Assignments

- **Other Assignments**
  1. Study laboratory experiments, evaluate sample problems and circuits.
  2. Mathematically evaluate the operation of each experimental circuit.
  3. Draw a component diagram for each experimental circuit.
  4. Answer a series of questions designed so that each student can express in writing the conclusions they have developed from performing each experiment.
  5. Study instructor handouts on selected topics.
  6. Use computer application software for tutorial purposes and evaluation of circuit parameters.

  Sample assignments:
  1. Does your predicted timing diagram for figure 14-2 agree with the timing diagram captured by your logic analyzer?
  2. If the input clock frequency into two cascaded 7490A's is 8kHz, what will the output frequency be at output Qd of the first 7490A? At the Qd output of the second 7490A?

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Lab Activities**
- **Other**

1. Laboratory reports are graded for accuracy and content. Reports consist of:
A. text study information
B. mathematical evaluations of each circuit studied in the experiment
C. component diagrams for each circuit
D. design problem solutions
E. procedures and data collection
F. end of experiment questions and conclusions

2. Midterm laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, and interpret their data to determine electrical concepts. A written examination is also given emphasizing circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.

3. A final laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, and interpret their data to determine electrical concepts. A written examination is also given emphasizing circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.

Sample test questions:
1. Explain the advantages and difficulties of using a data selector for the implementation of combinational logic designs.
2. Explain the processes required to implement 9's and 10's complementation when using BCD arithmetic.

Adopted Texts and Other Instructional Materials

Textbooks
None

Other Texts

1. Fletcher, W. An Engineering Approach to Digital Design. Prentice-Hall. I980
2. Greenfield, J. Practical Digital Design Using IC's.
3. Roth, C. Fundamentals of Logic Design. West. I985
4. Buchla. Experiments in Digital Fundamentals with VHDL. 1st ed. Prentice Hall 2003.
5. Instructor provided materials
6. Computer application programs
7. Data storage device (flash drive)
8. Electronic parts and proto boards
9. Three-ring binder
10. Graph paper/school supplies

Instructional Materials
None

Student Learning Outcomes

1. EL126 SLO1 - Design, construct, and test standard digital logic circuits for proper operating parameters.
2. EL126 SLO2 - Correctly measure and interpret digital logic circuit measurements using standard testing instruments and correct malfunctions using troubleshooting methodology.
3. EL126 SLO3 - Demonstrate knowledge of technology applicable to the field of digital systems, and show a proficiency in appropriate software used in digital design.

Distance Learning

This course is not Distance Learning.

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Board Approval: 05/16/2006
PCA Established:
DL Conversion:
Date Reviewed:
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics and
Department: Industrial Technology
Prefix and Number: EL 128
Catalog Course Title: Introduction to Renewable Energy
Banner Course Title: Intro to Renewable Energy

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade or Pass/No Pass

Requisites

Prerequisite
CEL 104 Introduction to Robotics and Mechatronics
or

Prerequisite
EL 104 Introduction to Robotics and Mechatronics
or

Prerequisite
ET 104 Introduction to Robotics and Mechatronics

Entrance Skills

Upon entering this course, the student should be able to:

CEL 104 - Introduction to Robotics and Mechatronics

- explain the concept and characteristics of a signal source.

- select and configure proper circuits to achieve desired interfacing requirements between a signal source and a downstream device such as a microcontroller or data acquisition system.
- explain the practical limitations of operational amplifiers and estimate the effects of these limitations on output voltage and current of the op-amp.
- design and analyze the performance of RC low-pass and high-pass filter circuits.
- explain the basic operation of bipolar and MOS field-effect transistors and design with them to activate solenoids, relays, motors, etc. from signal sources.
- explain the input/output characteristics of digital logic devices and design a logic circuit that accomplishes a given task.
- explain the underlying operational principles of servo motors.
- determine the torque and speed requirements for a given motion control application considering system inertia, external forces or torques, and motion profiles and select an appropriate motor.
- explain the basic structure of the BASIC Stamp2 and 68HC11 microcontrollers.
- write PBASIC, Assembly, and C language programs to successfully perform digital input and output functions from a microcontroller port.
- explain the common analog-to-digital-conversion (A/D) methods.
- develop a program to successfully perform A/D conversion using the BASIC Stamp2 and 68HC11 microcontrollers.
- explain the digital-to-analog (DAC) conversion process.
- write programs to successfully interface analog and digital devices, such as sensors and actuators, to th BASIC Stamp2 and 68HC11 microcontrollers.
- function effectively, as a team member, in carrying out laboratory assignments and open-ended project.
- document, in written form, laboratory experiments and projects clearly and completely.

EL 104 - Introduction to Robotics and Mechatronics

- explain the concept and characteristics of a signal source.
- select and configure proper circuits to achieve desired interfacing requirements between a signal source and a downstream device such as a microcontroller or data acquisition system.
- explain the practical limitations of operational amplifiers and estimate the effects of these limitations on output voltage and current of the op-amp.
- design and analyze the performance of RC low-pass and high-pass filter circuits.
- explain the basic operation of bipolar and MOS field-effect transistors and design with them to activate solenoids, relays, motors, etc. from signal sources.
- explain the input/output characteristics of digital logic devices and design a logic circuit that accomplishes a given task.
- explain the underlying operational principles of servo motors.
- determine the torque and speed requirements for a given motion control application considering system inertia, external forces or torques, and motion profiles and select an appropriate motor.
- explain the basic structure of the BASIC Stamp2 and 68HC11 microcontrollers.
- write PBASIC, Assembly, and C language programs to successfully perform digital input and output functions from a microcontroller port.
- explain the common analog-to-digital-conversion (A/D) methods.
- develop a program to successfully perform A/D conversion using the BASIC Stamp2 and 68HC11 microcontrollers.
- explain the digital-to-analog (DAC) conversion process.
- write programs to successfully interface analog and digital devices, such as sensors and actuators, to th BASIC Stamp2 and 68HC11 microcontrollers.
- function effectively, as a team member, in carrying out laboratory assignments and open-ended project.
- document, in written form, laboratory experiments and projects clearly and completely.

ET 104 - Introduction to Robotics and Mechatronics

- explain the concept and characteristics of a signal source.
- select and configure proper circuits to achieve desired interfacing requirements between a signal source and a downstream device such as a microcontroller or data acquisition system.
- explain the practical limitations of operational amplifiers and estimate the effects of these limitations on output voltage and current of the op-amp.
- design and analyze the performance of RC low-pass and high-pass filter circuits.

- explain the basic operation of bipolar and MOS field-effect transistors and design with them to activate solenoids, relays, motors, etc. from signal sources.
- explain the input/output characteristics of digital logic devices and design a logic circuit that accomplishes a given task.
- explain the underlying operational principles of servo motors.
- determine the torque and speed requirements for a given motion control application considering system inertia, external forces or torques, and motion profiles and select an appropriate motor.
- explain the basic structure of the BASIC Stamp2 and 68HC11 microcontrollers.
- write PBASIC, Assembly, and C language programs to successfully perform digital input and output functions from a microcontroller port.
- explain the common analog-to-digital-conversion (A/D) methods.
- develop a program to successfully perform A/D conversion using the BASIC Stamp2 and 68HC11 microcontrollers.
- explain the digital-to-analog (DAC) conversion process.
- write programs to successfully interface analog and digital devices, such as sensors and actuators, to th BASIC Stamp2 and 68HC11 microcontrollers.
- function effectively, as a team member, in carrying out laboratory assignments and open-ended project.
- document, in written form, laboratory experiments and projects clearly and completely.

Entrance Skills Other (Legacy)

1. explain the application of atomic theory to electronics; correctly analyze and solve electronic circuits; express in writing the relationship between electricity and magnetism.
2. describe in writing the construction, operation, and purpose of resistors, potentiometers, switches, fuses, capacitors, inductors and batteries.
3. identify the average, effective, peak and peak-to-peak values of AC waveforms; predict the frequency and period of AC waveforms.
4. identify defects in DC and AC circuits; interpret circuit parameters, diagnose and correct malfunctions in electronic circuits.
5. design DC an AC circuits using standard engineerig practices; develop graphs indicating relationships of electronic parameters.
6. evaluate the operation and circuit parameters of all experimental circuits.
7. interface electromechanical systems to microcontrollers.
8. use commonly used electronic test and measurement instrumentation and develop Assembly and PBASIC computer language programs for automation control.

Catalog Description

A study of the principles behind energy generation and conversion that can be applied to modern electrical, mechanical, and chemical devices that use or produce power. Special emphasis will be given to the study of electricity as a renewable energy source. This course is not open to students who are enrolled in or have received credit for Electronics 128 or Engineering Technology 128.

Course Content

Lecture

1. Solar Thermal Energy

2. Solar Photovoltaics
3. Wind Energy
4. Hydroelectricity
5. Geothermal Energy
6. Bioenergy
7. Integration and Control

Course Objectives

At the end of the course, the student will be able to:

1. design programmable charger systems for rechargeable batteries.
2. describe the operation of photovoltaic cells.
3. design power generation systems using solar cells.
4. fabricate servo-driven sun tracking capabilities to maximize power output of energy system.
5. describe the operation of AC alternators.
6. design power generation systems using wind-driven AC alternators.
7. determine the generation of three-phase power using both Delta or Wye configurations.
8. convert AC into DC using two basic forms of rectification, half-wave and full-wave.
9. design, build and program half- and full-wave rectification systems.
10. compare single-phase and three-phase power generation and applications to real-world devices.
11. design and program microcontroller systems to collect, log, plot, and analyze data from energy generation sources.
12. program microcontroller systems for control of energy generation sources.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Other Assignments**

  Cooperative learning group projects; presentations; short papers; research; and the following:
  1. Readings from adopted text and instructor handouts; evaluate sample problems and work end of chapter problems.
  2. Use computer applications to expand upon circuit analysis and comprehension.
  3. Use the Internet, as an information resource, to support topics studied in this course.
  4. Online practice quizzes and take-home exams covering assigned and related topics.
  5. Design projects assigned stressing application of learned concepts and theories.

  Sample writing assignment:
  Using the following diagram, explain the operation of the photovoltaic reaction for the charging of battery storage devices.

Methods of Evaluation

1. Comprehensive written exams for each major study area include problem solving techniques, word type problems, & will be graded for accuracy & techniques used for problem solutions.
2. End of chapter problems are assigned as homework & graded for accuracy.
3. Individual & group design projects, presentations, short papers are assigned & graded for quality of research, style & techniques applied & presented, & proper engineering practices.
4. Comprehensive final exam graded for accuracy & applied techniques.
5. Laboratory reports consisting of: text study information, mathematical evaluations of each experimental circuit studied; component diagrams for each circuit; design problem solutions; procedures & data collection; end of experiment questions & conclusions are graded for accuracy & content.

Sample essay question:
Read the explanation of how the following programmable battery charger program works, & discuss how & why the timer takes 64 seconds to complete its operation & reset.

```
Exp_1_Charge:
IF (doneCharging - True) THEN GOTO Exp_1_End
HIGH ChargeBatt
LOW DrainBatt
TOGGLE ChargeLed
LOW DrainLED
LOW ReplayLED
```

The first line of code checks the doneCharging flag. It it's True, the program simply exits. Otherwise, a HIGH ChargeBatt activates Charge transistor circuit, which allows current to begin flowing into the batteries (refer to Fig. 2-3). Correspondingly, the LOW DrainBatt deactivates the Discharge transistor circuit, disabling the batteries to drain or discharge. The TOGGLE instruction causes the green charge LED to flash each time through this part of the subroutine. Finally, the last two instructions deactivate the other two LEDS. Now to the next group of instructions.

```
a2dMuxId = a2dMuxId3
GOSUB A2D
ch3 = (255-a2dResult)
avgCurrent = aveCurrent+ch3

a2dMuxID = a2dMuxId2
GOSUB A2D
ch2 = a2dResult
avgVolts = avgVolts+ch2

IF (ch2>BattFullChg) AND (dataPtr<10) THEN
doneChargingin = True
HIGH ChargeLed
LOW ChargeBatt
ENDIF
counter = counter - 1
IF counter <> 0 THEN Exp_1_END
```

The first two instructions set the A/D Converter channel to ch3 & then take a voltage sample. While still a voltage sample, this is actually a measure of BCI, the battery charge current, based on the voltage drop across the 10 ? resistor connected to Vdd. The voltage drop across this resistor is the difference between Vdd, which is 5.00 volts (or 255 as it would be measured by the A/D converter) minus the sampled voltage (a2dResult). The third instruction computes this result & sets Ch3 equal to it. The StampPlot macro further adjusts this voltage reading to the equivalent current value. Finally, the fourth instruction adds the value of Ch3 to the avgCurrent. Recall that avgCurrent and avgVolts, coming up next, were both initialized to zero in the Exp_1_Init subroutine, so we're starting off our averaging cycle with a clean slate. The next four instructions sample the battery voltage directly & store the result to avgVolts, with A/D channel ch2 displayed as BV, or battery voltage, on StampPlot.

Following this, the IF statement is placed here to protect from overcharging the batteries by comparing the current battery voltage to the value of BattFullCh (CON 150 or 3:00 volts). However, this event must occur early in the charging cycle when dataPtr is less than 10. Said another way, this event must occur within the first 256 seconds of the charge cycle. You'll see what we mean shortly. And setting codePtr=2 will cause the BRANCH instruction to jump to the Exp_1_Drain subroutine the next time through. The following instruction decrements the averaging counter (counter), which was initialized to zero in Exp_1_Init. If this is the first

time through this subroutine from power on or reset, the counter value will be 255, since decrementing a byte set to zero causes the value to "roll over" to 255. Therefore, it will take another 255 decrements until the counter value is again zero. And this will take just over 64 seconds.

Adopted Texts and Other Instructional Materials

Textbooks

1. Chiras *The Homeowner's Guide to Renewable Energy* 2006 -

Other Texts

1. Software Tools (supplied by instructor and textbook bundle)
2. Microcontroller Development System (supplied by instructor)
3. Scientific Calculator
4. Graph paper and normal school supplies
5. Instructor handouts
6. Data Storage Device (Thumb Drive)
7. B. Sorensen. Renewable Energy. 3rd ed. Academic Press. 2004
8. G. Masters. Renewable and Efficient Electric Power Systems. Wiley-IEEE Press. 2004

Instructional Materials
None

Student Learning Outcomes

1. EL128 SLO1 - Demonstrate an understanding of fundamental alternative energy concepts that pertain to the generation of electricity.
2. EL128 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to design and fabricate alternative energy systems.
3. EL128 SLO3 - Demonstrate knowledge of technology applicable to the field alternative energy systems, and show a proficiency in appropriate software used in system design.

Distance Learning

Delivery Methods

- Internet

Instructor Initiated Contact Hours Per Week: 3.000

Contact Types

1. Chat room
2. Discussion Board
3. Email Communcation (group and/or individual communications)
4. Telephone Contacts
5. Orientation Sessions
6. Group Meetings
7. Review Session
8. Labs
9. Testing

Adjustments to Assignments
see initial proposal

Adjustments to Evaluation Tools
see initial proposal

Strategies to Make Course Accessible to Disabled Students
yes

Inform Students
Classroom meetings, orientation, and online announcements.

Additional Comments
None

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Board Approval: 05/16/2006
PCA Established: 05/16/2006
DL Conversion:
Date Reviewed: Fall 2017
Catalog Year: 2018/2019

Allan Hancock College
Course Outline

Discpline Placement: Electronics -1
Department: Industrial Technology
Prefix and Number: EL 131
Catalog Course Title: Programmable Logic Controllers and Controll Design
Banner Course Title: PLCs/Industrial Control Design

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 125 Digital Devices and Circuits

Entrance Skills

Upon entering this course, the student should be able to:

EL 125 - Digital Devices and Circuits

- model digital circuits using Boolean algebra.
- derive an equivalent logic circuit from a Boolean expression.
- design and analyze counters, registers, and dividers using bi-stable devices.
- properly interface logic families that have different operational parameters.
- design logic systems for a stated problem using standard engineering practices.
- analyze logic systems to determine their operating parameters.

Catalog Description

A study of the purpose and operating features of a programmable logic controller (PLC). Topics include PLC terminology, architecture, input/output modules, memory, commands for internal relays, on/off timers, up/down counters, use of subroutines, program control, and math instructions. Relay schematics, ladder logic diagrams, and programming of logic controllers are emphasized. Sensing devices and time-driven process sequences will be studied and integrated into control systems. This course is not open to students who are enrolled in or have received credit for CEL 131 or ET 131.

Course Content

Lecture

1. PLC Principles of Operation
2. PLC Hardware Components
3. Review of Number Systems, Codes, and Fundamentals of Logic
4. PLC Programming, RSLogic Familiarization
5. PLC Wiring Diagrams and Ladder Logic Programs
6. Programming Timers and Counters
7. Program Control Instructions
8. Math, Sequencer, and Shift Register Instructions
9. PLC Installation Practices, Editing and Troubleshooting
10. Process Control and Data Acquisition Systems
11. Computer-Controlled Machines and Process
12. Projects: Traffic Light Control Scenario, Elevator Control Scenario, Amusement Ride Scenario, and Power Management System Scenario

Course Objectives

At the end of the course, the student will be able to:

1. define what a PLC is and list its advantages over relay systems.
2. identify the main parts of a PLC and describe their function.
3. outline the basic sequence of operation for a PLC.
4. describe the basic circuitry and applications for discrete and analog I/O and CPU specifications.
5. explain I/O addressing.
6. explain the BCD, Gray, and ASCII code systems, and perform math operations with binary numbers.
7. construct circuits from Boolean expressions and derive Boolean equations from given logic circuits.
8. convert relay ladder schematics to ladder logic programs.
9. develop elementary programs based on logic gate functions.
10. program instructions that perform logical operations.
11. explain the operation of sensors commonly found in PLC installations.
12. explain the operation of output control devices commonly found in PLC installations.
13. compare sequential and combination control processes.
14. write PLC programs directly from a narrative description.
15. describe the operation of pneumatic on-delay and off-delay timers.
16. convert fundamental timer relay schematic diagrams to PLC ladder logic programs.
17. analyze and interpret typical PLC timer ladder logic programs.
18. list and describe the functions of PLC counter instructions.
19. describe the operation principle of a transitional, or one-shot, contact.
20. apply the PLC counter function and associated circuitry to control systems.
21. state the purpose of program control instructions.
22. explain the functions of subroutines.
23. describe safety considerations built into PLCs and programmed into a PLC installation.
24. explain how the temporary end instruction can be used to troubleshoot a program.
25. describe the basic operation of a closed-loop control system.

26. interpret data transfer and data compare instructions as they apply to a PLC program.
27. apply combinations of PLC arithmetic functions to processes.
28. compare the operation of an event-driven and a time-driven sequencer.
29. interpret and develop programs that use shift registers.
30. list and describe specific PLC troubleshooting procedures.
31. identify and describe the functions of bleeder resistors in PLCs.
32. compare individual, centralized, and distributive control systems.
33. outline the function of the different parts of a data acquisition system.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Outside Assignments**
  Cooperative learning group projects; presentations; short papers; research; and the following:
  1. readings from adopted text, CAI software, and instructor handouts; evaluate sample problems, work end of chapter problems and lab exercises.
  2. use computer applications to expand upon circuit analysis and comprehension.
  3. use the Internet, as an information resource, to support topics studied in this course.
  4. online practice quizzes and take-home exams covering assigned and related topics.
  5. design projects assigned stressing application of learned concepts and theories.

- **Sample Assignment(s)**
  Prepare a users and maintenance pamphlet that explains the operation and the logic you designed for one of the four-class projects: Traffic Light Scenario, Elevator Control Scenario, Amusement Ride Scenario, or the Power Management System Scenario.

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Group Projects**
- **Home Work**
- **Lab Activities**
- **Other**
  1. Comprehensive written examinations for each major study area. Exams will include problem solving techniques and word type problems. The exams will be graded for accuracy and techniques used for problem solutions.
  2. End of chapter problems are assigned as homework and graded for accuracy.
  3. Individual and group design projects, presentations, and short papers are assigned and graded for quality of research, style and techniques applied and presented, and for proper engineering practices.
  4. Comprehensive final exam. Exam graded for accuracy and applied techniques.
  5. Laboratory reports are graded for accuracy and content. Reports consist of:
  a. text study information.
  b. mathematical evaluations of each experimental circuit studied.
  c. component diagrams for each circuit.
  d. design problem solutions.
  e. procedures and data collection.
  f. end of experiment questions and conclusions.

  Sample essay questions:
  1. Compare and contrast the operation of the final control element in on/off and proportional control systems.

2. Compare the ways a timer is addressed in the Allen-Bradley PLC-5 and SLC-500 controllers with the methods used in a ControlLogix controller.

Adopted Texts and Other Instructional Materials

Textbooks

1. Petruzella *Programmable Logic Controllers* Edition: 5th 2017
2. Petruzella *Lab Manual for Programmable Logic Controllers, with Logixpro PLC Simulator* Edition: 5th 2017
3. Petruzella *Activities Manual for Programmable Logic Controllers* Edition: 5th 2017

Other Texts

1. Software Tools (supplied by instructor and textbook bundle)
2. Instructor handouts
3. NIDA. Homework CD 2. NIDA Corp. 2006.
4. J. Stenerson. Programming PLCs Using Rockwell Automation Controllers. Prentice Hall. 2004.
5. M. Rabiee. Programmable Logic Controllers Hardware and Programming. Goodheart-Willcox. 2002.
6. J. Rehg. Industrial Electronics. Prentice-Hall. 2006.

Instructional Materials

1. Scientific calculator
2. Graph paper/ school supplies
3. Data storage device (flash drive)

Student Learning Outcomes

1. EL131 SLO1 - Demonstrate an understanding of fundamental programmable logic controller concepts that pertains to the areas mechatronics.
2. EL131 SLO2 - Develop and implement software programs for programmable logic devices controlling mechatronic systems.
3. EL131 SLO3 - Design and construct programmable logic controller circuits using mathematical models.

Distance Learning

This course is not Distance Learning.

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Student Learning Outcomes

1. EL162 SLO1 - Demonstration basic safety procedures.
2. EL162 SLO2 - Demonstrate the understanding of basic concepts and procedures for hydraulics and pneumatics.
3. EL162 SLO3 - Design basic fluid power systems using standard engineering practices.

Distance Learning

This course is not Distance Learning.

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1. Describe Pascal's Law as it relates to fluid power.
2. Explain why gases are used for some fluid systems and liquids are used in others.

Methods of Evaluation

- **Exams/Tests**
- **Papers**
- **Projects**
- **Group Projects**
- **Class Participation**
- **Home Work**
- **Class Performance**
- **Other**

Class Performance
1. Comprehensive written examinations for each major study area. Exams will include problem solving techniques and word type problems. The exams will be graded for accuracy and techniques used for problem solutions.
2. End of chapter problems are assigned as homework and graded for accuracy.
3. Individual and group design projects, presentations, and short papers are assigned and graded for quality of research, style and techniques applied and presented, and for proper engineering practices.
4. Comprehensive final exam. Exam graded for accuracy and applied techniques.
5. Reports are graded for accuracy and content. Reports consist of:
a. text study information.
b. mathematical evaluations of each experimental circuit studied.
c. component diagrams for each circuit.
d. design problem solutions.

Sample essay questions:
1. Discuss the pros and cons of hydraulics and pneumatics.
2. Explain why gases are used for some fluid systems and liquids are used in others.

Adopted Texts and Other Instructional Materials

Textbooks

1. NIDA Corporation *Hydraulic and Pneumatic Systems* 2012
2. Esposito, A. *Fluid Power with Applications* Edition: 7th 2013

Other Texts

1. Course's Canvas website for tutorials and supplements
2. NIDA Corporation Homework Disk 2
3. Software Tools (supplied by instructor and textbook bundle)
4. Instructor handouts
5. J. Johnson. Introduction to Fluid Power. Thomson.
6. D. Norvelle. Fluid Power Technology. Thomson.

Instructional Materials

1. Graph paper / school supplies
2. Data storage device (USB)
3. Scientific calculator

Board Approval: 05/16/2006
PCA Established: 05/16/2006
DL Conversion:
Date Reviewed: Fall 2017
Catalog Year: 2018/2019

Allan Hancock College
Course Outline

Discpline Placement: Electronics -1
Department: Industrial Technology
Prefix and Number: EL 133
Catalog Course Title: Mechatronic Systems 1
Banner Course Title: Mechatronic Systems 1

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
CEL 104 Introduction to Robotics and Mechatronics
or EL 104 or ET 104

Entrance Skills

Upon entering this course, the student should be able to:

CEL 104 - Introduction to Robotics and Mechatronics

- explain the concept and characteristics of a signal source.
- select and configure proper circuits to achieve desired interfacing requirements between a signal source and a downstream device such as a microcontroller or data acquisition system.
- explain the practical limitations of operational amplifiers and estimate the effects of these limitations on output voltage and current of the op-amp.
- design and analyze the performance of RC low-pass and high-pass filter circuits.
- explain the basic operation of bipolar and MOS field-effect transistors and design with them to activate solenoids, relays, motors, etc. from signal sources.

- explain the input/output characteristics of digital logic devices and design a logic circuit that accomplishes a given task.
- explain the underlying operational principles of servo motors.
- determine the torque and speed requirements for a given motion control application considering system inertia, external forces or torques, and motion profiles and select an appropriate motor.
- explain the basic structure of the BASIC Stamp2 and 68HC11 microcontrollers.
- write PBASIC, Assembly, and C language programs to successfully perform digital input and output functions from a microcontroller port.
- explain the common analog-to-digital-conversion (A/D) methods.
- develop a program to successfully perform A/D conversion using the BASIC Stamp2 and 68HC11 microcontrollers.
- explain the digital-to-analog (DAC) conversion process.
- write programs to successfully interface analog and digital devices, such as sensors and actuators, to th BASIC Stamp2 and 68HC11 microcontrollers.
- function effectively, as a team member, in carrying out laboratory assignments and open-ended project.
- document, in written form, laboratory experiments and projects clearly and completely.

Catalog Description

This is a hands-on mechatronic systems course that focuses on the electromechanical concepts (mechanics, electronic, and programming) of automated systems. Emphasis is placed on how industrial grade sensors and transducers function and upon how they are interfaced into control systems. Study topics include: transducers and sensors for light, heat, motion, pressure, and position control; switching devices; input and output signal conditioning; continuous, closed-loop, and proportional integral derivative process control; and safety. This course is not open to students who have received credit for, or are enrolled in ET 133 or CEL 133.

Course Content

Lecture

1. Discrete control input and output devices
2. Introduction to Solid-State Devices in Industrial Applications, Operational Amplifiers, and Linear ICs
3. SCR, TRIACs, and other Thyristors
4. Discrete Automation Sensors and Devices including Vision Systems
5. Analog Process Control Devices and Sensors: Heat, Pressure, Flow, Level, and Position
6. Control of Continuous Processes
7. Data Communication between Intelligent Machines
8. Safety

Course Objectives

At the end of the course, the student will be able to:

1. identify, describe, and make an application selection for mechanically activated limit switches and process switches.
2. identify, describe, and make an application selection for the following control output devices: solenoids, commercial relays, industrial control and time delay relays, contactors, process solenoid valves, pneumatic direction control valves, heaters, and pilot lamps.
3. describe the operation of the low-pass, high-pass, bandpass, and band-elimination active filters.
4. describe the structure and operation of SCRs, tracs, and other members of the thyristor family.
5. select the appropriate noncontact sensor given the parameters for a sensing application and integrate the sensor using good design practices.
6. match the output of a sensor to the input of the controller using current-sourcing and current-sinking techniques.

7. select the appropriate type of vision and illumination system given the parameters for a sensing application.
8. analyze the characteristics of devices that convert electricity into light and light into electricity.
9. determine the range, linearity, and sensitivity of various thermal transducers.
10. analyze dynamic temperature transducer amplifiers.
11. identify the principles of motion and compass transducers.
12. compute linear and circular motion rates based on a system's mechanical and electrical parameters.
13. analyze the operation of optical-motion-to-frequency and motion-to-analog-DC-voltage transducer circuits for RPM, velocity, acceleration, and deceleration.
14. identify the principles of position-sensing circuits.
15. compute linear and rotary position based on electrical and mechanical circuit parameters.
16. develop a safety strategy, including risk assessment, risk elimination, and hazard minimization.
17. identify the principles of A/D and D/A conversion.
18. analyze the operation of PAM, PWM, PPM, modulation and demodulation circuits.
19. list the general closed-loop control modes and explain how each acts to correct the system error.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Outside Assignments**
  Cooperative learning group projects; presentations; short papers; research; and the following:
  1. Readings from adopted text, CAI software, and instructor handouts; evaluate sample problems; work end of chapter problems and lab exercises.
  2. Use computer applications to expand upon circuit analysis and comprehension.
  3. Use the Internet, as an information resource, to support topics studied in this course.
  4. Online practice quizzes and take-home exams covering assigned and related topics.
  5. Design projects assigned stressing application of learned concepts and theories.
- **Sample Assignment(s)**
  Describe how current-sourcing and current-sinking outputs operate. Why is current sinking associated with NPN transistors and current sourcing with PNP?

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Projects**
- **Home Work**
- **Lab Activities**
- **Other**
  1. Comprehensive written examinations for each major study area. Exams will include problem solving techniques and word type problems. The exams will be graded for accuracy and techniques used for problem solutions.

  2. End of chapter problems are assigned as homework and graded for accuracy.

  3. Individual and group design projects, presentations, and short papers are assigned and graded for quality of research, style and techniques applied and presented, and for proper engineering practices.

  4. Comprehensive final exam. Exam graded for accuracy and applied techniques.

  5. Laboratory reports are graded for accuracy and content. Reports consist of:
  a. Text and CAI study information
  b. Mathematical evaluations of each experimental circuit studied

c. Component diagrams for each circuit
d. Design problem solutions
e. Procedures and data collection
f. End of experiment questions and conclusions

Sample Essay Question:
How can you compare the frequency response specification given for inductive sensors with the rise- and fall-time specification given for photoelectric sensors?

Adopted Texts and Other Instructional Materials

Textbooks

1. NIDA Corporation *Model 1405 Transducers, CAI software* 2015
2. Miller, M *Industrial Electricity & Motor Control* 2013

Other Texts

1. Anderson, G. PLC Programming Using RS500: Basic Concepts of Ladder Logic Programming, Vol. 1, 2015.
2. Microcontroller Development Boards and Lab Components (supplied by instructor)
3. Instructor handouts
4. Lindsay, What's a Microcontroller?, 2012, Parallax (available online)
5. Lindsay, Robotics with the Boe-Bot, 2012, Parallax (available online)
6. W. Kleitz, Digital Electronics with VHDL, 2011, Prentice Hall
7. M. Gilliland, The Microcontroller Application Cookbook, 2000, Woodglen Press
8. NIDA Corporation Homework Disc 2 Software Tools (supplied by instructor and textbook bundle)

Instructional Materials

1. Data storage device (USB)
2. Scientific calculator

Student Learning Outcomes

1. EL133 SLO1 - Apply basic mathematical, scientific, electronic, and engineering concepts to evaluate sensing and transducer devices used in mechatronic systems.
2. EL133 SLO2 - Select the appropriate type of transmission medium, sensing and transducer elements in the design of mechatronic systems.
3. EL133 SLO3 - Identify the principles of basic mechatronic concepts.

Distance Learning

This course is not Distance Learning.

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Board Approval: 03/17/1992
PCA Established:
DL Conversion:
Date Reviewed: Spring 2017
Catalog Year: 2018/2019

Allan Hancock College
Course Outline

Discpline Placement: Electronics -1
Department: Industrial Technology
Prefix and Number: EL 135
Catalog Course Title: Electronic Measurement and Instrumentation
Banner Course Title: El Measurement & Instrumentati

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	3.000	48.0 - 54.0	3.0
Lab	0.000	0.0 - 0.0	0.0
Total Hours	3.0	48.0 - 54.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 122 Electronic Devices and Circuits
and

Prerequisite
EL 123 Electronic Devices and Circuits Laboratory
and

Prerequisite
EL 125 Digital Devices and Circuits
and

Prerequisite
EL 126 Digital Devices and Circuits Lab

Advisories
EL 136 Electronics Measurement and Instrumentation Laboratory

Entrance Skills

Upon entering this course, the student should be able to:

EL 122 - Electronic Devices and Circuits

- describe the electrical characteristics of semiconductor materials.
- explain in writing how semiconductor devices operate.
- differentiate the schematic symbols that are used to represent a wide variety of semiconductor devices.
- interpret device specifications using manufacturer's data sheets.
- analyze transistor amplifier circuits, describe their operation and list the characteristics for each.
- identify and explain the operation of power supply rectifiers, filters, and regulation circuits.
- evaluate the effects of negative and positive feedback on integrated circuits.
- analyze the basic operation of common linear integrated circuit systems

EL 123 - Electronic Devices and Circuits Laboratory

- determine component types and lead or pin indentifications.
- interpret semiconductor manufactures data sheets and characteristics curves.
- operate semiconductor testers and curve tracers.
- design properly biased transistor or linear amplifier circuits.
- construct a circuit and collect the necessary measurements required to determine voltage, current and power gains, input and output impedances, and frequency response.
- design and construct linear integrated circuits.

EL 125 - Digital Devices and Circuits

- model digital circuits using Boolean algebra.
- derive an equivalent logic circuit from a Boolean expression.
- design and analyze counters, registers, and dividers using bi-stable devices.
- properly interface logic families that have different operational parameters.
- design logic systems for a stated problem using standard engineering practices.
- analyze logic systems to determine their operating parameters.

EL 126 - Digital Devices and Circuits Lab

- construct a logic circuit from a schematic diagram using digital logic integrated circuits.
- test and analyze constructed logic circuits for proper operating parameters.
- use modern testing instruments to gather information necessary in defect analysis of logic circuits.
- design logic circuits and networks to solve assigned projects using standard engineering practices.

EL 136 - Electronics Measurement and Instrumentation Laboratory

- operate the most commonly used electronic instruments.
- calibrate instruments and evaluate both passive and active devices and circuits with laboratory grade instruments.
- trace the circuits of test equipment and signal trace the instrument with an oscilloscope.
- make complex instrumentation measurements using electronic instruments, mathematical and mechanical skills.
- make alterations in testing instruments to meet special calibration requirements.
- operate an ATE station.
- make response curves of electronic instruments to industrial standards.

Catalog Description

Designed to familiarize students with operating principles and characteristics of basic electronic testing equipment as well as advanced specialized measuring instruments. Methods of operation and calibration of these devices are covered including an overview of Automated Test Equipment (ATE) systems.

Course Content

Lecture

1. Passive Multimeters
2. Active Multimeters
3. Analog and Digital Oscilloscopes
4. Signal Generators
5. Special Measuring Instruments
6. Measurement Systems (ATE)

Course Objectives

At the end of the course, the student will be able to:

1. analyze the operating principles and applications of the commonly used electronic instruments such as multimeters, signal generators, oscilloscopes, electronic bridges, and frequency measuring instruments.
2. calibrate instruments against standards.
3. read schematic diagrams of electronic test instruments and equipment.
4. mathematically calculate the values to make alterations in test instruments to meet special requirements.
5. evaluate Automated Test Equipment (ATE) requirements for the performance of specific measurements.

Methods of Instruction

- **Lecture**

Outside Assignments

- **Outside Assignments**
  1. Readings from adopted text and instructor handouts on selected topics, evaluate sample problems and work end of chapter problems.
  2. Solutions of word problems stressing mathematical modeling and formulations.
  3. Use computer applications software to expand circuit analysis formulations and concepts.
  4. Design projects assigned stressing application of learned concepts and theories.

  Sample problems:
  1. A 10uA meter movement has a resistance of 1500 ohms. What value of multiplier resistor is

required to extend the range to 200 volts?
2. Draw a simple diagram of a dual slope ADC and explain the operation of each major section.

- **Outside Assignments**
  Home Work

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Home Work**
- **Other**
  1. Comprehensive written examinations for each major study area. Examinations are to include problem solving techniques and word type problems. These examinations are graded for accuracy and the techniques used in solving the problems.
  2. Assigned homework problems will be graded for accuracy.
  3. Design projects will be graded for techniques that were applied and for proper engineering practices.
  4. Quizzes and tests for assigned and related topics.
  5. Comprehensive final examination will be graded for accuracy and applied techniques.

  Sample essay question: Explain how you would measure the parameters of a non-electrolytic capacitor using an impedance bridge. Be sure to list all the precautions which must be taken to prevent false readings.

Adopted Texts and Other Instructional Materials

Textbooks

1. Groover, Mikell P. *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems* Edition: 6th 2012

Other Texts

1. Operation and service manuals for each instrument studied.
2. Scientific calculator.
3. Graph paper and normal school supplies.
4. Computer application programs.
5. USB Flash Drives
6. Three ring binder.

Instructional Materials

None

Student Learning Outcomes

1. EL135 SLO1 - Demonstrate an understanding of the fundamental concepts that pertain to instrumentation and measurements.
2. EL135 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts for the application and calibration of electronic testing instrumentation.

Distance Learning

This course is not Distance Learning.

Generated on: 6/22/2018 9:55:42 AM

Board Approval: 02/18/1975
PCA Established: 03/17/1992
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 136
Catalog Course Title: Electronics Measurement and Instrumentation Laboratory
Banner Course Title: El Measurement & Instrumentati

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	0.000	0.0 - 0.0	0.0
Lab	6.000	96.0 - 108.0	2.0
Total Hours	6.0	96.0 - 108.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Corequisite
EL 135 Electronic Measurement and Instrumentation

Prerequisite
EL 122 Electronic Devices and Circuits
and

Prerequisite
EL 123 Electronic Devices and Circuits Laboratory
and

Prerequisite
EL 125 Digital Devices and Circuits
and

Prerequisite
EL 126 Digital Devices and Circuits Lab

Entrance Skills

Upon entering this course, the student should be able to:

EL 135 - Electronic Measurement and Instrumentation

- analyze the operating principles and applications of the commonly used electronic instruments such as multimeters, signal generators, oscilloscopes, electronic bridges, and frequency measuring instruments.
- calibrate instruments against standards.
- read schematic diagrams of electronic test instruments and equipment.
- mathematically calculate the values to make alterations in test instruments to meet special requirements
- evaluate Automated Test Equipment (ATE) requirements for the performance of specific measurements.

EL 122 - Electronic Devices and Circuits

- describe the electrical characteristics of semiconductor materials.
- explain in writing how semiconductor devices operate.
- differentiate the schematic symbols that are used to represent a wide variety of semiconductor devices.
- interpret device specifications using manufacturer's data sheets.
- analyze transistor amplifier circuits, describe their operation and list the characteristics for each.
- identify and explain the operation of power supply rectifiers, filters, and regulation circuits.
- evaluate the effects of negative and positive feedback on integrated circuits.
- analyze the basic operation of common linear integrated circuit systems

EL 123 - Electronic Devices and Circuits Laboratory

- determine component types and lead or pin indentifications.
- interpret semiconductor manufactures data sheets and characteristics curves.
- operate semiconductor testers and curve tracers.
- design properly biased transistor or linear amplifier circuits.
- construct a circuit and collect the necessary measurements required to determine voltage, current and power gains, input and output impedances, and frequency response.
- design and construct linear integrated circuits.

EL 125 - Digital Devices and Circuits

- model digital circuits using Boolean algebra.
- derive an equivalent logic circuit from a Boolean expression.
- design and analyze counters, registers, and dividers using bi-stable devices.
- properly interface logic families that have different operational parameters.
- design logic systems for a stated problem using standard engineering practices.
- analyze logic systems to determine their operating parameters.

EL 126 - Digital Devices and Circuits Lab

- construct a logic circuit from a schematic diagram using digital logic integrated circuits.
- test and analyze constructed logic circuits for proper operating parameters.
- use modern testing instruments to gather information necessary in defect analysis of logic circuits.
- design logic circuits and networks to solve assigned projects using standard engineering practices.

Entrance Skills Other (Legacy)

The lab experience is the hands-on application of the theory taught in the concurrent class.

Catalog Description

Provides hands-on laboratory experience for the study and construction of electronic testing instruments. The student is introduced to many different types of testing equipment currently used by the electronics industry.

Course Content

Lecture

1. Errors in Experimental Data
2. Voltmeters and Multimeters
3. AC Voltmeters
4. Basic Reference Sources
5. A/D Converters
6. Bridges
7. Oscilloscopes
8. Counter Circuits
9. Function Generators
10. Sweep Frequency Generators
11. Spectrum Analyzer
12. Automated Test Equipment (ATE)

Course Objectives

At the end of the course, the student will be able to:

1. operate the most commonly used electronic instruments.
2. calibrate instruments and evaluate both passive and active devices and circuits with laboratory grade instruments.
3. trace the circuits of test equipment and signal trace the instrument with an oscilloscope.
4. make complex instrumentation measurements using electronic instruments, mathematical and mechanical skills.
5. make alterations in testing instruments to meet special calibration requirements.
6. operate an ATE station.
7. make response curves of electronic instruments to industrial standards.

Methods of Instruction

- **Lab**

Outside Assignments

- **Other Assignments**
  1. Study laboratory experiments, evaluate sample problems and circuits.
  2. Participate in post-lab evaluation discussions.
  3. Mathematically evaluate the operation of each experimental circuit.
  4. Draw a component diagram for each experimental circuit.
  5. Answer a series of questions designed so that students can express in writing the conclusions they have developed from performing each experiment.
  6. Study instructor handouts on selected topics.
  7. Use computer application software for tutorial purposes and evaluation of circuit parameters.

  Sample problems:
  1. Design a function generator using an XR2206 that will satisfy the following specifications: A. Vout = 2 VRMS; Freq. range 20Hz-200KHz; B. Sine and triangle outputs
  2. List the procedure for measuring the level of modulation of an AM signal using a Spectrum Analyzer.

Methods of Evaluation

- **Lab Activities**
- **Other**
  1. Laboratory reports are graded for accuracy and content. Reports consist of: A. text study information B. mathematical evaluations of each circuit studied in the experiment C. component diagrams for each circuit D. design problem solutions E. procedures and data collection F. end of experiment questions and conclusions
  2. Mid term laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, and interpret their data to determine electrical concepts. A written examination is also given emphasizing circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.
  3. A final laboratory examination evaluating the students' abilities to correctly connect circuits, make circuit measurements using standard test instruments, and interpret their data to determine electrical concepts. A written examination is also given emphasizing circuit behavior, components, and test instruments. These examinations are graded for accuracy and content.

  Sample essay question: Explain the major advantages and disadvantages of using an ATE system for testing electronic circuits.

Adopted Texts and Other Instructional Materials

Textbooks

1. Timmerhaus *Electronic Properties, Instrumentation, & Measurements* Edition: 1st 2014

Other Texts

1. Operation and service manuals for each instrument used in the laboratory.
2. Graph paper and normal school supplies
3. Instructor handouts
4. Computer application programs
5. Data storage device
6. Electronic parts and proto boards
7. Three ring binder
8. Heathkit. Electronic Test Equipment. (Book 1 and 2). Heath Company.

Instructional Materials
None

Student Learning Outcomes

1. EL136 SLO1 - Operate and calibrate standard electronic test instruments.
2. EL136 SLO2 - Modify and document circuits in instruments to meet calibration requirements.
3. EL136 SLO3 - Understand how standard electronic test instrumentation systems make measurements.

Distance Learning

This course is not Distance Learning.

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Board Approval: 05/16/2006
PCA Established: 05/17/2006
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: 2018/2019

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 139
Catalog Course Title: Electrical Power, Motors, and Controls
Banner Course Title: Electrical Power, Motors & Con

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 122 Electronic Devices and Circuits
and

Prerequisite
EL 125 Digital Devices and Circuits

Entrance Skills

Upon entering this course, the student should be able to:

EL 122 - Electronic Devices and Circuits

- describe the electrical characteristics of semiconductor materials.
- explain in writing how semiconductor devices operate.
- differentiate the schematic symbols that are used to represent a wide variety of semiconductor devices.
- interpret device specifications using manufacturer's data sheets.
- analyze transistor amplifier circuits, describe their operation and list the characteristics for each.
- identify and explain the operation of power supply rectifiers, filters, and regulation circuits.

- evaluate the effects of negative and positive feedback on integrated circuits.
- analyze the basic operation of common linear integrated circuit systems

EL 125 - Digital Devices and Circuits

- model digital circuits using Boolean algebra.
- derive an equivalent logic circuit from a Boolean expression.
- design and analyze counters, registers, and dividers using bi-stable devices.
- properly interface logic families that have different operational parameters.
- design logic systems for a stated problem using standard engineering practices.
- analyze logic systems to determine their operating parameters.

Catalog Description

A study of electronics, signal communication and power technology that support efficient manufacturing processes for various industries. Topics include motors, their drives and controls, power electronics, PLCs, and communications networks used to monitor industrial processes. This course is not open to students who are enrolled in or have received credit for CEL 139 or ET 139.

Course Content

Lecture

1. Fundamentals of Energy, the Power System, and Quality Considerations
2. Single and Three-Phase Power
3. Transformers, Magnet materials, and Circuits
4. Introduction to DC Motors and Generators
    a. Stepper Motors
    b. DC Series Motors
    c. Brushless DC Motors
5. Introduction to AC Motors and Generators
    a. Single Phase
    b. Three Phase
6. Pulse Width Modulation and Amplification
7. Open Loop Motor Systems
8. Motion Detection
9. Closed Loop Motor Systems
10. Proportional, Integral, and Derivative Control Systems
11. System maintenance and Troubleshooting
12. Building Electrical Systems

Course Objectives

At the end of the course, the student will be able to:

1. describe speed, torque, counter electromotive force, loads, power and efficiency in rotation machinery.
2. describe the operation of DC motors and generators.
3. measure signals in the control circuits for a DC motor/generator set.
4. troubleshoot a DC motor/generator set.
5. describe the operation and characteristics of stepper motors.
6. measure signal in the control circuits for stepper motors.
7. troubleshoot stepper motors.
8. describe AC motor theory of operation, and construction for single and three phase motors.

9. describe the equivalent model of an induction motor transformer.
10. describe general AC generator theory, construction and characteristics.
11. describe the DC Series Field motor and its characteristics.
12. identify the principles of circular force and torque.
13. identify the loaded characteristics of a DC Series Field motor.
14. identify the physical characteristics of a BLDC, brushless DC motor.
15. describe motor drive, position sensing, and other controller functions.
16. perform routine maintenance, operational, and performance tests on motors.
17. identify the principles of PWM, pulse width modulation.
18. describe the operation of PWM motor control.
19. describe the operation of a PWM Amplifier/Driver.
20. describe an open loop motor system.
21. examine block diagrams of open loop systems.
22. list the terminal characteristics of an armature-controlled motor.
23. measure circuit frequency and calculate RPM.
24. identify the characteristics of motion transducers.
25. compute linear and rotary motion rates based on system mechanical and electrical parameters.
26. analyze motion to frequency for RPM and velocity determinations.
27. analyze motion to analog DC for RPM and velocity determinations.
28. describe a closed loop feedback controlled motor system.
29. measure the error and feedback signals in a closed loop DC motor system.
30. describe the basic process of troubleshooting motor control systems.
31. trace signal flow through a closed loop feedback system.
32. troubleshoot and fault isolate to the circuit level of a closed loop feedback system.
33. identify the principles of PID, Proportional, Integral, and Derivative control.
34. adjust the PID proportional gain.
35. adjust the PID integral reset control.
36. adjust the PID derivative rate control.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Outside Assignments**
  Cooperative learning group projects; presentations; short papers; research; and the following:
  1. readings from adopted text and instructor handouts; evaluate sample problems and work end of chapter problems.
  2. use computer applications to expand upon circuit analysis and comprehension.
  3. use the Internet, as an information resource, to support topics studied in this course.
  4. online practice quizzes and take-home exams covering assigned and related topics.
  5. design projects assigned stressing application of learned concepts and theories.
- **Sample Assignment(s)**
  Sample writing assignments:
  1. Explain how the direction of rotation of a three-phase induction motor can be reversed.
  2. What are the advantages of wound-rotor induction motors?

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Papers**
- **Projects**
- **Group Projects**
- **Lab Activities**

- **Other**
  1. Comprehensive written examinations for each major study area. Exams will include problem solving techniques and word type problems. The exams will be graded for accuracy and techniques used for problem solutions.
  2. End of chapter problems are assigned as homework and graded for accuracy.
  3. Individual and group design projects, presentations, and short papers are assigned and graded for quality of research, style and techniques applied and presented, and for proper engineering practices.
  4. Comprehensive final exam. Exam graded for accuracy and applied techniques.
  5. Laboratory reports are graded for accuracy and content. Reports consist of:
  a. text study information.
  b. mathematical evaluations of each experimental circuit studied.
  c. component diagrams for each circuit.
  d. design problem solutions.
  e. procedures and data collection.
  f. end of experiment questions and conclusions.

  Sample essay Questions:
  1. Why is power-factor correction important for industries?
  2. Evaluate and explain the relationships of rotor current and stator current in a three-phase synchronous motor at unity power factor.

Adopted Texts and Other Instructional Materials

Textbooks

1. NIDA Corp *Motors and Motor Control Systems (online)* 2015

Other Texts

1. Course management system for tutorials and supplements.
2. NIDA Corporation Homework sets 2 and 3
3. Software Tools (supplied by instructor and textbook bundle)
4. Instructor handouts
5. G. Rockis. Electrical Motor Controls for Integrated Systems. Industrial Text Co. 2013

Instructional Materials

1. Scientific calculator
2. Graph paper / school supplies
3. Data storage device (USB)

Student Learning Outcomes

1. EL139 SLO1 - Demonstrate an understanding of fundamental motor and generator concepts that pertain to electromechanical systems.
2. EL139 SLO2 - Apply basic mathematical, scientific, electronic, and engineering concepts to evaluate motors and generators used in mechatronic systems.
3. EL139 SLO3 - Troubleshoot motors, generators, and control circuits used in mechatronic systems.

Distance Learning

This course is not Distance Learning.

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Board Approval: 03/16/1993
PCA Established: 12/14/2004
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 146
Catalog Course Title: Electronic Product Design, Fabrication and Documentation
Banner Course Title: Elec Product Design & Fabricat

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	1.000	16.0 - 18.0	1.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	4.0	64.0 - 72.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 122 Electronic Devices and Circuits
or

Prerequisite
EL 125 Digital Devices and Circuits

Entrance Skills

Upon entering this course, the student should be able to:

1. EL 122 - Electronic Devices and Circuits

    - describe the electrical characteristics of semiconductor materials.
    - explain in writing how semiconductor devices operate.
    - differentiate the schematic symbols that are used to represent a wide variety of semiconductor devices.
    - interpret device specifications using manufacturer's data sheets.
    - analyze transistor amplifier circuits, describe their operation and list the characteristics for each.
    - identify and explain the operation of power supply rectifiers, filters, and regulation circuits.
    - evaluate the effects of negative and positive feedback on integrated circuits.
    - analyze the basic operation of common linear integrated circuit systems
2. EL 125 - Digital Devices and Circuits

    - model digital circuits using Boolean algebra.
    - derive an equivalent logic circuit from a Boolean expression.
    - design and analyze counters, registers, and dividers using bi-stable devices.
    - properly interface logic families that have different operational parameters.
    - design logic systems for a stated problem using standard engineering practices.
    - analyze logic systems to determine their operating parameters.

Entrance Skills Other (Legacy)

7. analyze project designs using standard breadboarding techniques.
8. identify electronic components and symbols.
9. differentiate the schematic symbols that are used to represent a wide variety of semiconductor, reactive, and passive electronic devices.
10. interpret device specifications using manufactures data sheets; analyze circuits, describe their operation, and list characteristics for each.

Catalog Description

A study of product fabrication emphasizing mechatronic applications and designs. Topics include the design process; CADD drawings, schematics, diagrams, and support

graphic requirements; printed circuit board layout and population techniques; technical writing; project documentation requirements; surface mount technologies; prototyping; printed circuit board testing, troubleshooting, and final documentation emphasizing hands-on experiences. The use of industry standard computer aided drafting and support software will be studied and utilized in all phases of documentation through camera ready artwork.

Course Content

Lecture

1. Safety and Environmental Concerns
2. The Design Process
3. Schematic and Fabrication Drawings
4. Technical Writing
5. Experimentation and Breadboarding Designs
6. Surface Mount Technologies and Techniques
7. Prototyping PC Board Design
8. Prototyping PC Board Fabrication
9. Prototyping Final Assembly and Project Packaging
10. Testing, Troubleshooting, and Final Documentation

Course Objectives

At the end of the course, the student will be able to:

1. evaluate and interpret the five-stage design and fabrication process.
2. explain what electrical shock is, and how it can affect your heart.
3. describe how to avoid safety problems when working with power tools.
4. discuss environmental concerns with regard to product design and development.
5. select and acquire electronic components.

6. create design drawings that are required to illustrate system operation, circuit function, and packaging concepts.
7. apply computer-based design tools to design, simulate, and analyze electronic circuits.
8. identify likenesses and differences between mechanical, architectural, and electronic drawings.
9. develop the 10-drawing set needed to design and fabricate working prototype projects.
10. write proper technical documents and outlines to support working prototype projects.
11. explain the differences between breadboarding, prototyping, and production.
12. identify factors to consider in creating computer-generated PC board artwork.
13. create a photoresist pattern on the PC board.
14. explain how PC boards are manufactured in industry.
15. produce PC assembly drawings.
16. cut, drill, and punch sheet metal and plastic patterns.
17. produce wiring diagrams.
18. produce the final packaging drawing.
19. assemble the final prototype project.
20. explain the four basic testing and troubleshooting steps.
21. perform preliminary, operational, and performance tests on prototype projects.
22. develop troubleshooting flowcharts.
23. write a Test Results document.
24. write a Summary and Recommendations document.
25. compile the final prototype project report.
26. describe the many advantages of designing with surface mount technologies (SMT).
27. describe automatic SMT assembly using flow soldering.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Outside Assignments**

  1. Read and study adopted textbook including all appendices. Evaluate sample problems in each chapter.
  2. End-of-chapter problems assigned as homework.
  3. Read and study instructor handouts.

- **Other**

  1. Comprehensive exam for each major study area, written and/or practical project, will be graded for accuracy and techniques used in the solution of the problems.
  2. End of chapter questions and problems will be graded.
  3. Design problems will be graded for techniques used in their solution and also for proper engineering practices.
  4. Student projects will be graded for techniques used in their solutions and for proper engineering practices. All projects must meet industry standards.
  5. Mid-term project assigned by the instructor will be graded.
  6. Effective use of CAD equipment will be looked for in each project and drawing.
  7. Final examination will consist of a project selected by the student and a comprehensive exam covering material from all major study areas. Project and written exam will be graded for accuracy and to standards set by industry. The student keeps his/her final project.

  Sample Evaluation Problems that requires student to think independently and write:
  What important characteristic does documentation have that is of great importance to the designer and manufacturer? Why?

Adopted Texts and Other Instructional Materials

Textbooks

1. Electronics Workbench *EWB Multisim Student Edition Life V.9* Edition: 11th 2015

Other Texts

1. Manufacture Product Reference and Applications Manuals. (available in EL Labs).
2. Internet resources
3. Manufacturer's data and reference manuals
4. Graph paper
5. Instructor handouts
6. Hardware development boards
7. Data storage device (flash drive)
8. Scientific Calculator
9. Shimizu, Electronic Fabrication, 2nd edition, Delmar.
10. Department of Defense, Military Standards for Printed Wiring to Electronic Equipment, Department of Defense, online publication.

4. Research data books and manuals for information required for drawings and projects.
5. Design and produce drawings and products from written and verbal instructions.
6. Drawing and art-work assignments will be produced using CAD equipment.
7. Use computer based software as a tool for the analysis of circuit designs.
8. Hands-on student projects are assigned for laboratory experiences.
9. Student selected final project.

- **Sample Assignment(s)**

  Sample Assignment:
  Using CADD software draw a well-proportioned schematic of a Wein Bridge Sine Wave Oscillator; include all component values, reference designators and footnotes.

  Sample Writing Assignment:
  You're an electronics technician working at a small electronics contract manufacturing firm. The company employs 25-30 assemblers to stuff printed circuit boards with electronic components.

  The personnel turnover rate in the assembly area is high, and new hires tend to be inexperienced and lacking in electronic component familiarity. An assembler needs to have a series of Electronic Component Physical Description Sheets depicting and describing the physical characteristics of each component to be installed. The purpose of each sheet is to allow the assembler to quickly and accurately identify the correct electronic component, determine its electrical value, know if it has polarity, and recognize the special physical characteristics affecting its selection and proper installation. With a three-ring binder of individual Electronic Component Physical Description Sheets close at hand, the assembler will be greatly aid in performing his or her assembly job.

  Your assignment is to prepare an Electronic Component Physical Description Sheet. Pick any component. Consider the sample sheet as a guide only (pg 95 of textbook). Feel free to structure your sheet in any way you determine is most effective in helping the assembler identify an electronic component and install it in the correct manner.

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Home Work**
- **Lab Activities**

Instructional Materials
None

Student Learning Outcomes

1. EL146 SLO1 - Demonstrate the understanding of basic concepts and procedures of project design and prototyping.
2. EL146 SLO2 - Construct projects using standard engineering practices.
3. EL146 SLO3 - Create and Compile documentation that supports product design and fabrication.

Distance Learning

This course is not Distance Learning.

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Board Approval: 05/16/2006
PCA Established:
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 162
Catalog Course Title: Fluid Power And Control
Banner Course Title: Fluid Power And Control

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	0.000	0.0 - 0.0	0.0
Total Hours	2.0	32.0 - 36.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

None

Entrance Skills

None

Catalog Description

An introduction to the generation, control and basic applications of hydraulics and pneumatics force and motion systems. Topics include safety, properties of and forces in liquids, pumps, motors, valves, reservoirs, strainers, filters, accumulators, basic diagramming, system design and troubleshooting. This course is not open to students who are enrolled in or have received credit for CEL 162 or ET 162.

Course Content

Lecture

1. Introduction to Fluid Power
2. Physical Properties of Fluids
3. Energy and Power in Fluid Power Systems
4. Losses in Hydraulic Pipelines
5. Fluid Power Motors and Pumps
6. Cylinders and Cushioning Devices
7. Valve Construction and Operation
8. Basic Electrical Controls for Fluid Power Circuits
9. Fluid Logic Control Systems
10. Designing and Troubleshooting Fluid Power Systems

Course Objectives

At the end of the course, the student will be able to:

1. apply safety procedures and issues in the areas of hydraulics and pneumatics.
2. identify and describe a basic hydraulic and pneumatic system and their components.
3. explain the construction and operation of fluid power cylinders.
4. explain the construction and operation of directional control valves.
5. explain the operations of fluid power components such as filters, regulators, lubricators, needle valves, check valves, flow control valves, and quick exhaust valves.
6. explain the construction and the operation of common fluid power circuits.
7. design basic fluid power systems using schematic diagrams to document designs.
8. identify common hydraulic and pneumatic component failures and symptoms.
9. identify symptoms of common pump failures.
10. describe the basic repairs needed to restore pump operation.
11. describe the electrical control of fluid power components.

Methods of Instruction

- **Lecture**

Outside Assignments

- **Outside Assignments**
  Cooperative learning group projects; presentations; short papers; research; and the following:
  1. readings from adopted text and instructor handouts; evaluate sample problems and work end of chapter problems.
  2. use computer applications to expand upon circuit analysis and comprehension.
  3. use the Internet, as an information resource, to support topics studied in this course.
  4. online practice quizzes and take-home exams covering assigned and related topics.
  5. design projects assigned stressing application of learned concepts and theories.
- **Sample Assignment(s)**

Board Approval: 12/13/2016
PCA Established:
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: 2017/2018

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 189
Catalog Course Title: Independent Projects in Electronics
Banner Course Title: Independent Projects

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	-	-	-
Lab	3.000 - 9.000	48.0 - 54.0 to 144.0 - 162.0	1.0 - 3.0
Total Hours	3.0 - 9.0	48.0 - 54.0 to 144.0 - 162.0	1.0 - 3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

None

Entrance Skills

None

Catalog Description

Courses for students capable of independent work who demonstrate the need or desire for additional study beyond the regular curriculum. Enrollment allows students to pursue activities such as directed field experience, research, or development of skills and competencies under faculty advisement and supervision. Independent projects may be earned in most disciplines.

Students wishing to enroll in Independent Projects should contact the appropriate instructor identified in the class schedule. If the project proposed is acceptable to that instructor, a contract will be developed.

All contracts for these classes must be completed and approved by the appropriate dean before the last day of the enrollment.

Units are awarded depending upon satisfactory performance and the amount of time committed by the student to the course. Allowable units vary according to discipline, and are based on the following formula:

1 unit - 48 hours per semester
2 units - 96 hours per semester
3 units - 144 hours per semester

Course Content

Lecture

1. Introduction
2. Defining student responsibility
3. Establishing project and procedures
4. Individual student work to fit particular project
5. Summary and critiques

Course Objectives

At the end of the course, the student will be able to:

1. plan and submit for instructional approval an independent project
2. gather data, research, evaluate, and use appropriate information to complete contractual project
3. assume responsibility for meeting set deadlines, and completing project
4. evaluate project for completeness, clarity, and presentation

Methods of Instruction

- **Lab**
- **Methods of Instruction Description:**
  Independent Study

Outside Assignments

- **Other Assignments**
  Assignments will vary depending on contest of the project.

Methods of Evaluation

Means for evaluation will be worked out between the individual student and the instructor, or will be stated on the course outline if Independent Projects for the specific discipline.

Adopted Texts and Other Instructional Materials

Textbooks
None

Other Texts

1. Text, if any, will vary depending on contest of the project.

Instructional Materials
None

Student Learning Outcomes

1. SLO1 - Plan and submit for instructional approval an independent project.
2. SLO2 - Gather data, research, evaluate, and use appropriate information to complete contractual project.
3. SLO3 - Assume responsibility for meeting set deadlines, and completing project.
4. SLO4 - Evaluate project for completeness, clarity, and presentation.

Distance Learning

This course is not Distance Learning.

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Board Approval: 12/13/2016
PCA Established: 12/13/2016
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 320
Catalog Course Title: A+ Certification
Banner Course Title: A+ Certification

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	2.000	32.0 - 36.0	0.5
Total Hours	4.0	64.0 - 72.0	2.5

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Advisories
EL 105 PC Preventive Maintenance and Upgrading

Entrance Skills

Upon entering this course, the student should be able to:

EL 105 - PC Preventive Maintenance and Upgrading

- identify the major components found in a personal computer.
- perform common preventive maintenance procedures to extend the life of a personal computer.
- correctly remove and reinsert IC's (RAM) in a personal computer.
- solder and desolder electronic components and wire from printed circuit boards.
- create an CONFIG.SYS and AUTOEXEC.BAT files that will properly startup a PC.
- install and set-up both hard and floppy disk drives.
- determine if the hard drive has been set-up for the most efficient system operation.
- backup and restore data on a hard disk drive.
- configure the system parameters and store the information in CMOS memory.
- configure a video display for different screen resolutions and displayed colors.

Catalog Description

Computer repair and maintenance with a focus on preparations required for achieving the industry standard CompTIA A+ Certification. The hands-on study includes the A+ Core Test Domains and the Windows/DOS Test Domains. This course is not open to students who have received credit for CS 320.

Course Content

Lecture

A+ Core Module

1. Basic Computer Service Concepts and Safety
2. PC Architecture
3. PC Memory Architecture
4. Disk System Architecture
5. PC Bus Architectures
6. Peripheral Devices
7. Installation and Upgrades
8. How Printers Work
9. Networking Fundamentals
10. Customer Service
11. Troubleshooting Techniques

A+ DOS/Windows Module

1. Operation and installation of Microsoft Operating Systems
2. Operating System Configuration and Management
3. Installing and Running Applications
4. Networking with DOS and Windows
5. Troubleshooting Operating Systems and Applications

Course Objectives

At the end of the course, the student will be able to:

1. identify and apply basic terms, concepts, and functions of computer system modules and software, including how each module should work during normal operation.
2. identify and apply basic procedures for adding and removing field replaceable modules.
3. apply basic troubleshooting procedures and good practices for eliciting problem symptoms from customers.
4. identify potential hazards and proper safety procedures relating to computer systems, lasers and high voltage equipment.
5. identify items that require special disposal procedures that comply with environmental guidelines.
6. identify common printer problems and apply proper service techniques.
7. identify the unique components of portable computers and their unique problems.
8. identify basic networking concepts, including how a network works.
9. identify typical memory conflict problems and how to optimize memory use.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Other Assignments**
  1. Readings from assigned textbooks
  2. Online CBT practice exams and instructional material (Intranet)
  3. Troubleshooting Projects (hardware and software)
  4. Customer Service assignments (service calls)

Methods of Evaluation

- **Exams/Tests**
- **Papers**
- **Projects**
- **Home Work**
- **Lab Activities**
- **Other**
  1. Chapter and Section Exams (some exams online to simulate actual A+ Certification Core Exams)
  2. Projects and assignments graded
  3. Final Exam

  Sample essay question: Explain the limitations that are presented by digital phone lines. Older phone lines, before 1940, were analog from beginning to end; there were no digital components. This is not true today. Regular telephone lines are always analog as they leave a customer's house or office building, but are almost always converted to a digital signal at some point in the transmission. There, digital signals can then be transmitted, using sophisticated computing equipment and methods, and then converted back to analog signals at some point before traveling that last step between a local central office and the phone of the person receiving the call. The limitation on modem speeds is the result of the method used when an analog signal is converted to a digital signal.

Adopted Texts and Other Instructional Materials

Textbooks
None

Other Texts

1. Groth, D. A+ Complete Study Guide. Sybex
2. Antonakos, J. Microcomputer Repair. Prentice Hall
3. Mueller, S. Upgrading and Repairing PCs. QUE
4. Instructor Provided materials

Instructional Materials
None

Student Learning Outcomes

1. EL320 SLO1 - Demonstrate the understanding of basic computer maintenance concepts and procedures required for A+ certification.
2. EL320 SLO2 - Troubleshoot computer and network hardware and operating systems.

Distance Learning

This course is not Distance Learning.

Generated on: 6/22/2018 9:58:41 AM

Board Approval:
PCA Established:
DL Conversion:
Date Reviewed:
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics and
Department: Industrial Technology
Prefix and Number: EL 332
Catalog Course Title: Wireless Network Administrator
Banner Course Title: Wireless Network Administrator

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade or Pass/No Pass

Requisites

None

Entrance Skills

None

Catalog Description

A study of the basic concepts and technologies of wireless data networking. Includes basic RF theory, WiFi infrastructure, link budget math, troubleshooting techniques, site survey skills, and security measures. Prepares students to take the CWNA Certification Exam at Prometric Testing Centers. This course is not open to students who have completed or who are currently enrolled in CS 332.

Course Content

Lecture

1. Introduction to Wireless LANs
2. Radio Frequency (RF) Fundamentals
3. Spread Spectrum Technology
4. Wireless LAN Infrastructure Devices
5. Antennas and Accessories
6. Wireless LAN Organizations and Standards
7. 802.11 Network Architecture
8. MAC and Physical Layers
9. Troubleshooting Wireless LAN Installations
10. Wireless LAN Security
11. Site Survey Fundamentals

Course Objectives

At the end of the course, the student will be able to:

1. explain the basic operation of a wireless data network.
2. describe the function of access points, wireless bridges, gateways, routers, switches, hubs, and client devices.
3. design and install a small wireless network.
4. explain the operation of RF amplifiers, attenuators, splitters, connectors, cables, and antennas.
5. list and describe wireless organizations and standards.
6. explain basic site survey fundamentals.
7. explain wireless network security.
8. describe various troubleshooting tools and techniques in wireless local area network maintenance.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Other Assignments**
  1. Read 11 online study unit outlines (requires Internet connection from home or use of on campus laboratory computers).
  2. Reading from adopted text and instructor handouts, evaluate sample problems and work end of chapter review questions.
  3. Study laboratory experiments and complete pre-lab section prior to attending the class.
  4. Prepare laboratory post-lab reports and conclusions.
  5. Complete take-home projects and threaded case studies.

Sample Writing Assignment:
The XYZ Research Company is a small company that is developing high-speed wireless products. The main office occupies two buildings in Sydney. One building is for the Administration Group. The other building is for the Sales and Marketing Group, and the larger Research and Development Group. The Research Group and the Sales and Marketing Group will each have employees located on all three floors of the main building. The XYZ Research Company also has a Sales Branch Office located in Melbourne. The company is implementing a wireless network at the Sydney site. This wireless LAN should support 100% growth over the next five to ten years. A logical diagram has been provided. The task is to design, implement and fully document the XYZ Research Company network. Your first task is to write a preliminary user's needs report outlining the network requirements.

Methods of Evaluation

1. Exam reports for each study unit from online testing.
2. Written and performance based examinations for each major study area. Examinations will include problem-solving techniques and word-type problems. Examinations are graded for accuracy.
3. Class projects will be graded for accuracy, content, and applied techniques.
4. Assigned homework problems and projects will be graded for accuracy.
5. Laboratory experiments with pre and post lab sections including a written conclusion will be graded for accuracy and understanding.
6. A case study will be assigned and graded for accuracy and content. The case study will be a team based exercise.
7. a comprehensive written final examination will be administered and graded for accuracy and applied techniques as well as a final laboratory project that will assess the student's abilities in applying wireless network concepts and troubleshooting.

Sample Essay Question:
You have a wireless 802.11b network with two rooms separated by 20 meters. There are two 14 dBi parabolic dish antenna interconnecting these rooms. Your IT manager has notified you that the link, which has been working for the past six months, is experiencing excessive intermittent data losses. Explain your steps in troubleshooting this problem and explain your justification for each step. Please refer to the network topology diagram for additional information.

Adopted Texts and Other Instructional Materials

Textbooks

1. Planet3 Wireless *CWNA Certified Wireless Network Administrator* 2003 -

Other Texts

1. 2 computer 3.5-inch data diskettes
2. Scientific calculator
3. 3-ring binder
4. Bhola, J. Wireless LANs Demystified. McGraw-Hill. 2002
5. Ohrtman, F. WI-FI Handbook. McGraw-Hill. 2003
6. Smith, R. WiFi Home Networking. McGraw-Hill. 2003
7. Potter, B. 802.11 Security. O'Reilly & Assoc. 2002

Instructional Materials
None

Student Learning Outcomes

1. EL332 SLO1 - Demonstrate the understanding of basic wireless data networks.

2. EL332 SLO2 - Design and construct wireless data networks.
   Describe various troubleshooting tools and techniques used in WLAN.

Distance Learning

This course is not Distance Learning.

Generated on: 6/22/2018 9:59:05 AM

Board Approval: 05/17/2005
PCA Established: 05/17/2005
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 333
Catalog Course Title: Introduction to Network Security
Banner Course Title: Intro to Network Security

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	1.000	16.0 - 18.0	1.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	4.0	64.0 - 72.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 106 Networking Essentials 1

Entrance Skills

Upon entering this course, the student should be able to:

EL 106 - Networking Essentials 1

- explain the basic electrical and electronic devices used in a PC and networking environment.
- identify and explain the basic operation of PC hardware.
- explain the concept of networking.
- explain and identify the OSI model.
- explain and identify IP addressing.
- describe the function of routers, switches, and hubs.
- demonstrate the processes of laying and terminating networking media.
- design and install a local area network.
- describe various troubleshooting tools and techniques of LAN maintenance.

Catalog Description

A comprehensive overview of network security. General security concepts, communications security, infrastructure security, basics of cryptography, and operational/organizational security will be covered. Prepares students to take the CompTIA Security+ Certification Exam at Prometric or Vue sites.

Course Content

Lecture

1. Security Overview
2. Authentication
3. Attacks and Malicious Code
4. Remote Access
5. E-Mail
6. Web Security
7. Directory and File Transfer services
8. Wireless and Instant Messaging
9. Devices
10. Media and Medium
11. Network Security Topologies
12. Intrusion Detection
13. Security Baselines
14. Cryptography
15. Physical Security
16. Disaster Recovery and Business Continuity

Course Objectives

At the end of the course, the student will be able to:

1. describe security threat trends and their ramifications.
2. describe what mutual authentication is and why it is necessary.
3. list the major types of attacks used against encrypted data.
4. discuss the different vulnerabilities associated with telecommuting.
5. explain the dangers posed by e-mail hoaxes and spam, as well as actions that can be taken to counteract them.
6. explain the vulnerabilities of JavaScript, buffer overflow, ActiveX, cookies, CGI (Common Gateway Interface), applets, SMTP (Simple Mail Transfer Protocol) relay, and how they are commonly exploited.

7. explain the benefits offered by centralized enterprise directory services such as LDAP (Lightweight Directory Access Protocol) over traditional authentication systems.
8. describe the (WTLS) Wireless Transport Layer Security protocol and how it works.
9. explain the purpose of a network firewall and the different kinds of firewall technology available on the market.
10. identify and discuss the various types of transmission media.
11. explain the network perimeter's importance to an organization's security policies.
12. explain what intrusion detection systems are and identify some of the major characteristics of intrusion detection products.
13. identify network services that are commonly exploited by attackers.
14. discuss the characteristics of PKI (public key infrastructure) certificates and the policies and procedures surrounding them.
15. discuss the impact of location on a facility's security.
16. explain the importance of defining and documenting security policies and procedures.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Outside Assignments**
  1. Read 17 online study unit outlines (requires Internet connection from home or use of on campus laboratory computers).
  2. Reading from adopted text and instructor handouts, evaluate sample problems and work end of chapter review questions.
  3. Study laboratory experiments and complete pre-lab section prior to attending the class.
  4. Prepare laboratory post-lab reports and conclusions.
  5. Complete take-home projects and threaded case studies.
- **Sample Assignment(s)**
  Sample writing assignment: Write several paragraphs that answer the following two questions: How secure should I make my network? Isn't there a point at which the network becomes unusable?

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Home Work**
- **Lab Activities**
- **Other**
  1. Exam reports for each study unit from online testing.
  2. Written and performance based examinations for each major study area. Examinations will include problem-solving techniques and word-type problems. Examinations are graded for accuracy.
  3. Class projects will be graded for accuracy, content, and applied techniques.
  4. Assigned homework problems and projects will be graded for accuracy.
  5. Laboratory experiments with pre and post lab sections including a written conclusion will be graded for accuracy and understanding.
  6. A case study will be assigned and graded for accuracy and content. The case study will be a team based exercise.
  7. A comprehensive written final examination will be administered and graded for accuracy and applied techniques as well as a final laboratory project that will assess the student's abilities in applying security concepts and techniques.

  Sample essay question: Is cyberterrorism a real threat or just a distraction from the day-to-day job of maintaining network security? In light of materials covered in this course, justify your answer.

Adopted Texts and Other Instructional Materials

Textbooks

1. Ciampa, Mark *Security+ Guide to Network Security Fundamentals* Edition: 4th 2012
2. Ciampa,Mark *Security+ Guide to Network Security Fundamentals Lab Manual* Edition: 5th 2015

Other Texts

1. data storage device
2. 3-ring binder
3. Maiwald Eric. Network Security: A Beginner's Guide. 2nd ed. ISBN: 0072229578
4. Kaufman, Charlie. Network Security: Private Communication in a Public World. 2nd ed. ISBN: 0130460192

Instructional Materials

None

Student Learning Outcomes

1. EL333 SLO1 - Demonstrate the understanding of basic network security.

Distance Learning

This course is not Distance Learning.

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COURSE OUTLINES
(IN REVIEW)

Board Approval: 04/16/1996
PCA Established:
DL Conversion: 05/13/2003
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 105
Catalog Course Title: PC Preventive Maintenance and Upgrading
Banner Course Title: PC Care And Upgrade

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	2.000	32.0 - 36.0	2.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	5.0	80.0 - 90.0	3.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

None

Entrance Skills

None

Catalog Description

Necessary skills and information needed to make an informed purchase, maintain, upgrade, and evaluate personal computer systems. The student will receive hands-on instruction for performing basic preventive maintenance and the installation of simple upgrades such as adding RAM, installing hard drives, sound cards, etc. Included is the study of soldering techniques, electronic part identification, and safety and system operation. Emphasis will be placed on the student's ability to keep personal computers running at their best performance levels.

Course Content

Lecture

1. Basic Skills
    a. safety
    b. hand tool usage
    c. component identification

2. Operating Systems
    a. using floppy disks
    b. files
    c. editors
    d. utilities
3. Preventive Maintenance
    a. system teardown and assembly
    b. power supplies, drives, printers
    c. monitors
4. Subsystem Replacements
    a. RAM
    b. Drives
    c. Upgrades, including CD-ROM and modems
5. Performance Tests and Failure Recovery

Course Objectives

At the end of the course, the student will be able to:

1. identify the major components found in a personal computer.
2. perform common preventive maintenance procedures to extend the life of a personal computer.
3. correctly remove and reinsert IC's (RAM) in a personal computer.
4. create an CONFIG.SYS and AUTOEXEC.BAT files that will properly startup a PC.
5. install and set-up both hard and flash drives.
6. determine if the hard drive has been set-up for the most efficient system operation.
7. backup and restore data on a hard disk drive.
8. configure the system parameters and store the information in CMOS memory.
9. configure a video display for different screen resolutions and displayed colors.

Methods of Instruction

- **Lab**
- **Lecture**
- **Methods of Instruction Description:**
  The course material used for a given semester will be either hard-copy textbooks or the on-line TestOut application, or a mixture of both. The specific method(s) of instruction used each semester will be found in the bookstore.

Outside Assignments

- **Sample Assignment(s)**
  Example: From laboratory written report
  Referring to computer switching power supplies, explain and indicate how the following terms are related: current, voltage, and power.
- **Outside Assignments**
  1. Readings from adopted text and instructor handouts, evaluate sample problems and work end of chapter problems.
  2. Study and perform laboratory experiments.
  3. Prepare laboratory written reports.
  4. Participate in post-lab evaluation discussions.

Methods of Evaluation

- **Exams/Tests**
- **Quizzes**
- **Home Work**
- **Lab Activities**
- **Other**

1. Written and performance-based examinations for each major study area. These examinations are graded for accuracy.
2. Assigned homework problems will be graded for accuracy.
3. Laboratory reports are graded for accuracy and content.
4. A final laboratory examination evaluating the student's abilities to correctly perform preventive maintenance on a computer system will be administered. A comprehensive written final examination will also be graded for accuracy and applied techniques.

Example: Explain how to reduce the effects of EMI (RFI) on your computer.

Adopted Texts and Other Instructional Materials

Textbooks

1. Meyers, Mike *CompTIA A+ Certification Exam Guide* Edition: 9th 2016
2. Meyers, Mike *CompTIA A+ Guide to Managing and Troubleshooting PCs* Edition: 5th 2016

Other Texts

1. Data storage device (USB)
2. Graph paper/school supplies
3. Scientific calculator
4. 3-ring binder

Instructional Materials

None

Student Learning Outcomes

1. EL105 SLO1 - Identify, remove, install, and configure all major components that comprise a personal computer system.
2. EL105 SLO2 - Perform preventative maintenance procedures (hardware and software) to personal computer systems.
3. EL105 SLO3 - Perform basic operating system and hardware configurations.

Distance Learning

This course is not Distance Learning.

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Board Approval: 03/16/1993
PCA Established: 12/14/2004
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 146
Catalog Course Title: Electronic Product Design, Fabrication and Documentation
Banner Course Title: Elec Product Design & Fabricat

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	1.000	16.0 - 18.0	1.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	4.0	64.0 - 72.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

None

Entrance Skills

Entrance Skills Other (Legacy)

7. analyze project designs using standard breadboarding techniques.
8. identify electronic components and symbols.
9. differentiate the schematic symbols that are used to represent a wide variety of semiconductor, reactive, and passive electronic devices.
10. interpret device specifications using manufactures data sheets; analyze circuits, describe their operation, and list characteristics for each.

Catalog Description

A study of product fabrication emphasizing mechatronic applications and designs. Topics include the design process; CADD drawings, schematics, diagrams, and support graphic requirements; printed circuit board layout and population techniques; technical writing; project documentation requirements; surface mount technologies; prototyping; printed circuit board testing, troubleshooting, and final documentation emphasizing hands-on experiences. The use of industry standard computer aided drafting and support software will be studied and utilized in all phases of documentation through camera ready artwork.

Course Content

Lecture

1. Safety and Environmental Concerns
2. The Design Process
3. Schematic and Fabrication Drawings
4. Technical Writing
5. Experimentation and Bread-boarding Designs
6. Surface Mount Technologies and Techniques
7. Prototyping PC Board Design
8. Prototyping PC Board Fabrication
9. Prototyping Final Assembly and Project Packaging
10. Testing, Troubleshooting, and Final Documentation

Lab

1. Equipment and Tool Safety
2. Kit Building
3. Component Identification and Assembly
4. Experimentation and Bread-boarding Designs
5. Printed Circuit Board Assembly
6. Prototyping Final Assembly and Project Packaging
7. Testing, Troubleshooting, and Final Documentation

Course Objectives

At the end of the course, the student will be able to:

1. evaluate and interpret the five-stage design and fabrication process.
2. explain what electrical shock is, and how it can affect your heart.
3. describe how to avoid safety problems when working with power tools.
4. discuss environmental concerns with regard to product design and development.
5. select and acquire electronic components.
6. create design drawings that are required to illustrate system operation, circuit function, and packaging concepts.
7. apply computer-based design tools to design, simulate, and analyze electronic circuits.
8. identify likenesses and differences between mechanical, architectural, and electronic drawings.
9. develop the 10-drawing set needed to design and fabricate working prototype projects.
10. write proper technical documents and outlines to support working prototype projects.
11. explain the differences between breadboarding, prototyping, and production.
12. identify factors to consider in creating computer-generated PC board artwork.
13. create a photoresist pattern on the PC board.
14. explain how PC boards are manufactured in industry.
15. produce PC assembly drawings.
16. cut, drill, and punch sheet metal and plastic patterns.
17. produce wiring diagrams.
18. produce the final packaging drawing.
19. assemble the final prototype project.
20. explain the four basic testing and troubleshooting steps.
21. perform preliminary, operational, and performance tests on prototype projects.
22. develop troubleshooting flowcharts.
23. write a Test Results document.
24. write a Summary and Recommendations document.
25. compile the final prototype project report.
26. describe the many advantages of designing with surface mount technologies (SMT).
27. describe automatic SMT assembly using flow soldering.

Methods of Instruction

- **Lab**
- **Lecture**

Outside Assignments

- **Outside Assignments**
  1. Read and study adopted textbook including all appendices. Evaluate sample problems in each chapter.
  2. End-of-chapter problems assigned as homework.
  3. Read and study instructor handouts.
  4. Research data books and manuals for information required for drawings and projects.
  5. Design and produce drawings and products from written and verbal instructions.
  6. Drawing and art-work assignments will be produced using CAD equipment.
  7. Use computer based software as a tool for the analysis of circuit designs.
  8. Hands-on student projects are assigned for laboratory experiences.
  9. Student selected final project.
- **Sample Assignment(s)**

  Sample Assignment:
  Using CADD software draw a well-proportioned schematic of a Wein Bridge Sine Wave Oscillator; include all component values, reference designators and footnotes.

  Sample Writing Assignment:
  You're an electronics technician working at a small electronics contract manufacturing firm. The company employs 25-30 assemblers to stuff printed circuit boards with electronic components.

  The personnel turnover rate in the assembly area is high, and new hires tend to be inexperienced and lacking in electronic component familiarity. An assembler needs to have a series of Electronic Component Physical Description Sheets depicting and describing the physical characteristics of each component to be installed. The purpose of each sheet is to allow the assembler to quickly and accurately identify the correct electronic component, determine its electrical value, know if it has polarity, and recognize the special physical characteristics affecting its selection and proper installation. With a three-ring binder of individual Electronic Component Physical Description Sheets close at hand, the assembler will be greatly aid in performing his or her assembly job.

  Your assignment is to prepare an Electronic Component Physical Description Sheet. Pick any component. Consider the sample sheet as a guide only (pg 95 of textbook). Feel free to structure your sheet in any way you determine is most effective in helping the assembler identify an electronic component and install it in the correct manner.

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Home Work**
- **Lab Activities**
- **Other**
  1. Comprehensive exam for each major study area, written and/or practical project, will be graded for accuracy and techniques used in the solution of the problems.
  2. End of chapter questions and problems will be graded.
  3. Design problems will be graded for techniques used in their solution and also for proper engineering practices.
  4. Student projects will be graded for techniques used in their solutions and for proper engineering practices. All projects must meet industry standards.
  5. Mid-term project assigned by the instructor will be graded.
  6. Effective use of CAD equipment will be looked for in each project and drawing.
  7. Final examination will consist of a project selected by the student and a comprehensive exam covering material from all major study areas. Project and written exam will be graded for accuracy and to standards set by industry. The student keeps his/her final project.

  Sample Evaluation Problems that requires student to think independently and write:
  What important characteristic does documentation have that is of great importance to the designer and manufacturer? Why?

Adopted Texts and Other Instructional Materials

Textbooks

1. Electronics Workbench *EWB Multisim Student Edition Life V.9* Edition: 11th 2015

Other Texts

1. Manufacture Product Reference and Applications Manuals. (available in EL Labs).
2. Internet resources
3. Manufacturer's data and reference manuals
4. Graph paper
5. Instructor handouts
6. Hardware development boards
7. Data storage device (flash drive)
8. Scientific Calculator
9. Shimizu, Electronic Fabrication, 2nd edition, Delmar.
10. Department of Defense, Military Standards for Printed Wiring to Electronic Equipment, Department of Defense, online publication.

Instructional Materials

None

Student Learning Outcomes

1. EL146 SLO1 - Demonstrate the understanding of basic concepts and procedures of project design and prototyping.
2. EL146 SLO2 - Construct projects using standard engineering practices.
3. EL146 SLO3 - Create and Compile documentation that supports product design and fabrication.

Distance Learning

This course is not Distance Learning.

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Board Approval: 05/17/2005
PCA Established: 05/17/2005
DL Conversion:
Date Reviewed: Fall 2016
Catalog Year: None

Allan Hancock College
Course Outline

Discpline Placement: Electronics
Department: Industrial Technology
Prefix and Number: EL 333
Catalog Course Title: Introduction to Network Security
Banner Course Title: Intro to Network Security

Units and Hours

	Hours per Week (Based on 16 Weeks)	Total Hours per Term (Based on 16-18 Weeks)	Total Units
Lecture	1.000	16.0 - 18.0	1.0
Lab	3.000	48.0 - 54.0	1.0
Total Hours	4.0	64.0 - 72.0	2.0

Number of Times Course may be Repeated
None

Grading Method
Letter Grade Only

Requisites

Prerequisite
EL 106 Networking Essentials 1

Entrance Skills

Upon entering this course, the student should be able to:

EL 106 - Networking Essentials 1

- explain the basic electrical and electronic devices used in a PC and networking environment.
- identify and explain the basic operation of PC hardware.
- explain the concept of networking.
- explain and identify the OSI model.
- explain and identify IP addressing.
- describe the function of routers, switches, and hubs.
- demonstrate the processes of laying and terminating networking media.
- design and install a local area network.
- describe various troubleshooting tools and techniques of LAN maintenance.

Catalog Description

A comprehensive overview of network security. General security concepts, communications security, infrastructure security, basics of cryptography, and operational/organizational security will be covered. Prepares students to take the CompTIA Security+ Certification Exam at Prometric or Vue sites.

Course Content

Lecture

1. Security Overview
2. Authentication
3. Attacks and Malicious Code
4. Remote Access
5. E-Mail
6. Web Security
7. Directory and File Transfer services
8. Wireless and Instant Messaging
9. Devices
10. Media and Medium
11. Network Security Topologies
12. Intrusion Detection
13. Security Baselines
14. Cryptography
15. Physical Security
16. Disaster Recovery and Business Continuity

Course Objectives

At the end of the course, the student will be able to:

1. describe security threat trends and their ramifications.
2. describe what mutual authentication is and why it is necessary.
3. list the major types of attacks used against encrypted data.
4. discuss the different vulnerabilities associated with telecommuting.
5. explain the dangers posed by e-mail hoaxes and spam, as well as actions that can be taken to counteract them.
6. explain the vulnerabilities of JavaScript, buffer overflow, ActiveX, cookies, CGI (Common Gateway Interface), applets, SMTP (Simple Mail Transfer Protocol) relay, and how they are commonly exploited.
7. explain the benefits offered by centralized enterprise directory services such as LDAP (Lightweight Directory Access Protocol) over traditional authentication systems.
8. describe the (WTLS) Wireless Transport Layer Security protocol and how it works.
9. explain the purpose of a network firewall and the different kinds of firewall technology available on the market.
10. identify and discuss the various types of transmission media.
11. explain the network perimeter's importance to an organization's security policies.

12. explain what intrusion detection systems are and identify some of the major characteristics of intrusion detection products.
13. identify network services that are commonly exploited by attackers.
14. discuss the characteristics of PKI (public key infrastructure) certificates and the policies and procedures surrounding them.
15. discuss the impact of location on a facility's security.
16. explain the importance of defining and documenting security policies and procedures.

Methods of Instruction

- **Lab**
- **Lecture**
- **Methods of Instruction Description:**
  The course material used for a given semester will be either hard-copy textbooks or the on-line TestOut application, or a mixture of both. The specific method(s) of instruction used each semester will be found in the bookstore.

Outside Assignments

- **Outside Assignments**
  1. Read 17 online study unit outlines (requires Internet connection from home or use of on campus laboratory computers).
  2. Reading from adopted text and instructor handouts, evaluate sample problems and work end of chapter review questions.
  3. Study laboratory experiments and complete pre-lab section prior to attending the class.
  4. Prepare laboratory post-lab reports and conclusions.
  5. Complete take-home projects and threaded case studies.
- **Sample Assignment(s)**
  Sample writing assignment: Write several paragraphs that answer the following two questions: How secure should I make my network? Isn't there a point at which the network becomes unusable?

Methods of Evaluation

- **Exams/Tests**
- **Projects**
- **Home Work**
- **Lab Activities**
- **Other**
  1. Exam reports for each study unit from online testing.
  2. Written and performance based examinations for each major study area. Examinations will include problem-solving techniques and word-type problems. Examinations are graded for accuracy.
  3. Class projects will be graded for accuracy, content, and applied techniques.
  4. Assigned homework problems and projects will be graded for accuracy.
  5. Laboratory experiments with pre and post lab sections including a written conclusion will be graded for accuracy and understanding.
  6. A case study will be assigned and graded for accuracy and content. The case study will be a team based exercise.
  7. A comprehensive written final examination will be administered and graded for accuracy and applied techniques as well as a final laboratory project that will assess the student's abilities in applying security concepts and techniques.

  Sample essay question: Is cyberterrorism a real threat or just a distraction from the day-to-day job of maintaining network security? In light of materials covered in this course, justify your answer.

Adopted Texts and Other Instructional Materials

Textbooks

1. Dulaney, Emmett *CompTIA Security+ Deluxe Study Guide: Exam Sy0-501* Edition: 4th 2017

Other Texts

1. data storage device
2. 3-ring binder

Instructional Materials
None

Student Learning Outcomes

1. EL333 SLO1 - Demonstrate the understanding of basic network security.

Distance Learning

This course is not Distance Learning.

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DEGREE REQUIREMENTS

Electronics Technology (A.S.)

EL 118	Fundamentals of DC & AC Circuit Analysis	3
EL 119	Fundamentals of DC & AC Circuit Analysis Lab	2
EL 122	Electronic Devices and Circuits	3
EL 123	Electronic Devices and Circuits Lab	2
EL 125	Digital Devices and Circuits	3
EL 126	Digital Devices and Circuits Lab	2
EL 135	Electronic Measurement & Instrumentation	3
EL 136	Electronic Measurement & Instrumentation Lab	2
EL 146	Electronic Product Design, Fabrication & Documentation	2

Electronic Engineering Technology (A.S.)

CS	Any 3 unit programming course	3
CHEM 120	Introductory Chemistry	4
EL 118	Fundamentals of DC & AC Circuit Analysis	3
EL 119	Fundamentals of DC & AC Circuit Analysis Lab	2
EL 122	Electronic Devices and Circuits	3
EL 123	Electronic Devices and Circuits Lab	2
EL 125	Digital Devices and Circuits	3
EL 126	Digital Devices and Circuits Lab	2
EL 135	Electronic Measurement & Instrumentation	3
EL 136	Electronic Measurement & Instrumentation Lab	2
EL 146	Electronic Product Design, Fabrication & Documentation	2
MATH 181	Calculus 1	5
PHYS 141	General Physics 1	4
PHYS 142	General Physics 2	4

Electronics Technology with Emphasis in Network Maintenance and Digital Technology (A.S.)

EL 105	PC Preventative Maintenance and Upgrading	3
EL 106	Networking Essentials 1	3
EL 107	Networking Essentials 2	3
EL 108	Networking Essentials 3	2
EL 109	Networking Essentials 4	2
EL 118	Fundamentals of DC & AC Circuit Analysis	3
EL 119	Fundamentals of DC & AC Circuit Analysis Lab	2

Plus a minimum of 3 units selected from the following

BUS 101	Introduction to Business	3
CBIS 101	Computer Concepts and Applications	3
CS 102	Introduction to Computing with HTML	3

Plus a minimum of 5 units selected from the following Electronics option or Computer Science option:

EL 125	Digital Devices and Circuits	3
EL 126	Digital Devices and Circuits Lab	2

OR

CS 141	Computer Fundamentals in Digital Design	3
CS 142	Computer Fundamentals in Digital Design Lab	2

Plus a minimum of 3 units selected from the following

CS 111	Fundamentals of Programming 1	4
CS 161	Discrete Structures	3
CS 171	FORTRAN	3
CS 175	Object-Oriented Programming	3

Electronics Technology: Mechatronics (A.S.)

CS 111	Fundamentals of Programming 1	4
EL/CEL/ET 104	Introduction to Robotics & Mechatronics	3
EL 122	Electronic Devices and Circuits	3
EL 123	Electronic Devices and Circuits Lab	2
CS 141	Computer Fundamentals in Digital Design	3

OR

EL 125	Digital Devices and Circuits	3
CS 142	Computer Fundamentals in Digital Design Lab	2

OR

EL 126	Digital Devices and Circuits Lab	2
MT 330	Print Reading and Interpretation	3

OR

WLDT 306	Layout and Fabrication Interpretation	3
EL 146	Electronic Product Design, Fabrication and Documentation	2
MT 109	Survey of Machining	4
ET 140	Engineering Drawing	3
SP 128	Materials and Processes	3

Plus a minimum of 15 units selected from the following

CS 137	Microcomputer Architecture and Software Design	4
CS 175	Object-Oriented Programming	3
CS 164	Software Engineering	3
EL 105	PC Preventive Maintenance and Upgrade	3

OR

EL 320	A+ Certification	2
EL 106	Networking Essentials 1	3
EL 107	Networking Essentials 2	3
EL/CEL/ET 128	Renewable Energy	3
EL/CEL/ET 131	Programmable Logic Controllers and Industrial Control Design	3
EL/CEL/ET 133	Transducers and Sensors	3
EL 135	Electronic Measurement & Instrumentation	3
EL 136	Electronic Measurement & Instrumentation Lab	2
EL/ET 138	Introduction to Motorola's 68000 Microprocessor Family	3
EL/CEL/ET 139	Electrical Power, Motors, and Controls	3
EL/CEL/ET 162	Fluid Power and Control	2
ET 100	Computer Aided Drafting and Design	3
MT 100	Machine Tool Practices	4
PHYS 100	Concepts in Physics	3

OR

PHYS 110	Introductory Physics	3

OR

PHSC 111	Matter, Energy, and Molecules	4
SP 104	Quality Management Control and Safety	3
WLDT 106	Beginning Welding	3
WLDT 107	Advanced Welding	3
WLDT 307	G.M.A.W. Welding	3

OR

WLDT 308	T.I.G. Welding	3
WLDT 315	Metal Fabrication	3

CERTIFICATE REQUIREMENTS

Digital Systems Technician (Certificate of Achievement.)

EL 118	Fundamentals of DC & AC Circuit Analysis	3
	OR	
EL 111	Fundamentals of DC Circuit Analysis	1.5
	AND	
EL 113	Fundamentals of AC Circuit Analysis	1.5
EL 119	Fundamentals of DC & AC Circuit Analysis Lab	2
	OR	
EL 112	Fundamentals of DC Circuit Analysis Lab	1
	AND	
EL 114	Fundamentals of AC Circuit Analysis Lab	1
EL 122	Electronic Devices and Circuits	3
EL 123	Electronic Devices and Circuits Lab	2
EL 125	Digital Devices and Circuits	3
EL 126	Digital Devices and Circuits Lab	2
EL 135	Electronic Measurement & Instrumentation	3
EL 136	Electronic Measurement & Instrumentation Lab	2
EL 146	Electronic Product Design, Fabrication & Documentation	2
CS 141	Computer Fundamentals in Digital Design	3

Electronics Technology with Emphasis in Network Maintenance and Digital Technology
(Certificate of Achievement.)

EL 105	PC Preventative Maintenance and Upgrading	3
EL 106	Networking Essentials 1	3
EL 107	Networking Essentials 2	3
EL 108	Networking Essentials 3	2
EL 109	Networking Essentials 4	2
EL 118	Fundamentals of DC & AC Circuit Analysis	3
	OR	
EL 111	Fundamentals of DC Circuit Analysis	1.5
	AND	
EL 113	Fundamentals of AC Circuit Analysis	1.5
EL 119	Fundamentals of DC & AC Circuit Analysis Lab	2
	OR	
EL 112	Fundamentals of DC Circuit Analysis Lab	1
	AND	
EL 114	Fundamentals of AC Circuit Analysis Lab	1

Plus a minimum of 3 units selected from the following

BUS 101	Introduction to Business	3
CBIS 101	Computer Concepts and Applications	3
CS 102	Introduction to Computing with HTML	3

Plus a minimum of 5 units selected from the following Electronics option or Computer Science option:

EL 125	Digital Devices and Circuits	3
EL 126	Digital Devices and Circuits Lab	2
	OR	
CS 141	Computer Fundamentals in Digital Design	3
CS 142	Computer Fundamentals in Digital Design Lab	2

Plus a minimum of 3 units selected from the following

CS 111	Fundamentals of Programming 1	4
CS 161	Discrete Structures	3
CS 171	FORTRAN	3
CS 175	Object-Oriented Programming	3

Electronics Technology: Mechatronics (Certificate of Achievement)

CS 111	Fundamentals of Programming 1	4
EL/CEL/ET 104	Introduction to Robotics & Mechatronics	3
EL 111	Fundamentals of DC Circuit Analysis	1.5
EL 112	Fundamentals of DC Circuit Analysis Lab	1
EL 113	Fundamentals of AC Circuit Analysis	1.5
EL 114	Fundamentals of AC Circuit Analysis Lab	1
EL 122	Electronic Devices and Circuits	3
EL 123	Electronic Devices and Circuits Lab	2
CS 141	Computer Fundamentals in Digital Design	3
	OR	
EL 125	Digital Devices and Circuits	3
CS 142	Computer Fundamentals in Digital Design Lab	2
	OR	
EL 126	Digital Devices and Circuits Lab	2
MT 330	Print Reading and Interpretation	3
	OR	
WLDT 306	Layout and Fabrication Interpretation	3
EL 146	Electronic Product Design, Fabrication and Documentation	2
MT 109	Survey of Machining	4
ET 140	Engineering Drawing	3
SP 128	Materials and Processes	3

Plus a minimum of 15 units selected from the following

CS 137	Microcomputer Architecture and Software Design	4
CS 175	Object-Oriented Programming	3
CS 164	Software Engineering	3
EL 105	PC Preventive Maintenance and Upgrade	3
	OR	
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EL 135	Electronic Measurement & Instrumentation	3
EL 136	Electronic Measurement & Instrumentation Lab	2
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EL/CEL/ET 162	Fluid Power and Control	2
ET 100	Computer Aided Drafting and Design	3
MT 100	Machine Tool Practices	4
PHYS 100	Concepts in Physics	3
	OR	
PHYS 110	Introductory Physics	3
	OR	
PHSC 111	Matter, Energy, and Molecules	4
SP 104	Quality Management Control and Safety	3
WLDT 106	Beginning Welding	3
WLDT 107	Advanced Welding	3
WLDT 307	G.M.A.W. Welding	3
	OR	
WLDT 308	T.I.G. Welding	3
WLDT 315	Metal Fabrication	3

Electronics Technology

The philosophy of the Allan Hancock College's Electronics Program is to offer our students detailed instruction emphasizing hands-on training using today's modern laboratory instrumentation. We supply the necessary educational knowledge required for success in challenging and rewarding fields, such as mechatronics, computer maintenance, network administration, telecommunications, industrial control, and instrumentation. Several of these technologies require industry certifications, and the training you will receive at Allan Hancock College will fully prepare you to meet and exceed industry standards of certification. In order to provide more flexibility, many of our courses are offered via the Internet to support our students who have busy schedules.

If you are curious about how things work, enjoy operating, maintaining and installing electrical equipment and thrive on using your analytical skills, electronics may be right for you. From circuits to microprocessors, you'll learn the basics in a broad range of applicable skills to set you on your path to a successful career in electronics.

For more information:

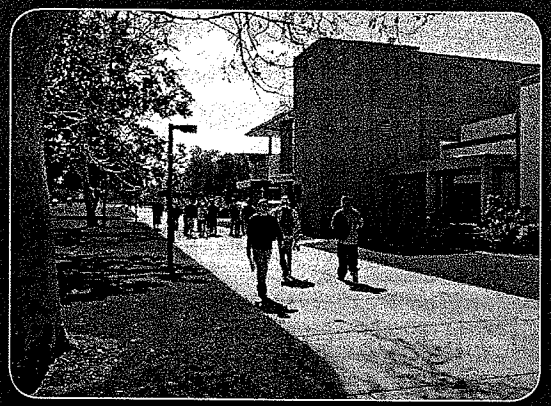
Electronics Technology is one of the career technical education programs at Allan Hancock College within the deparment of Industrial Technology. It resides in the Engineering Design industry sector.

Department of Industrial Technology
Phone: 805.922.6966 ext. 3335
industrialtechnology@hancockcollege.edu

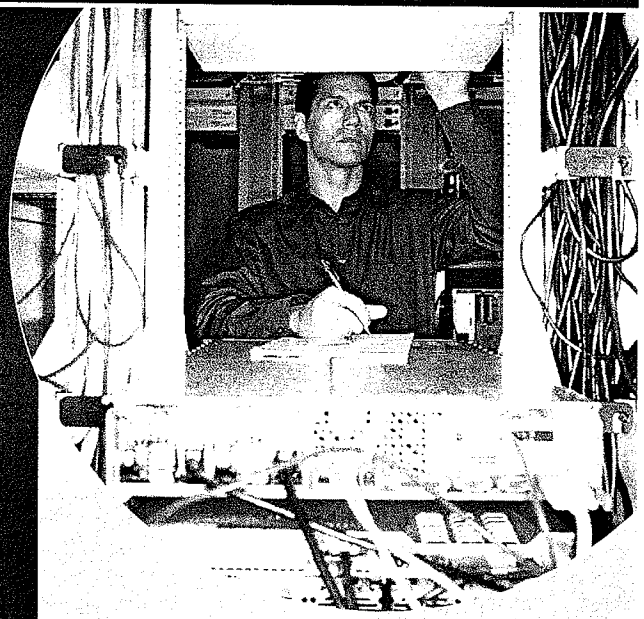
Or visit our website at:
www.hancockcollege.edu/cte

ALLAN HANCOCK COLLEGE

800 South College Drive
Santa Maria, CA 93454-6399
(805) 922-6966
www.hancockcollege.edu



Allan Hancock College is a California public community college in northern Santa Barbara County serving more than 11,000 credit students each semester. The college offers degrees and certificates in more than 100 fields of study from accounting to welding. The college has a campus in Santa Maria and centers in Lompoc, Solvang, and at Vandenberg AFB.



Career Technical Education (CTE)

Electronics Technology

- **Associate in Science Degree in options**
  - Electronics Technology
  - Electronic Engineering Technology
  - Network Maintenance and Digital Technologies
  - Mechatronics
- **Certificate of Achievement options**
  - Digital Systems Technician
  - Network Maintenance and Digital Technologies
  - Electronic Training
  - Mechatronics

ALLAN HANCOCK COLLEGE
Start here. Go anywhere.

Electronics Technology

We envision a 21st century electronic technician to be a versatile person equipped with technical competence, resourcefulness, and broad teamwork skills. We believe the extensive training provided at Allan Hancock College will give our students a decisive edge in today's demanding job markets.

Our program's curricula are specifically designed to enable you to tailor an area of study and your individual needs by selecting specialized courses or degree program options. We can help with career goals, whether interested in acquiring an A.S. degree, a certificate, industry certifications, or updating job related skills. Our program was the first at Hancock College to offer online course work options.

Facilities and equipment:

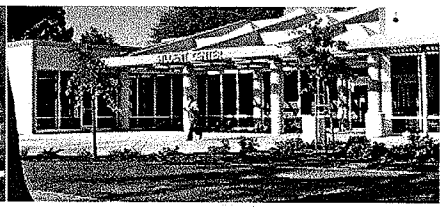
The program has two laboratories each equipped with 24 student stations and modern technological instrumentation. One lab also includes 3 large networking pods including complete wireless and fiber optic construction sets. The second lab includes automated control-manufacturing pods and special computer-aided-instruction hardware. Students in our program are eligible for free software from Microsoft and Cisco Systems corporations.

Employment Opportunities:

Earning an Associate in Science degree or certificate in electronics technology from Allan Hancock College will provide you with the skills necessary to pursue a successful career in electronics in a wide variety of industries such as:

- Aerospace & Aviation
- Banking
- Robotics in Police/Sheriff Depts
- Wine & Bottling
- Gaming
- Medical and/or Bioscience
- Automotive and/or Heavy Equipment
- Manufacturing and Logging
- Ski Industry
- Semiconductor Fabrication
- Petroleum and Renewable Energy
- State & Federal Traffic Control Agencies
- Computer Technology
- Network Maintenance
- Alternative Energy





Depending on your emphasis, employees in electronics occupations can make an average annual salary of $55,920 according to the Bureau of Labor Statistics (www.bls.gov). Pay increases with experience and higher education.

Electronics Technology *(A.S.)* & Digital Systems Technician *(Certificate of Achievement)*

This associate in science degree/certificate option provides you with the basic knowledge and skills required for a wide variety of occupations in the field of electronics. This degree will also allow you to transfer into an engineering technology baccalaureate program. You will gain fundamental mastery of the use of electronic equipment in electrical, digital, and analog circuits; use computer simulation and design software to conduct, analyze and interpret electrical, digital, and analog circuits. Several class projects involve designing, building and evaluating electronic equipment.

Electronic Engineering Technology *(A.S.)*

An associate in science degree in electronic engineering technology provides the lower division course requirements leading to a baccalaureate degree in engineering technology. Choosing this option will give you skills in the use of electronic equipment in electrical, digital and analog circuits. You will use computer simulation and design software to conduct, analyze and interpret electrical, digital, and analog circuits. Towards the completion of your degree requirements you will demonstrate learned skills with a capstone project requiring you to design, build, and evaluate a piece of electronic equipment.

Network Maintenance and Digital Technologies *(A.S. & Certificate of Achievement)*

Upon graduation with an associate in science degree or certificate option in network maintenance and digital technologies our students will have demonstrated understanding of how computers communicate with each other and the methods employed to ensure that the communication is reliable. We offer students a comprehensive program in networking essentials, basic electronics, and computer applications.

Electronic Training *(Certificate of Achievement)*

The electronic training certificate option provides you with the basic knowledge and skills required for entry-level employment in a range of career occupations. As a part of your curriculum you will have the opportunity to build and analyze a modern computer system using subsystems.

Mechatronics *(A.S. & Certificate of Achievement)*

An associate in science degree or certificate in mechatronics gives you a comprehensive foundation in the software, electronics, and mechanics of technologies used in automation (process control), robotics, and machine design and maintenance. Mechatronics lets you build and manipulate things, combining the best parts of mechanical engineering, electronics, controls engineering and computers. It emphasizes links between machine and computer, using software to guide a physical system like a robot.

ADVISORY COMMITTEE

Electronics Technology

Susan Appel
Rabobank

Jim Bevill
LR Baggs

Steve Burgess
Burgess Forensics

Dr. Larry Gooch
USAF, Retired

Greg Johnson
Aerospace Engineer, Retired

Michael Limotta
Limotta IT

Kevin McConnell
SYV Computer Center

Greg Schug
Monolithic Sound

Ryan Toussaint
On-Site Business & IT Solutions

Joe Wade
Lockheed-Martin

Les Wood
Santa Maria High School District

Allan Hancock College
Faculty/Staff

Margaret Lau, Academic Dean

Kevin Keinert, Lead Electronics Instructor

Gabriel Marquez, Welding Technology Instructor and Department Chair

Patrick McGuire, Auto Technology Instructor

Mark Peterschick, Electronics Instructor

Jeff Wilson, Electronics Instructor

Estevan Alvarado, Electronics Instructor

Bob Alldredge, Retired Electronics Instructor

John Reese, Retired Electronics Instructor

VALIDATION

PROGRAM REVIEW -- VALIDATION TEAM MEMBERS

TO: Academic Dean Date: 8/7/2018

From: Kevin Keinert

We recommend the following persons for consideration for the validation team:

DEPARTMENT Industrial Technology PROGRAM Electronics Technology

Board Policy requires that the validation team be comprised of the dean of the area, one faculty member from a related discipline/program, and two faculty members from unrelated disciplines.

Dominic Dal Bello	Engineering
(Name)	(Related Discipline/Program)
Gabriel Marquez	Welding Technology
(Name)	(Unrelated Discipline/Program)
Patrick McGuire	Auto Technology
(Name)	(Unrelated Discipline/Program)

At the option of the self-study team, the validation team may also include one or more of the following: a. someone from a four-year institution in the same discipline; someone from another community college in the same discipline; a high school instructor in the same discipline; a member of an advisory committee for the program. Please complete the following as relevant to your program review.

Rick Motawakel, MBA — Professor, Electronics Technology
(Name) (Title)

Affiliation: Antelope Valley College Telephone Contact Number: 661-772-6300

Address 3041 E Ave K, Lancaster, CA 93536 rmotawakel@avc.edu
(Mailing) City/State/Zip email address

(Name) (Title)

Affiliation: Telephone Contact Number:

Address
(Mailing) City/State/Zip email address

(Name) (Title)

Affiliation: Telephone Contact Number:

Address
(Mailing) City/State/Zip email address

APPROVED: Margaret Lan 8/7/2018
Academic Dean Date

EXECUTIVE SUMMARY
(Validation Team Report)

1. MAJOR FINDINGS

Strengths of the program/discipline:

- High quality of instruction
- Dedication of PT instructors and coordinator
- Labor market data that validates regional occupational demand that outstrips supply of graduates' entry into middle skill, middle wage jobs with high employment outcomes
- Despite scheduling obstacles and challenges resulting in limited program offerings, outcome data show that EL students persist and succeed to attain certificates and degrees
- High student satisfaction rates as indicated by recent survey of current and former EL students

Concerns regarding the program/discipline:

- Degree and certificate curricula need to be streamlined
- Lack of adequate and up-to-date, organized, and physically attractive learning environments (classrooms and labs)
- Lack of class offerings during the day
- Lack of program oversight and championing by a full-time discipline lead
- Lack of consistency in program offerings, resulting in missed opportunities to serve more students and improve completion rates

2. RECOMMENDATIONS

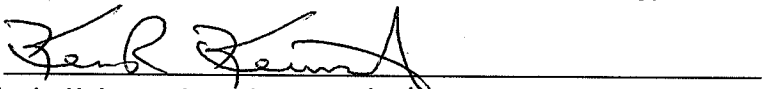
- Hire at least one and possibly two full-time instructors.
- Hire a part-time instructional assistant for the electronics and networking labs.
- Develop a Survey of Electronics course designed to satisfy the General Education requirement in the Natural Sciences area.
- Reinstate an Electronics Calculations course to increase student success in all EL courses.
- Relocate EL classrooms into renovated facilities in O-300.
- Expand dual enrollment and articulation agreements with high schools and maintain and expand articulation agreements with 4-year institutions.
- Streamline the EL curriculum and develop two-year plans of completion.
- Revitalize and expand the program's industry advisory committee to ensure workforce needs are met and to ensure currency and adequacy of curriculum and instructional resources (see attached list of identified equipment needs to meet state-of-the-industry standards).
- Rebrand and refresh targeted program promotional and outreach materials.
- Plan and execute educational outreach events and activities to engage students in career exploration and pathway awareness and enthuse prospective new students into the program to close equity gaps in access.

VALIDATION TEAM SIGNATURE PAGE

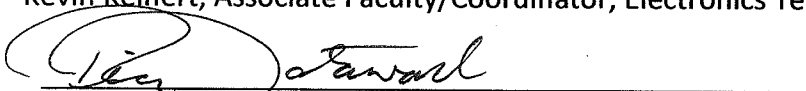
Dominic Dal Bello, Chair, Mathematical Sciences Department and Professor, Engineering

Gabriel Marquez, Chair, Industrial Technology Department and Assoc. Prof., Welding

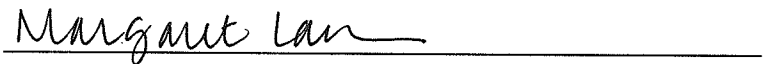
Patrick McGuire, Professor, Automotive Technology



Kevin Keinert, Associate Faculty/Coordinator, Electronics Technology



Rick Motawakel, MBA; Professor, Electronics Technology, Antelope Valley College



Margaret Lau, Dean, Academic Affairs

PLAN OF ACTION – POST VALIDATION
(Sixth-Year Evaluation)

DEPARTMENT: **Industrial Technology** PROGRAM: **Electronics Technology**

In preparing this document, refer to the Plan of Action developed by the discipline/program during the self-study, and the recommendations of the Validation Team. Note that while the team should strongly consider the recommendations of the validation team, these are recommendations only. However, the team should provide a rationale when choosing to disregard or modify a validation team recommendation.

Identify the actions the discipline/program plans to take during the next six years. Be as specific as possible and indicate target dates. Additionally, indicate by the number each institutional goal and objective which is addressed by each action plan. (See Institutional Goals and Objectives) The completed final plan should be reviewed by the department as a whole.

Please be sure the signature page is attached.

RECOMMENDATIONS TO IMPROVE DESIRED **STUDENT OUTCOMES** AND IMPROVE **STUDENT PERFORMANCE**	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Target Date**
Hire a full-time faculty member to lead, champion, and galvanize the Electronics Technology program and boost enrollment.	Goal IE1	Spring 2021
Remodel the electronics and networking labs to provide safe, attractive, and accessible environments that enhance the ability to teach and learn.		Spring 2021
Develop a Survey of Electronics course designed to satisfy the General Education requirement in the Natural Sciences area.	Goal SLS1	Spring 2021
Streamline the EL curriculum and develop two-year plans of completion.	Goal SLS3	Spring 2021
Relocate EL classrooms into renovated facilities in O-300.	Goal IR4	Spring 2021
Revitalize and expand the program's industry advisory committee to ensure workforce needs are met and to ensure currency and adequacy of curriculum and instructional resource (see attached list of identified equipment needs to meet state-of-the-industry standards).	Goal E1	Spring 2021

RECOMMENDATIONS TO ACCOMMODATE CHANGES IN **STUDENT CHARACTERISTICS**	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Target Date**
Enrollment Changes Expand dual enrollment and articulation agreements with high schools; maintain and expand articulation agreements with 4-year institutions.	Goal SLS2	Spring 2021
Demographic Changes Plan and execute educational outreach events and activities to engage students in career exploration and pathway awareness and enthuse prospective new students into the program to close equity gaps in access.	Goal SLS2	Spring 2021

RECOMMENDATIONS TO IMPROVE THE **EDUCATIONAL ENVIRONMENT**	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Target Date**
Curricular Changes Reinstate an Electronics Calculations course to increase student success in all EL courses. Develop a Survey of Electronics course designed to satisfy the General Education requirement in the Natural Sciences area.	Goal SLS2	Spring 2021
Co-Curricular Changes Investigate possibility of cross-listing Computer Science and EL courses.	Goal SLS2	Spring 2021
Neighboring College and University Plans Maintain and expand articulation agreements with 4-year institutions.	Goal SLS2	Spring 2021
Related Community Plans Revitalize and expand the program's industry advisory committee to ensure workforce needs are met and to ensure currency and adequacy of curriculum and instructional resource (see attached list of identified equipment needs to meet state-of-the-industry standards).	Goal E1	Spring 2021

RECOMMENDATIONS THAT REQUIRE ADDITIONAL RESOURCES	**Theme/Objective/ Strategy Number AHC from Strategic Plan**	**Resources Needed**	**Target Date**
Facilities Relocate EL classrooms into renovated facilities in O-300.	Goal IE1	N/A	Spring 2021
Equipment Purchase (25) Soldering Workstations Consider "2in1 862d+ SMD Hot Air Rework Station Soldering Iron Station LED Display W/4 Nozzle 110V New Version"	Goal IE1	$2,200 (Total)	Spring 2021
Purchase (25) Fume Absorbers Consider "VALTCAN Solder Smoke Absorber Fume Remover Fan Carbon Filter ESD Safe FA400"		$2,425 (Total)	Spring 2021
Purchase (6) Power Supply Consider "B&K Precision 1902 Switching DC Bench Power Supplies 1-60V, 15A"		$5,880 (Total)	Spring 2021
Purchase (25) ESD Mat Kits Cannot determine model# until the work benches are set up.		$2,000 (Total)	Spring 2021
Staffing Hire a full-time faculty member to lead, champion, and galvanize the Electronics Technology program and boost enrollment	Goal IE1	N/A	Spring 2021

VALIDATION TEAM RECOMMENTATIONS **Disregarded or modified (if appropriate)**	**REASON**	**ACTION/CHANGE**
Recommendation N/A		
Recommendation N/A		
Recommendation N/A		

PLAN OF ACTION – Post-Validation

Review and Approval

Plan Prepared By

Kevin Keinert _____ Date: 8-21-18

Patrick McGuire _____ Date: 8-8-18

Rick Motawakel _____ Date: 8-21-2018

_____ Date: _____

_____ Date: _____

Reviewed:

Gabriel Marquez, Department Chair, Industrial Technology

_____ Date: 8/29/18

*Signature of Department Chair indicates approval by department of Plan of Action.

Reviewed:

Margaret Lau, Dean of Academic Affairs

_____ Date: 9/4/18

Dr. Robert Curry, Vice President, Academic Affairs

_____ Date: 9/9/18

ACADEMIC AFFAIRS
6-Year Program Review Checklist

Electronics Technology

☐ Table of Contents – the page numbers in the table of contents match the page numbers in the document.

☒ Status Summary – current status on previous plan of action

☒ Supporting documentation – evidence is attached and supports responses to the self-study questions, data is analyzed and summarized

☒ Completed self-study questions referred to data sources where appropriate, embedded data tables.

☒ Student Data Summary

☒ Assessment Plan

☒ Course Review Cycle Completed:

General Education review

- ☒ PCA Summary Sheet
- ☒ Articulation status of courses (in conjunction with articulation officer)
- ☒ Course Review Verification Form (includes all courses in the discipline listed as been reviewed)
- ☒ Program listings and current course outlines - download from CurricUnet

☒ Pre-Validation Plan of Action (P.O.A.) – this plan is written prior to the validation team meeting

☒ Validation Team Member List – approved by the dean

☒ Executive Summary (written by the validation team)

☒ *Validation Team Signature Page (this is the signature page to the Executive Summary and only requires the signatures of validation team members)

☒ Post Validation P.O.A. – final plan of action including validation team recommendations or statement indicating the reason for not including those recommendations in final P.O.A.

☒ *Signature Page (signature page to the Post Validation P.O.A. signed by the self-study team members, department chair, dean, and VP academic affairs)

☒ Labor market data and analysis

☒ Other advisory board recommendations, meeting notes, member list (not a requirement to include)

Submitting the Document to VP Office

☒ Completed document, UNBOUND, including 2 signature pages*, to the VP Academic Affairs. (Bound documents will be taken apart for scanning).

☐ The signed document will be forwarded to IE office for posting to the "Program Review Matrix" on myHancock and the original returned to the academic dean's office.

For assistance, please contact Rebecca Andres, Academic Affairs, ext. 3246 or randres@hancockcollege.edu.