

Meeting the Educational Needs of the Manufacturing Industry in California's Central Valley

A Report to the Fresno
Workforce Investment Board

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Introduction

The Fresno Workforce Investment Board (Fresno WIB) sponsored a project to study the relationship between the California State University campuses in the Central Valley and manufacturers in that region. California State University, Bakersfield, California State University, Fresno (Fresno State), and California State University, Stanislaus took part in this study. The project assessed the educational programs that the universities provide to the manufacturing sector and the methods used by the campuses to serve manufacturers.

The project received funding from the Fresno WIB in late 2015. The study took place during 2016 and the Spring of 2017. CSU Bakersfield took a lead role in organizing the project and engaging with leaders from the other two campuses. Each campus team worked independently to assess the relationship between its campus and the manufacturing sector in its community. This report presents each campus' report, a national report on best practices of university-manufacturing relationships, a report on prior learning assessment (PLA), and a summary of best practices based on this research.

A part of the mission of the California State University system is to provide opportunities for individuals to develop intellectually, personally, and professionally. Our three campuses take great pride in the fact that we are impacting the lives of our community members through the education we provide.

Executive Summary / Key Findings

- A review conducted by each campus found that each campus offers some programs and courses that serve the manufacturing sector. Generally, these courses and programs are housed in Schools/Colleges of Business, Science, and Engineering.
- Each campus uses advisory boards to receive input from manufacturers. Advisory boards advise on curriculum development and current industry needs.
- The Extended Education (EE) units on each campus use a model of program and course design that includes input from corporate and community stakeholders. EE units apply this model to the development of degree and non-degree programs.
- None of the campuses currently offer stackable certificates in relation to manufacturing degrees. The application of non-degree credit to degree programs is rare or non-existent in the CSU.
- A national study of best practices of university programs to suit the manufacturing sector was conducted. The report found that manufacturing companies appreciate the value of university-educated workers. The companies proposed a closer working relationship between manufacturers and universities in their region. Manufacturers note the value of certificate programs with content targeted to specific corporate needs.
- Three CSU campuses offer prior learning assessment for non-academic workplace learning or non-academic experience; Bakersfield, San Francisco State, and California Polytechnic University. CSU campuses do offer PLA for some military programs. Also students may use challenge exams to seek academic credit toward their degree. Some campuses allow credit for a student portfolio. These are assessed by faculty and administration before credit is awarded.

Campus Reports

Meeting the Educational Needs of the Manufacturing Industry at California State University, Bakersfield

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Summary of Findings and Best Practices

California State University, Bakersfield (CSUB) is located in the Southern San Joaquin Valley, and Kern County is the southernmost county of the Central Valley. The socioeconomic diversity of the local community has helped to shape CSUB and the programs and courses the campus currently offers. Although oil and agriculture have traditionally had the largest impact on our local economy, manufacturing companies have begun locating warehousing facilities in the area. This is due primarily to the relatively inexpensive cost of land, as well as access to large areas of flat land conducive to such facilities. These warehouses and factories require a skilled workforce to fill required positions.

CSUB offers degree programs in AgriBusiness, Business Administrations with concentrations in Management, Marketing, and Supply Chain Logistics, Computer and Electrical Engineering, Engineering Sciences, and Environmental Resource Management. But degree programs with a focus in manufacturing are limited. This is where our non-credit certificate programs excel. Currently, there are three certificates that address the manufacturing needs in our area: Geographic Information Systems (GIS), Occupational Safety and Risk Management, and the online Project Management program.

These certificate programs have been created by the professionals and local experts who understand the individual needs of the industries they represent. Many have previously worked with the University and have helped form advisory boards. Beyond that, these experts want to help shape the incoming wave of new employees to their companies. Such collaboration with local talent has resulted in quality programs.

CSUB has partnerships with several community colleges in Bakersfield and Kern County to assist students in the region with degree completion. These include Bakersfield, Porterville, and Taft Colleges. The Agribusiness degree is a 2+2 program that allows students to complete lower division and foundation courses in Ag-science and Ag-business at a community college and combine that knowledge with the upper division core courses for the major.

Additionally, CSUB has partnerships with other Universities, such as Fresno State, UC Merced, University of the Pacific, and CSU San Bernardino. The Community Engagement and Career Education (CECE) department at CSUB coordinates with these schools each year to organize and promote job fairs for local vendors and available student internships. The job fairs are open to all industries and students from all majors are welcome; however, the highest number of students who are hired as a result of attending these fairs come from business majors, primarily with accounting and agribusiness concentrations. While the percentage of Engineering students who have received positions after attending such fairs is small, this may be due to the fact that the program is relatively new and little-known.

Although CSUB offers no degree programs which focus solely on manufacturing, several do have manufacturing features and courses built into them. The School of Business offers majors in Environmental Resource Management, Agricultural Business, and Business Administration with concentrations in Marketing, Management, and Supply Chain Logistics. Examples of courses within these degrees include Agricultural Management, Operations Management, Logistics Management, Purchasing and Supply Chain Management, Marketing Channels, Services Marketing, and Occupational Safety and Health. The School of Natural Sciences, Mathematics and Engineering offers majors in Engineering Sciences, Computer Engineering, and Electrical Engineering. These majors include the following courses: Electric Circuits, Analytic Mechanics, Properties of Materials, Fundamentals and Transport in Petroleum Engineering and Digital Design with VHDL.

The formation of advisory boards has been a key factor in the success of such programs. Faculty have invited alumni back to campus to assist in building these groups, as well as to inspire students to succeed. Our alumni have become industry leaders in many manufacturing companies, and they appreciate the opportunity to give back to the campus and students. Within the degree programs, there are several opportunities for the students to engage with our local alumni companies; either through student internships, work experience, or summer programs. Our campus department of Community Engagement and Career Education also helps to bring such like-minded people together through job fairs.

CSUB offers a program called “Open University” within the Extended University Division. The program allows community members who have not applied to the university to enroll in courses, on an instructor approved basis. Students can choose an academic class they are interested in to help them update their skills or make a career change. This is helpful to those in the manufacturing sector, because when new technology becomes available; they can register for a class without formally applying to the university.

Although incorporating more manufacturing courses, certificates, and degree programs would be most helpful to our local industry, the survey results found that employers were also interested in hiring those employees that had a solid work ethic, communication skills, critical thinking skills, as well as basic soft skills. Employers want to hire a well-rounded employee who is educated and technically minded, but who also has the soft skills to succeed in a working environment. Based on all the findings, the recognized best practices at CSUB that can be replicated and lead to success for both the manufacturing industry and the wage earner include:

- Continued development of certificate programs focused on the manufacturing sector. Expanding and adding courses to already existing programs.
- Continued partnerships with local community colleges to enable a seamless transfer for students to earn their Baccalaureate degrees.
- Development of advisory boards to assist with recommending and reviewing courses, providing internships and jobs for students, and teaching in the programs.
- Promotion of Open University to encourage the workforce to take academic courses to help them update their skills.
- Development of workshops focused on building soft skills within the workforce.

Program Development and Course Reviews

Overview

California State University Bakersfield (CSUB) is located in the heart of agriculture and oil fields, and the programs offered represent that influence. The Schools that have a focus on the manufacturing sector are (1) School of Business and Public Administration, (2) School of Natural Sciences, Mathematics and Engineering, and (3) Extended University Division. Faculty members from each department within the aforementioned Schools were approached for a meeting or asked to fill out a short survey regarding manufacturing courses, use of advisory boards, and graduate hiring. An overview of each of the schools is presented here.

School of Business and Public Administration

The School of Business and Public Administration (BPA) is accredited by the Association to Advance Collegiate Schools of Business (AACSB) and consists of four departments: Accounting & Finance, Economics, Management & Marketing, and Public Administration. We offer six undergraduate degree programs with concentration options and three graduate degree programs. The degrees that include manufacturing offered within BPA are: (1) Bachelor of Science in Agricultural Business, (2) Bachelor of Science in Business Administration with a concentration in Management, (3) Bachelor of Science in Business Administration with a concentration in Marketing, (4) Bachelor of Science in Business Administration with a concentration in Operations and Supply Chain Management, and (5) Bachelor of Science Environmental Resource Management.

Departments within BPA have formed their own advisory boards to meet their specific needs and fields of study. Some boards are more active than others. The various boards’ members form an eclectic group, and many industries are represented. The manufacturing sector is represented by companies such as Grimmway, Bolthouse, Nestle, Aera, and Wonderful.

Board membership is on a volunteer basis and consists of a high percentage of BPA alumni. The boards are involved in student internship placements and assist in building course curriculum. Additionally, board members are invited as guest speakers in courses, work as adjunct instructors, and serve as mentors for students.

To foster the relationship between local agricultural businesses and CSUB, the BPA has developed a 2+2 program within the BS in Agricultural Business degree. This allows students to complete lower division and foundation courses in Ag-science and Ag-business at a community college and combine that knowledge with the undergraduate core courses here at CSUB. This encourages degree completion and prepares students for entry-level management positions in the agriculture and food sector.

School of Natural Sciences, Mathematics and Engineering

The School of Natural Sciences, Mathematics and Engineering (NSME) houses eight departments: Biology, Chemistry & Biochemistry, Computer & Electrical Engineering and Computer Science, Geological Sciences, Mathematics, Nursing, and Physics & Engineering. There are thirteen undergraduate degrees and two graduate degrees. The degrees which feature aspects of manufacturing are (1) Bachelor of Science in Electrical Engineering, (2) Bachelor of Science in Engineering Sciences with Emphases in Bio-systems and Agricultural Engineering, and (3) Bachelor of Science in Engineering Sciences with Emphasis in Petroleum Engineering. The School of NSME averages over \$7 million annually in external funding.

The departments of Computer & Electrical Engineering and Computer Engineering, and Physics & Engineering have one combined advisory board that meets monthly to consult on curriculum changes, as well as internships and job opportunities for students. Many different industries are represented on the advisory board, including Chevron, Taft College, Delta Testing Services, San Joaquin Valley Air Pollution Control District, and GAF, but does not include many alumni. This is partially due to the fact that the Engineering program is relatively new, with its first graduating class in 2014. Board members provide connections to the local community and help build relationships within these companies for the students to foster.

Community Engagement and Career Education

The Community Engagement and Career Education (CECE) department coordinates job fairs, on-campus employment, part-time and full-time employment placement, and internships for students and alumni. In recent years, several of our sister schools have worked together when scheduling events such as job fairs to prevent scheduling conflicts. Such collaboration encourages the sharing of internships and employment opportunities for students between campuses. The CECE has placed the most students from the School of BPA in Accounting and Sales into paid and internship positions. No company names or breakdown was provided.

Extended University Division

The Extended University Division currently offers three certificate programs related to the manufacturing sector, they are: (1) Geographic Information Systems (GIS), (2) Occupational Safety and Risk Management, and (3) Project Management.

Geographic Information Systems Certificate

The GIS program was developed based upon the suggestion of the CSUB Provost, Dr. Jenny Zorn. We approached the local chapter of the Central California URISA (CCAURISA) group and asked if any members would be interested in forming a focus group to discuss the local needs of the industry. Five representatives from CCAURISA attended the first meeting, in which the discussion centered around the basic entry level skills needed to gain employment in the GIS field. In the initial meeting, members of the group were assigned courses to develop and an academic coordinator was identified. Once these steps were accomplished, instructors were identified and contracted, and the program began with a cohort of 20 students.

Having workers skilled in GIS is important to local industries because GIS technology provides the ability to digitally map the fields, assign attributes to that geospatial data, and analyze it using the systems' ability to overlay other relevant data on top of the field data. Additionally, thanks to satellites, aerial imagery, and GIS technology, the agricultural manufacturing industry can see historical data digitally and make decisions for the future based on what can no longer be visualized in the fields.

Remote-sensing techniques have also expanded the role GIS plays in understanding crop yields, pest movement, and is helping to ease the time the industry spends on environmental regulation and protection. Drone technology is also making strides in the agricultural industry because of its ability to detract pests from killing vital trees or eating the products that ensure the business' future growth.

GIS technology comes in many forms and can be utilized by this industry in many ways, however the ability to understand how the technology benefits the industry can be time consuming and costly. The first place to combat the highly technical nature of the GIS field is to have highly trained and skilled employees that know how to maximize the GIS system in place all the while being able to understand future needs and keep up with the technology. Programs such as the GIS certificate program at CSUB is vital in filling this need.

Occupational Safety and Risk Management Certificate

The Occupational Safety and Risk Management program introduces the potential new employee or safety professional with the foundations surrounding both OSHA and Cal-OSHA agencies, the influence of people and decision-making in organizational safety, and the importance of cultivating a positive organizational safety culture. These topics are covered in the program, which encompasses 3 courses over a 24-week span. Industry regulatory topics covered focus on the primary industries serving Kern County including General Industry, Agriculture, and Oil & Gas.

Additionally, the inclusion behavioral safety is a key ingredient to the lesson plan which guides the students in understanding the human factor and its effect in the workplace. Soft skills are also an important element integrated into the curriculum to introduce and improve each students' ability to use

technology, writing skills, public speaking, and inter-personal communication. After the completion of this program, students should have a solid foundation of organizational safety concerning the regulatory role in the workplace, common safety regulations and safe work practices, and strategies to assist in creating a positive organizational safety culture.

The knowledge and tools gained from the Occupational Safety and Risk Management program can be readily utilized immediately in the Manufacturing Industry with about 80% of the program's content. Over half of the topics concern General Industry regulations which are the primary focus of manufacturing industry professionals. Moreover, the Construction Industry regulations cover a major portion of the remainder of the program, which by its title may not appear to be relevant to the manufacturing industry, but an often overlooked element of understanding regulatory applicability is not based on the Industry of the organization, but that of the specific Task the employee is completing.

Under the law, a great deal of industries classified under General Industry will find a number of common tasks completed by employees may fall under a different Industry Standard than generally perceived. The Occupational Safety and Risk Management program facilitates closing that gap in perception and understanding of regulatory compliance. Finally, the lessons covering behavioral safety, soft skills, and the human factor is relevant to any industry which desires to improve its culture and relationship management between the organization and its employees.

Project Management Certificate

The Project Management program is designed to give project managers and team members the tools and skills necessary to efficiently manage and contribute to the success of their projects, regardless of industry or specialization. It is 100% on line, to accommodate the schedules of working professionals. The courses introduce students to various concepts, processes, and areas within the scope of a project. Students learn how to communicate effectively, procure quality goods and services, as well as assess the risks associated with the project and how to avoid those risks. These topics are covered in the program, which includes five courses delivered in a sixteen-week semester.

A Project Management course is also offered in the online Master of Science in Administration degree. Once a student has completed the course in the MSA program, the student is notified the course counts for two of the five required courses for the Project Management Certificate. The student has the option to complete the remaining three courses to receive the certificate. There is no reciprocity from certificate to the Master's program.

Open University

CSUB does not offer manufacturing-specific degree programs, but there are several programs which have courses associated with the manufacturing industry. These courses are offered in the (1) Bachelor of Science in Agricultural Business, (2) Bachelor of Science in Business Administration with a concentration in Management, (3) Bachelor of Science in Business Administration with a concentration in Marketing, (4) Bachelor of Science in Business Administration with a concentration in Operations and Supply Chain Management, (5) Bachelor of Science Environmental Resource Management, (6) Bachelor of Science in Electrical Engineering, (7) Bachelor of Science in Engineering Sciences with Emphasis in Bio-systems and Agricultural Engineering, and (8) Bachelor of Science in Engineering Sciences with Emphasis in Petroleum Engineering.

In the "Open University" program, community members, current or the incoming workforce, may enroll in academic courses they are interested in to help them build their skills, update their knowledge base, and teach them any new technology related to the manufacturing sector on an instructor approved basis. No formal application to the University is required.

Survey of Kern County Companies

A survey was created using Survey Monkey and shared via a link with our partner schools, Fresno and Stanislaus. Fresno State shared the link via email, while Stanislaus printed and mailed the survey. CSUB sent the link via email to 15 companies in Kern County.

The names of the companies, an example of the email, and the survey questions are provided (Appendix F). After evaluating the results via Survey Monkey, the response rate for CSUB was 20% (3 surveys). Ten percent for survey response is considered average.

Two of the three respondents said they offered internship opportunities to college students and one company in particular reported they hired 32 college graduates in the last three years. The positions hired were for entry level employees, because "they could train the graduates the way they wanted." The one common attribute all three companies gave as a desired trait was intelligence or an ability to think. The respondents primarily hire engineering majors (agribusiness and chemical), although several other majors were noted (Business, Project Management, and Safety and Environmental Health).

One company stated that it hired only graduates from UC Santa Barbara, UC Riverside, and Cal Poly because those schools have ChemE programs and the students are rooted within the Bakersfield area.

Kern County has positions for those interested in working in the manufacturing field. However, applicants must have the right education for the positions. All respondents of the survey indicated that Engineering was most important. Additionally, they also placed importance on degrees in Chemical Engineering, General Business, Agribusiness, Safety and Environmental Health, and Project Management. Education alone is not enough, today's workforce must be intelligent, able to work as a team, communicate well, and have the soft skills employers find invaluable.

Company Names and Cover Letter

The names of the Kern County companies the survey was sent to are as follows:

- AC Plating
- Aera
- Bolthouse
- Cotterman
- Driscolls
- Grimmway
- Mobile Dock Trailers
- Nestle
- Newby Rubber
- Nusil
- Pneumatic Control
- Structure Cast
- SunWorld
- Western Nutrients Corp.
- Wonderful

To the right is an example of the email that was sent to these companies.

Hello there,

CSU Bakersfield – Extended University Division has recently received a grant from the Fresno Workforce Investment Board (FWIB). The FWIB would like to learn how our campus connects with local companies and vice versa with regards to curriculum, program offerings, and overall student employment success rate.

We ask that you please take a few minutes to complete this 7-question survey: <https://www.surveymonkey.com/r/Z85HBCG> . If you are not the correct person who should have received this message, please forward the message to the proper contact.

Please be assured that your responses will be kept confidential and your information will not be sold.

Thank you.

Your time and input is appreciated.

Sincerely,

Jennifer

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**Jennifer Patino, M.S.**

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# Meeting Educational Needs of the Manufacturing Industry at Fresno State

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## Summary of findings and best practices

Fresno State has had a long-standing relationship working with local manufacturers. Given the number of manufacturers in Fresno's surrounding areas, there is a pool of interested individuals available to serve on University Advisory Boards to provide important feedback on educational opportunities for students.

The University has three degrees that will specifically give the students the educational knowledge to work with these local manufactures. Those degrees include Mechanical Engineering, Industrial Technology and Agricultural Mechanics. In addition to the degrees that provide direct hands on experience for manufactures, there are also degrees that can work with manufactures as are the degrees provided by the Craig School of Business.

While conducting the interviews with the above mentioned departments at Fresno State, we learned that a best practice is to have an advisory board from local manufactures that are alumni of the program or the University. This practice has shown that as alumni of the program they seem to have a higher interest in the success of the program and tend to remain more active.

A second best practice that was identified was that involving the internship or career services in identifying what skills or education students are lacking is important. If during and after a student completes the internship, a survey of how successful it was, from the student and the company perspective is ideal. The items that are identified are then shared with the Advisory Board and faculty, giving everyone a broader idea of the needs in the industry.

In Summary, the best practices that were identified at Fresno State that can be replicated, include:

- Having an Advisory Board consisting of alumni of the University, to assist with class and program reviews, determining skills needed in the students, as well as hiring of students.
- Involving the internship and/or career services in the identification of skills the students are lacking. The staff from these programs tend to have a more one of one interaction with the local manufactures related to the student's skill level and educational needs, such as SAP training.

## Methods used

Fresno State has had a long-standing relationship working with local manufacturers. Given the number of manufacturers in Fresno's surrounding areas, there is a pool of interested individuals available to serve on university Advisory Boards to provide important feedback on educational opportunities for students. As part of the research effort for this report, the Fresno State team conducted one-on-one meetings with various departments on campus who offered courses related to the manufacturing industry. The team learned about the many programs, courses, and the interactions with Advisory Boards.

One-on-one meetings were conducted with Mechanical Engineering, Industrial Technology, Agricultural Mechanics, Craig School of Business Professional Development Center, and the Fresno State Career Center. The outcomes from those meetings form the body of this report.

## Program Development and Course Reviews

### Mechanical Engineering

The Mechanical Engineering Department has a very active Advisory Board consisting of employees from local manufacturers including alumni of Fresno State. The Board assists the department by lecturing to students, fundraising, evaluating curriculum, acting as a sounding board for recruitment, and providing feedback on industry needs.

Three major examples were provided on the direct impact of feedback from board members that led to positive change. First, in order to reduce the number of "super seniors" (students with more than 150 units completed), Fresno State administration instructed all departments to reduce the number of required classes. The Mechanical Engineering Department provided a list of classes, descriptions and what was required to their Advisory Board. The Board reviewed the classes and determined a list of priority skills for the student learning experience. That list helped determine what classes would be taken off the required list and moved to electives.

Second, the Advisory Board determined there was a need for a Programmable Logic Controller (PLC) course, which will be an engineering level course that was not yet offered. Working in conjunction with Extended Education, the Advisory Board and

faculty from Mechanical Engineering developed a course that will be offered through Extended Education.

And third, the manufacturing industry has identified a lack of general awareness of local career options for the manufacturing industry.

In partnership with the manufacturing community, the Industrial Technology and Mechanical Engineering Departments formed a committee that met to address this issue. The outcome was the creation of the Manufacturing Summit. The purpose of the event is to provide seminars that addressed industry needs as well as to promote careers in manufacturing. The event was so successful that it outgrew the original committee and is now the responsibility of the Office of Community and Economic Development (OCED) at Fresno State. OCED provides staff for the event, and the industry committee still provides the vision and input for the event.

## **Craig School of Business Professional Development Department**

The Craig School of Business identified several departments that provide courses specifically related to the manufacturing industry. The direct involvement with industry comes from the Office of Professional Development. Staff from this office works with students to place them in internships, assists companies seeking to hire graduates as well as career planning for current students. The Office of Professional Development conducts surveys with students as well as with companies participating in internship programs. Survey responses are reviewed, and any deficiencies in skills learned by the students are identified and shared with faculty for consideration of modifying course curriculum.

One of the major deficiencies revealed in the survey was the lack of student awareness concerning SAP (Systems, Applications and Products) Software. The software program is commonly used in most areas of manufacturing, including operations management, inventory, and accounting, among others. Based on this feedback, the Craig School of Business identified several faculty members for additional training on how to incorporate the SAP software into their curriculum. This increased awareness of the SAP software and its applications are still needed to be fully implemented into the curriculum. More information on this issue can be found under “Other areas of interest.”

## **Industrial Technology**

The Industrial Technologies Department has an active Advisory Board comprised of local manufacturers who provide feedback on existing curriculum as well as any proposed new courses. During the latest review of curriculum, the Advisory Board indicated that they would like to see more theoretical teaching about Computer Numerical Control (CNC). Currently the application and operation of a CNC machine is taught at local community colleges. However, the Advisory Board would like Fresno State students to learn more about programming CNC machines.

The Advisory Board also identified a need for a new water technology option in the Industrial Technology Department. To establish the new option, the Board is currently reviewing a list of classes as well as equipment required to accomplish this effort.

## **Career Center**

The Career Center coordinates internships, part-time and full-time employment placement and assists other colleges on campus with Job/Career Fairs. Based on past experience and feedback from local manufacturers, it was determined that these types of events, based on college degrees were not achieving the desired results. It was determined that these events needed to be opened up to all students with relevant degrees across the campus.

Spearheaded by the Career Center, and working with other areas of campus, a revised Career Fair format was established. The first revised manufacturing Job/Career Fair took place in spring 2016 and included students from the Craig School of Business, Lyles College of Engineering, and the Jordan College of Agricultural Sciences and Technology. The event was deemed a big success for both students and manufacturers.

## **Agricultural Mechanics**

The Ag Mechanics Department at Fresno State is focused on teaching future teachers basic shop skills in the agricultural machinery area. Typically, students that graduate from this program go on to teach Ag mechanics at high schools and community colleges. It is important that the faculty has a direct relationship with manufacturers that will eventually hire students coming out of high school or community colleges. Local manufacturers of agricultural machinery form part of the

Advisory Board for this department and donate equipment for instruction to enhance the educational experience of future Ag teachers.

## Summary of best practices

While doing the interviews with the above mentioned departments at Fresno State, we learned that a best practice is to have an advisory board from local manufactures that are alumni of the program or the University. This practice has shown that as alumni of the program they seem to have a higher interest in the success of the program and tend to remain more active.

A second best practice that was identified was that involving the internship or career services in identifying what skills or education students are lacking. If during and after a student completes the internship, a survey of how successful it was, from the student and the company perspective is ideal. The items that are identified are then shared with the Advisory Board and then the faculty, giving everyone a broader aspect of the needs in the industry.

## Course review by Advisory Boards (Local Manufacturing)

The Industrial Technology and Mechanical Engineering Departments along with the Craig School of Business were identified as having the most courses and programs directly related to the manufacturing sector. A review of the Fresno State's catalog offering was conducted to identify the specific courses (as well as the descriptions and associated departments) related to manufacturing careers. Appendix D provides a list of classes identified.

The Industrial Technology and Mechanical Engineering Departments both have Advisory Boards that consist of individuals working at local manufacturers. Members of these Advisory Boards are asked to review new and existing courses in order to evaluate the relevancy of student learning for careers in the manufacturing industry.

The Craig School of Business has a slightly different approach. They have an Advisory Board that review courses but the process is largely driven by feedback from evaluations of student internships. Students are required to fulfill their internship requirements for graduation, and part of the process

both the student and the employer are required to complete several evaluations of the experience. This includes identifying any deficiencies in the student's skill set.

The findings are then shared with the faculty, to determine whether the deficiency lies in an individual student or is a deficiency in the skills that are being taught in the classroom. If it is the latter, faculty review how they can incorporate the needed skill into the classroom. The SAP software is a prime example of identification and action in problem solving. If the need for significant change to the curriculum is needed to advance the student learning process, then the entire course is reviewed by the Advisory Board for potential changes.

## Summary of best practices

The best practice identified for course review is to have an active advisory board review the changes in a specific course or the program in general regarding required courses. An Advisory Board from local manufactures, which are alumni of the program who hire students is best because they tend to be more active in the programs.

## Graduate hiring

Based on experience from Fresno State staff, a majority of students that are offered full-time positions immediately upon graduation have participated in an internship program. The most successful places for manufacturers to find interns at Fresno State is the VIP Internship Program managed by the Lyles College of Engineering, the Craig School of Business Professional Development Office, the internship coordinator at the Jordan College of Agricultural Sciences and Technology and the University's Career Center.

The main source of internship placement for the Lyles College of Engineering is through their VIP Internship Program. The program places about 24 students per year at local manufacturing companies for period of six-month. About two-thirds of those students are hired full time by the companies where they did their internship upon graduation.

Currently there is no formal process to follow up with students after graduation. Most of the information comes from informal discussions. Fresno State is looking into using a national survey system to follow up at six months and again at twelve months after graduation. This will be tabulated and compared

to national trends. Currently, the Craig School of Business is the pilot at Fresno State for the national system survey. Once survey process has been vetted and finalized, it will be extended to all Fresno State Colleges and Schools.

## Stackable Certificates

The nature of how courses, degrees, and minors work at Fresno State, does not facilitate the creations for stackable certificates. A student can specialize in an area by taking additional classes towards his/her degree, but there is no certificate provided. If a student needs a certificate for something that is industry specific, they might be able to take a class toward preparing for that certification, but needs to go outside the University to acquire that certificate.

## Mix degree and non-degree courses

There are two ways the University provides courses at Fresno State. As part of a regular degree or via Open University with no credit courses. Those are courses that are open to the public but because they are not part of a regular curriculum on campus, they are not part of a degree. There are no degrees on campus that are mixed with courses that work toward a degree and ones that do not. If an enrolled student takes any of these classes, they would not count toward his/her degree. They would be taking them to prepare for an industry specific test or to gain industry specific skills that are not provided as part of their regular degree courses.

## Other areas of interest

During the one-on-one meetings with departments, several areas of opportunity were identified. One area of immediate need and high impact is to significantly improve the students training and exposure to SAP software. SAP is a German software company whose products allow businesses to track customer and business interactions. SAP is well-known for its Enterprise Resource Planning (ERP) and data management programs, which can be used in many aspects of manufacturing.

CSU, Chico identified this need several years ago and developed an eight-week mini institute provided through Extended Education during the summer. This institute is available to all degrees as the software is used in multiple aspects of manufacturing. Each summer there has been a waiting list to register for this class. Students that have completed this

program report being hired after attending the institute and this one skill separates them from other applicants.

Another finding worth noting is the similarities between student's skills in Industrial Technology needed for manufacturing as well as those required in the food processing industry. To help better train Fresno State students, the food processing industry is donating a new packing line to the Industrial Technology Department in order for students to better learn how to operate, maintain, and improve food processing procedures.

The last item discussed was the collaborative work being done with local high schools and departments at Fresno State to develop student career pathways. The importance of a student identifying manufacturing as a career option early is critical to meet future employment demand. Providing these experiences at the high school level encourages the best and brightest students to seek meaningful careers locally in manufacturing, which helps ensure a strong and competitive economic base.

## Conclusion

The study identified several areas in which Fresno State is working in collaboration with the local manufacturing industry to improve the student experience through internships and quality of the educational experience through review and change in curriculum. It is through the university/industry partnership that students and the community will best benefit. While much has been accomplished, there is still more to be done. The process is most successful when we work together for a common outcome, student success.

Even though several areas were identified that can use improvement, the one that is recommended that would be easy, is more SAP training. Either a course for the students, or more training for the faculty on how to incorporate it into their classes.

## Fresno State Survey Results

A survey was created via Survey Monkey by our partner school, CSUB. Fresno State shared the link via email to thirty companies located in Fresno and surrounding areas.

The names of the companies are provided. After evaluating the results via Survey Monkey, ten surveys were returned for Fresno State, the response rate was 30% (10 surveys). This is an above average rate of return, which is normally considered ten percent.

Half of the respondents said they offered internship opportunities to college students and one company in particular reported they hired fifteen college graduates in the last three years. The positions most hired were management, marketing, and accounting employees. The one common attribute the companies gave as a desired trait was a good work ethic. Communication and critical thinking skills were also mentioned. The respondents primarily hire Engineering majors (Ag and Mechanical), although other majors were noted (Business and Industrial Technology).

Six of the companies stated hiring graduates from Fresno State. Cal Poly SLO, Purdue, and Berkeley were mentioned by other respondents as the choice universities to hire from.

The manufacturing industry is counting on the universities to deliver an employee prepared with the skill set to work. Fresno State is ambitiously working to meet that goal. Development of the SAP program and strong advisory boards will deliver a workforce that exceeds the needs of the employers.

## **Fresno State Companies surveyed**

Below are the following companies who have been asked to participate in the short survey delivered through Survey Monkey via email for the Fresno Workforce Investment Board (WIB):

- Advanced Drainage Systems Ads-Pipe
- Alex-Tronix Controls
- American-Marsh Pumps
- Andros Engineering
- Energy Design Group
- Betts Company
- BORGA Steel Buildings and Components
- Bowsmith Inc
- CENCAL CNC/ High Precision Turning and Milling
- EuroDrip USA
- Flowserve
- Fresno Valves and Castings Inc.
- Grundfos
- H2O-Optimizer
- Irritec USA- Irrigation System
- Jain USA
- Franklin Electric
- Lakos
- Madera Pumps
- Mechanical Associates
- ITT
- Morrill Industries INC
- National Pump
- Netafim USA
- Paige Electric Co
- Phoenix Plastics
- Preferred Pump
- Prinsco Inc.
- Quality Counts PNMCMC
- Safe Drain
- Turner Designs Hydrocarbon
- Waterman Industries USA
- Weir Minerals



## Meeting the Educational Needs of the Manufacturing Industry at Stanislaus State

Stanislaus State meets the needs of its regional employers by serving a diverse student body of over 9,500 by offering programs grounded in the liberal arts, with an emphasis on life-long learning. While Stanislaus State does not offer engineering degrees, the University does offer three sought after degree programs for those students interested in pursuing careers focused on the manufacturing sector: (1) Bachelor of Science in Business Administration with a concentration in Operations Management, (2) Bachelor of Arts in Agricultural Studies, and (3) Bachelor of Science in Biological Sciences with an emphasis in Food Safety. The key to the success of these programs is the strong relationships University faculty, administrators, and staff have developed with their advisory boards, which often include employer representatives, industry leaders, alumni, and members of regional community college systems.

In terms of community college partnerships, the College of Business Administration is working closely with Modesto Junior College to ensure that an articulation agreement is in place so that students who earn their Associate's Degree in "Logistics and Supply Chain Management" can easily transfer to Stanislaus State in order to earn their 4-year degree.

In addition to these three degree programs, there are numerous courses related to manufacturing, which include those offered in the College of Business Administration (Operations Management, Supply Chain Management, and Lean Operations Strategies); those offered in the Department of Agricultural Studies (Tree and Fruit Crop Production and Management, Principles of Plant Propagation, and Farm Management); and those offered in the Department of Biological Sciences with an emphasis on Food Safety (Medical Microbiology, Bacterial Physiology, and Food Microbiology). Each of these degree programs also offer student internship opportunities, an important part of a student's educational journal and work experience that many employers are seeking from new college graduates.

The University's "Open University Program" within Extended

Education offers educational opportunities, on a space-available basis, for non-admitted students wanting to update their professional skills, add to their credentials, make a career change, or try out college-level academic classes. Thus, those already employed within the manufacturing sector who wish to update their skills, as well as those who have a desire to make a career change focusing on manufacturing, can take advantage of Stanislaus State's Open University Program. Similar programs are offered at the other 22 California State University campuses.

While it is clear that courses focused on specific manufacturing related topics is important to employers, results of the employer survey indicate that soft skills, including interpersonal skills, communication skills, and critical thinking skills, are also imperative to the success of employees and employers. The ideal employee would then be someone who possesses technical expertise, coupled with authentic soft skills.

In summary, the best practices that could be replicated to ensure that both the individual worker and our regional economies prosper include:

- (1) Development of Advisory Boards to assist with strategic planning, reviewing and recommending courses, mentoring students and faculty, providing internships and jobs, helping with fundraising, and teaching in the programs.
- (2) Continued partnerships with regional community colleges to establish articulation agreements and a seamless transfer for students to earn their Baccalaureate degrees.
- (3) Promotion of the "Open University System" to encourage current and potential employees to take academic classes to help them upgrade their skillsets.
- (4) Development of workshops and/or certificate programs focused on soft skills for individuals employed in the manufacturing sector.

## Overview

While a variety of Stanislaus State's graduates are employed within the manufacturing sector, the three programs offered by the University that have a strong focus on manufacturing, including agricultural manufacturing, include the Bachelor of Science in Business Administration with a concentration in Operations Management, (2) the Bachelor of Arts in Agricultural Studies, and (3) the Bachelor of Science in Biological Sciences with an emphasis in Food Safety. An overview of each of these programs, including advisory board involvement and course descriptions, is presented here.

### College of Business Administration

The College of Business Administration consists of three departments: Accounting and Finance, Computer Information Systems, and Management, Operations, and Marketing. We offer one undergraduate degree program with several concentration options and three graduate degree programs.

The College of Business Administration (COBA) has a very active and involved "Business Advisory Board" (BAB) with 30 members. These members span a variety of industries, including the manufacturing sector. Specific companies from the manufacturing sector that are represented include Bronco Wine Company, E&J Gallo Winery, American Lumber Co., Foster Farms, and Del Monte. The BAB also includes a faculty member from the University's main transfer partner, Modesto Junior College. While the members come from the six regions Stan State serves (Calaveras, Mariposa, Merced, San Joaquin, Stanislaus, and Tuolumne), the majority come from Modesto (Stanislaus County), the largest city in close proximity to the University.

The majority of the board members are mid-to upper-level managers who serve as volunteers with no set term limits. These members are often speakers at student organizations and guest speakers in classes, as well as "Professor for a Day." Several have also taught courses on a part-time basis for the College. The members are also involved in internships and job placement for COBA students. In addition, these members provide input into skill sets that employers are seeking and industry trends, which then leads to curriculum updates.

There is an established BAB curricular review process every 2-3 years whereby industry experts provide input into updates and courses that the COBA might consider revising or adding. For example, the accounting curriculum was reviewed in spring 2016 and the management/marketing curriculum will be reviewed in spring 2017. The board is also very involved in the College's strategic plan.

A unique partnership and collaboration is with Opportunity Stanislaus, whose President is a member of the BAB. Their mission is to facilitate job growth in Stanislaus County. Stan State is a member of Opportunity Stanislaus and has a seat on their Board of Advisors. In the fall of 2016, the COBA and Opportunity Stanislaus are sponsoring a "Fast Pitch Innovation Challenge," where students can present an innovative business/product concept with the winner be awarded a \$500 cash prize.

Another unique partnership is with Modesto Junior College, who offer a certificate in "Logistics and Supply Chain Management," and an Associate's Degree in "Logistics and Supply Chain Management." A near-term goal of the COBA is work with Modesto Junior College and their program director, who earned his MBA from Stan State, to ensure a seamless transfer from the community college into the COBA's operations management major.

### College of Arts, Humanities, and Social Sciences: Department of Agricultural Studies

The Bachelor of Arts in Agricultural Studies is a multidisciplinary program that blends the contribution of a number of academic departments through upper division core courses and four concentrations: Agricultural Biology, Agricultural Economics, Sustainable Agriculture and General Agriculture. Experiential learning and applied research opportunities are offered through the concentrations. Students are encouraged to explore diverse approaches to sustainable agricultural production, distribution, and management in evolving economic and environmental settings.

The Department of Agricultural Studies also has a very active advisory board with 15 members. These members are concentrated in the agribusiness industry and include representatives from Hilmar Cheese, Foster Farms, Fredriks Nursery, the California Poultry Federation, and various independent farming families located in the Central Valley. The chair of Stan State's Biological Sciences Department, where the Food Safety programs reside, has a seat on the board. The board also includes representation from two community colleges, Modesto Junior College and Merced College. Since approximately 80 percent of students in the major transfer from these community colleges, Stan State has forged a strong relationship with the administration and faculty involved in these programs.

The board members participate as part-time faculty and guest lecturers and provide information about the future of agribusiness in the Central Valley. They also provide connections to the local community which enable Stan State students to obtain internships and jobs. In addition, they review and provide feedback about the program and its curriculum. This feedback has led to two recent course offerings, Integrated Pest Management and Agribusiness and Entrepreneurship, as well as a proposal to change the Bachelor of Arts in Agricultural Studies to a Bachelor of Science.

The Endowed Chair of the Agricultural Studies Department, Dr. Oluwarotimi Odeh, notes that current students in the program, as well as graduates from the program, have obtained a number of manufacturing related positions throughout the Central Valley. These positions include a focus on quality control, sustainability, crop and plant production, and pest management.

## College of Science: Development of Food Safety Programs

Agricultural Business (Agribusiness) is a key industry segment in the Central Valley. Agribusiness includes growing, harvesting, manufacturing, processing, packaging, and distributing food products; thus, agribusiness is important to include when researching the manufacturing industry sector. With Stan State's main campus located in Stanislaus County, and our Stockton Center located in San Joaquin County, developing programs focused on this sector has been a key strategic initiative for several years.

Stan State currently offers a Bachelor of Arts in Agricultural

Studies within the College of Arts, Humanities, and Social Sciences. This major was started in 2003. Beginning in the fall of 2016, a Food Safety emphasis was added within the Department of Biological Sciences in the College of Science. In addition, Stan State has agreed to partner with Safe Food Alliance, an organization that offers technical services to growers, packers, processors, and food manufacturers to aid in their efforts to maintain food safety standards, to begin offering food safety training on site at the University's main campus located in Turlock in the Summer of 2017, with the possibility of expanding this training at both the Turlock campus and the Stockton Center. The history and steps taken to get to where we are today provide insight into the needs of our Central Valley employers and the ways in which Stan State has attempted to meet these needs. Several key milestones are outlined here.

Stan State first started to research the possibility of adding Food Science programs in 2010. Program names such as "Food Science and Technology" and "Food Science, Engineering, and Logistics" were presented. Discussion focused on a complete major, both undergraduate and graduate, a concentration in the biology and chemistry majors, a post-baccalaureate academic certificate, and a non-credit certificate. Further discussions focused on food science versus food safety. Based on market and economic research, coupled with the University's availability of resources, it was deemed that the University should focus on food safety, but not completely discarding the possibility of adding food science at a later date.

Over the next two to three years, the University applied for several grants, including proposals to the Department of Agriculture, the JP Morgan Chase Foundation, and the Commission on the Extended Education from the California State University. Stan State was not successful in obtaining these outside funding sources, which delayed program development. But in 2015, the University did receive funding from a private donor to help develop curriculum and build a food laboratory kitchen.

This has resulted in the development of the recent "Food Safety Emphasis" pathway for students. More recently, in November of 2016, the College of Science and University Extended Education have partnered with the Education Advisory Board/Burning Glass to complete an updated market research and labor market analysis of a food safety

undergraduate program, concentration, and certificate program. This new information will help us decide on the strategic directions we will need to take to fill the gaps between

employer needs and the education level of our Central Valley community.

## Survey of Manufacturers

In order to gather information pertaining to employment of current students and graduates of Stanislaus State, a survey was distributed to 25 of the largest manufacturing employers in the Central Valley. Many of these employers have representation on the College of Business Administration's Business Advisory Board or the College of Arts, Humanities, and Social Sciences Department of Agricultural Studies' Advisory Board.

The list of companies, their location (city and county), and a brief description are provided here. The survey and cover letter are also included. Five surveys were returned, which equates to a return rate of 20 percent. This is generally considered an acceptable return rate for a survey of this type.

On average, these Central Valley employers hire 8-30 college graduates each year. The majority also offer internship opportunities for college students. The survey respondents mainly hire engineering majors (chemical, electrical, industrial, and mechanical). They also hire business and accounting majors, particularly operations management majors. Those in the food manufacturing sector also hire students focused on food science and dairy manufacturing.

Recent college graduates are most often placed in production/operations management, quality assurance, process and manufacturing engineering, and analyst positions. In addition to work and internship experience, the skills and attributes most important to these employers include the graduates' ability to work well in a team environment, communication skills, personal integrity, ability to learn and solve problems, critical thinking skills, and their fit with the company's cultural values.

One company only hires graduates from the top U.S.-based universities such as Berkeley, Stanford, and MIT, while the others hire from a variety of private and public regionally-based universities, including those within the California State University system.

In summary, Central Valley employers are continuing to hire a significant number of college graduates with majors focused on the manufacturing sector. Engineering majors are the most sought after, followed by business and food science majors. Employers are also interested in individuals who are problem solvers and can demonstrate that they have the interpersonal and communication skills to succeed in a team environment.

| #  | Company                            | Location                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----|------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Applied Aerospace Structures Corp. | Stockton/<br>San Joaquin County | Specializes in the design, fabrication, and testing of lightweight aerospace assemblies. Space products that they have manufactured range from small strut tubes to complete spacecraft structural assemblies. Aircraft products range from near zero CTE optical benches, to aero fairings, to large turret assemblies.                                                                                                                                                                                                      |
| 2  | Berry Plastics                     | Lathrop/<br>San Joaquin County  | Manufacturer of plastic packaging and protection products for household, food, health care, and industrial applications.                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3  | Bronco Wine Company                | Ceres/Stanislaus County         | Bronco Wine Company is a family-owned winery committed to growing, producing and selling the finest quality wines of the highest value to their customers. It is currently the fifth largest winery and the largest vineyard owner in the United States. It is vertically integrated, from the vineyard to the table.                                                                                                                                                                                                         |
| 4  | CBC Steel Buildings                | Lathrop/<br>San Joaquin County  | One of the largest metal building manufacturers in the Western United States and Canada.                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5  | Del Monte Foods                    | Modesto/Stanislaus County       | Manufacturer and marketer of processed foods, primarily canned vegetables, fruit and tomato products. The Modesto plant produces over 27 million cases of apricots, fruit cocktail, peaches, and pears, and fruit cups each year.                                                                                                                                                                                                                                                                                             |
| 6  | Duarte Nursery                     | Hughson/Stanislaus County       | Largest permanent crop's nursery in the U.S. Part of their commitment to innovation and quality is Dry Creek Lab, the nursery's on-site laboratory where DNI produces fruit and nut trees through micropropagation and tissue culture.                                                                                                                                                                                                                                                                                        |
| 7  | Duraflame                          | Stockton/<br>San Joaquin County | America's firelog brand leader; offers a variety of fire-related products, including firelogs, firestarters and barbecue products.                                                                                                                                                                                                                                                                                                                                                                                            |
| 8  | E&J Gallo Winery                   | Modesto/Stanislaus County       | The largest family-owned winery in the United States; brands include Andre, Boone's Farm, Carlo Rossi and Barefoot Wines.                                                                                                                                                                                                                                                                                                                                                                                                     |
| 9  | Foster Farms                       | Livingston/Merced County        | Specializes in a variety of chicken and turkey products advertised as fresh and naturally locally grown.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 10 | Hilmar Cheese                      | Hilmar/Merced County            | Specializes in the production of natural cheeses utilized by private label and national brand, retail and foodservice companies throughout the world. Hilmar Ingredients, a division of Hilmar Cheese Company, markets a wide range of whey protein concentrates, whey protein hydrolysates, whey protein isolate, Lactoferrin; edible, refined and ultra-refined lactose; and skim milk powders. These ingredients are sold to food and beverage companies worldwide for use in everything from chocolate bars to smoothies. |
| 11 | J.R. Simplot Co.                   | Oakdale/Stanislaus County       | One of the largest privately held food and agribusiness companies in the nation. The company pioneers innovation in plant nutrition and food processing.                                                                                                                                                                                                                                                                                                                                                                      |

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| 11 | J.R. Simplot Co.                   | Oakdale/Stanislaus County       | One of the largest privately held food and agribusiness companies in the nation. The company pioneers innovation in plant nutrition and food processing.                                                                                                                                                                                                                                                                                                                                                                      |
| 12 | Jackrabbit                         | Ripon/San Joaquin               | Manufactures nut harvesting equipment for growers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 13 | Leprino Foods                      | Tracy/San Joaquin County        | A global leader in the production of cheeses, whey, and dairy food ingredients; largest lactose producer in the world. Also the world's largest producer of mozzarella and a premier partner to leading pizzerias, restaurants, food distributors and retail brands. The plant in Tracy produces cheese products.                                                                                                                                                                                                             |

|    |                                       |                                                           |                                                                                                                                                                                                                                                                                                                                                                                |
|----|---------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14 | Linden Nut Co.                        | Linden/San Joaquin County                                 | Offers in-shell walnuts, raw walnut kernels with various certification standards.                                                                                                                                                                                                                                                                                              |
| 15 | Morada Produce                        | Stockton/<br>San Joaquin County                           | A family owned grower/packer/shipper of cherries, walnuts, onions, and bell peppers.                                                                                                                                                                                                                                                                                           |
| 16 | Pacific Coast Producers               | Lodi/San Joaquin County                                   | An agricultural cooperative, owned by over 160 family-farms located in Central and Northern California. They specialize in canning fruits and tomatoes for Private Brands throughout the world.                                                                                                                                                                                |
| 17 | Schuff Steel Company                  | Stockton/<br>San Joaquin County                           | The largest structural steel fabricator and erector in the United States.                                                                                                                                                                                                                                                                                                      |
| 18 | Sconza Candy                          | Oakdale/Stanislaus County                                 | With over 500,000 square feet of manufacturing and packaging capabilities, Sconza develops, manufactures, packages and ships confections for contract customers nationwide.                                                                                                                                                                                                    |
| 19 | Seneca Food Corporation               | Modesto/Stanislaus County                                 | Involved in every major phase of agribusiness from developing crop seeds to manufacturing our own cans. Modesto is its largest plant location where apricots, fruit cocktail, fruit concentrates, fruit mix, fruit nectars, peaches, and pears are packaged.                                                                                                                   |
| 20 | Sensient Natural Ingredients          | Turlock/Stanislaus County                                 | Sensient Natural Ingredients, a division of Sensient Technologies, cultivates natural ingredients that bring flavor, texture, color, and nutrition to food wholesome products and solutions. Their core offerings include California-grown onion, garlic, and parsley, as well as capsicums and vegetables.                                                                    |
| 21 | Simpson Strong-Tie Company            | Stockton/<br>San Joaquin County                           | A leader in structural systems research, testing and innovation. Its structural products are recognized for helping structures resist high winds, hurricanes and seismic forces. Product offerings include engineered structural connectors, fasteners, fastening systems, lateral-force resisting systems, anchors and products that repair, protect and strengthen concrete. |
| 22 | Stanislaus Food Products              | Modesto/Stanislaus County                                 | A family-owned cannery specializing in fresh-packing tomato products used in Italian restaurants and pizzerias throughout North America. Their products are available to restaurants only through foodservice distributors throughout the United States and Canada.                                                                                                            |
| 23 | Stockton Steel Inc./<br>Herrick Corp. | Stockton/<br>San Joaquin County                           | One of the largest steel fabricators and erectors in the United States.                                                                                                                                                                                                                                                                                                        |
| 24 | Tesla Motors                          | Lathrop/<br>San Joaquin County                            | Design and manufacture of advanced electric vehicles, battery packs, and drive systems.                                                                                                                                                                                                                                                                                        |
| 25 | The Wine Group                        | Livermore/Multi-county;<br>Headquarters in Alameda County | Established in 1981, The Wine Group (TWG) is the world's second-largest wine producer by volume. TWG is a privately-held, management-owned company with a portfolio of leading brands, including Cupcake, Franzia, flipflop and Almaden.                                                                                                                                       |

# Summary of Research Findings and Best Practices from Three Campuses

## Best practices:

**1. Student internships** provide valuable preparation for work in industry. Internships serve at least two purposes – students gain practical experience and manufacturers have a chance to observe students. Some of these interns receive offers of employment from their internship site.

This ranks as a best practice. Internships serve the needs of students who want jobs and the needs of manufacturing companies who need qualified employees. Internships weave work experience into the student’s academic program. They provide an efficient and cost-effective method of training the next generation of workers.

Manufacturers say that, in addition to technical expertise, they value graduates’ ability to work well in a team environment. They also look for communication skills, personal integrity, the ability to learn and solve problems, critical thinking skills, and a student’s fit with the company’s cultural values.

**2. “Open University” (OU)** programs within Extended Education units on each campus offer educational opportunities, on a space-available basis, for non-matriculated students who want to update their professional skills, add to their credentials, make a career change, or try out college-level academic classes.

Workers already employed within the manufacturing sector, who wish to update their skills, as well as those who have a

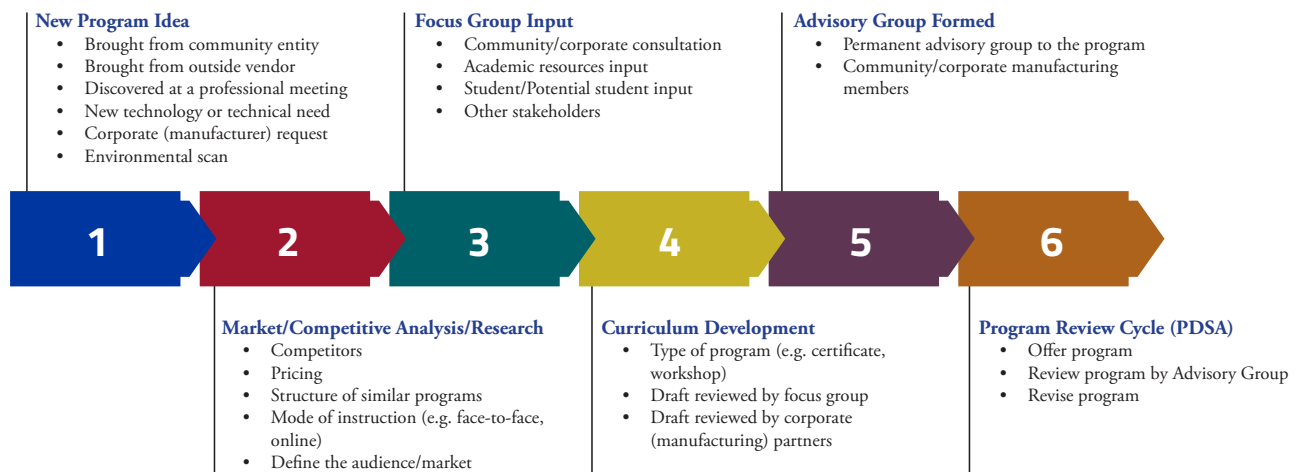
desire to make a career change focusing on manufacturing, can take advantage of Open University programs. Similar programs are offered at all California State University campuses.

OU programs rank as a best practice because they offer relatively low cost education to people in manufacturing settings or those who want to enter a manufacturing career. OU courses already exist as degree credit courses on campus. Students in these courses fill vacant seats that would otherwise go unused.

OU programs have very few barriers to entry. Some courses (especially in technical fields) may require prerequisites. But if a person has the background to take a course, a little paperwork and the professor’s permission allows a person entry. A typical 3-credit course will cost about \$1,000.

Adult learners can select OU courses that meet their specific personal needs or their company’s goals. Courses that take place in the evenings best suit these learners. Manufacturers could encourage current and potential employees to take these academic classes to help them upgrade their skills.

**3. The Extended Education Model of Program Design** is used by each of the campus’ Extended Education units to respond to corporate needs. Below we provide a typical model of program development used by EE units. This model serves as a best practice. It includes collaboration with the corporate sector throughout the process of program development.





**4. Extended Education programs** work on a self-support financial model. This makes EE programs sensitive to market needs and demands. This market sensitivity sets EE apart from state supported degree programs. EE programs, especially non-degree, certificate programs, can respond quickly to market needs and requests by industry. These units maintain a close connection with corporate partners and advisory groups to keep programs relevant and valued by the market.

Industry often contracts with EE units for training to meet specific corporate needs (e.g. team building, computer skills, conflict resolution). These programs have advisory boards. Also, Program Directors consult regularly with the manufacturing sector to ensure the relevance of programs to industry needs. EE programs often hire industry experts to teach in these programs.

Extended education units offer non-degree workshops and certificate programs. These programs meet specific needs of the corporate sector. Non-degree programs range from technical topics such as occupational risk and safety to training in interpersonal skills, communication skills, and critical thinking skills. Manufacturers say they need workers with technical expertise, who can also express themselves verbally and in writing. Post-graduate, non-degree soft skills training can help fill a gap in workers' abilities.

Non-degree courses and certificates provide the most flexible education and training options in the university. They can meet specific needs of a specific manufacturer through an on-site course or serve the needs of an industry through a multi-course certificate program. These non-degree courses and programs provide a nimble and cost-effective response to ever-changing industry needs.

Extended Education courses and programs meet the immediate needs of workers and manufacturers. Students in these programs demand relevant, up to date, practical, and useful knowledge and information. In the case of unemployed or under-employed

workers, these programs can provide an efficient path back to the workplace. The low barriers to entry, the focus on employment, and the relatively short duration of the programs make them ideal for the unemployed or under-employed student.

**5. Advisory boards** on each campus assist with strategic planning, reviewing and recommending courses, mentoring students and faculty, providing internships and jobs, helping with fundraising, and teaching in the programs. Programs consult regularly with their boards to keep programs up to date.

**6. Partnerships** with regional community colleges can establish articulation agreements and create a seamless transfer for students to earn their Baccalaureate degrees. Articulation serves as a best practice. It provides students a smooth path to a university degree. Sound advising at the community college ensures that students get the lower division courses they need to efficiently enter university as third year students.

Advising becomes especially important for students who want to enter technical fields in the manufacturing sector. Third year courses in a student's major in science or engineering, for example, will require fulfillment of lower division prerequisites. Preparing students for careers in manufacturing requires coordination of community colleges and university programs to ensure a smooth movement toward the Bachelor's degree.

**7. Stackable Certificates** count as a best practice in meeting the needs of manufacturers. This can refer to non-credit certificates (e.g. a certificate leading to an advanced certificate). It can refer to degree credit certificates that can be brought into a degree program (e.g. a business analytics certificate that can count toward credit in an MBA program). And it can refer to a degree credit graduate who can bypass some courses in a non-degree certificate program. CSU, Bakersfield offers this last

option to graduates of its Master of Science in Administration program. These graduates get to bypass some courses in the non-degree Project Management certificate program. We see this mix of degree and non-degree learning as a future trend.

Stackable certificates can also refer to non-degree certificates that can count toward degree credit. This last option does not exist in the California State University system to our knowledge.

## Summary

The Schools and Colleges within the universities reviewed here sometimes engage with manufacturing companies when creating course content or curricula. More typically curricula follow lines set out by professional associations, scholarly associations, or accrediting agencies. Manufacturing-related topics can appear as electives and specializations within traditional degrees (e.g. engineering).

Traditional curricula serve the needs of manufacturing companies by providing basic skills such as critical thinking, writing, and oral communication. Majors typically provide specific skills in fields such as engineering, accounting, finance, human resources, and many others that meet manufacturing firms' needs.

In addition, specific courses serve manufacturing firms' needs such as Six Sigma, lean manufacturing, and total quality management. These topics and skill sets may exist as separate courses or may exist inside courses with broader scope.

Graduate courses (e.g. the MBA) contain topics, skills, and case studies that prepare students for work in manufacturing settings.

University programs in business, engineering, and the sciences create advisory groups that may include professionals from the manufacturing sector. These groups meet periodically (e.g. once or twice a year) to discuss the curriculum, discuss changes in the field, provide input to the program director with respect to corporate needs, provide feedback on graduates' performance, and other functions that support academic programs.

These advisory groups seldom play a major role in creating or shaping degree credit curricula. They have little or no role in the actual content of courses delivered in the classroom. Professors guard their autonomy with respect to curricula and course content. Some instructors in more practice-oriented fields (such as business or engineering) do keep up with trends in the corporate world and incorporate these insights into their programs. But this depends on the instructor's field and interest in linking course content to real-world manufacturing interests. It is sometimes said (critically) that the universities focus (too much) on theory and spend too little time on the application of knowledge. Some people in the academy would take this as a compliment.

In sum, the universities reviewed here, by tradition, do not typically engage with the manufacturing sector in planning or revising their curricula. Programs tend to stay stable from year to year (though course content will change depending on the instructor's interests and developments in a field). Introduction of new courses to meet the needs of external entities such as manufacturing companies occur periodically. They often begin as "special topics" courses. Major changes to curricula such as the introduction of a new major or a new field of study can take several years to implement.

## The Future

This report points to gaps between the interests and needs of the manufacturing sector for higher education programs and the current provision of those programs by the three CSU campuses studied here.

Traditional higher education programs provide educated and skilled workers to the manufacturing sector. We highlighted business and engineering graduates as examples of how universities produce an educated workforce for the manufacturing industry. But graduates from the humanities and social sciences also enter manufacturing settings as office workers and junior executives. The university serves as an engine that produces knowledge workers for the 21st century.

The universities do less well in responding to the emerging and immediate educational needs of manufacturers. Curricula change slowly, instructors may lose touch with the day-to-day life of industry, and, as a result, courses can lose relevance. Universities could do better at fostering and maintaining links with manufacturers. But universities change slowly, and respond to change slowly. That is both a strength and a weakness of the university.

In recognition of this slow response to change, each campus studied here contains an Extended Education (Extended University, Continuing Education) unit. EE units pay close attention to industry and community needs. They build partnerships and relationships with local stakeholders. Programs can develop quickly and efficiently to meet market (in this case manufacturing needs). Examples of such programs that suit the manufacturing sector include Six Sigma, Lean

Manufacturing, Total Quality Management, and Risk and Safety programs. Manufacturing industries also need executive and managerial training including programs on workplace safety and risk, human resources issues, team building, conflict management, and communication skills.

A proper university response to manufacturing sector needs would use the EE model described in this report. This is a form of action research, where the research leads to immediate, responsive action.

The three CSU campuses in the Central Valley have consistently given focused attention to the manufacturing sector to date. And yet, this sector could benefit from higher education programs and a closer connection to the campuses. We propose that the EE units on each campus undertake a program development initiative that focuses on manufacturing industries.

This would take the form of rapid prototyping of programs and immediate deployment to manufacturers. An assessment of these programs would lead to improvement in their fit and service to industry. An advisory group comprised of industry and EE leaders would oversee this program development initiative.

Similarities among the industries in the region (e.g. value added agriculture) could lead to efficiencies in program development. Programs developed through this model could be shared among the campuses for deployment in their catchment area. Also, the joint development of online programs would allow industries throughout the valley to enroll workers in the programs.

## Appendix A

### Model Extended Education Programs that Fit Manufacturing Needs

#### CSU Bakersfield

##### Geographical Information Systems

Every day, millions of decisions are made using the power of geospatial technologies and the need to harness these tools in the southern Central Valley has never been greater. Private industry, government agencies, and non-profit organizations across the valley are utilizing Geographic information systems (GIS) resources on a daily basis, yet the lack of GIS-trained staff and new recruitments has led to staffing shortages and hard-to-fill positions. The GIS certificate program at CSUB has identified this educational gap and believes that, through a comprehensive GIS training program, the need for educated and skilled entry-level GIS professionals can be met.

Mapping, surveying and computer-aided technology have been vital to the agricultural industry for decades. The need to visualize crop layouts, map where certain varieties have been planted and plan for future land use is crucial for the growers, just as mapping distribution networks and delivery schedules are important for the manufacturing portion of agribusiness.

Geographic information systems (GIS) technology is making it easier than ever for these long-standing business needs to be more efficient and is helping to streamline the industry. GIS provides the ability to digitally map the fields, assign attributes to that geospatial data, and then analyze it using the systems' ability to overlay other relevant data on top of the field data.

Additionally, thanks to satellites, aerial imagery, and GIS technology, the agricultural manufacturing industry, especially its farmers and distributors, can see historical data digitally and make decisions for the future based on what can no longer be visualized in the fields. Remote-sensing techniques have also expanded the role GIS plays in understanding crop yields, pest movement, and is helping to ease the time the industry spends on environmental regulation and protection.

Drone technology is also making strides in the agricultural

industry because of its ability to detect pests from killing vital trees or eating the products that ensure the business' future growth. GIS technology comes in many forms and can be utilized by this industry in many ways, however the ability to understand how the technology benefits the industry can be time consuming and costly. The first place to combat the highly technical nature of the GIS field is to have highly trained and skilled employees that know how to maximize the GIS system in place all the while being able to understand future needs and keep up with the technology. This is where the GIS certificate program at CSUB can fill in that gap.

##### Occupational Safety and Risk Management

The Occupational Safety and Risk Management Program introduces the potential new employee or safety professional with the foundations surrounding both OSHA and Cal-OSHA agencies, the influence of people and decision-making in organizational safety, and the importance of cultivating a positive organizational safety culture. These topics are covered in the program which encompasses 3 courses over a 24-week span. Industry regulatory topics covered focus on the primary industries serving Kern County including General Industry, Agriculture, and Oil & Gas. Additionally, the inclusion behavioral safety is a key ingredient to the lesson plan which guides the students in understanding the human factor and its effect in the workplace. Soft skills are also an important element integrated into the curriculum to introduce and improve each students' ability to use technology, writing skills, public speaking, and inter-personal communication. After the completion of this program, students should have a solid foundation of organizational safety concerning the regulatory role in the workplace, common safety regulations and safe work practices, and strategies to assist in creating a positive organizational safety culture.

The knowledge and tools gained from the Occupational Safety and Risk Management Program can be readily utilized immediately in the Manufacturing Industry with about 80% of the program's content. Over half of the topics concern General Industry regulations which are the primary focus of manufacturing industry professionals. Moreover, the Construction Industry regulations cover a major portion of the remainder of the program, which by its title may not appear to be relevant to the manufacturing industry, but an often overlooked element of understanding regulatory applicability

is not based on the Industry of the organization, but that of the specific Task the employee is completing. Under the law, a great deal of industries classified under General Industry will find a number of common tasks completed by employees may fall under a different Industry Standard than generally perceived. The Occupational Safety and Risk Management program facilitates closing that gap in perception and understanding of regulatory compliance. Finally, the lessons covering behavioral safety, soft skills, and the human factor is relevant to any industry which desires to improve its culture and relationship management between the organization and its employees.

### **Project Management**

The Project Management Certificate Program is designed to give project managers and team members the tools and skills necessary to efficiently manage and contribute to the success of their projects, regardless of industry or specialization. It is 100% on line, to accommodate the schedules of working professionals. The courses introduce students to various concepts, processes, and areas within the scope of a project. Students learn how to communicate effectively, procure quality goods and services, as well as assess the risks associated with the project and how to avoid those risks. These topics are covered in the program, which includes five courses delivered in a sixteen-week semester.

A Project Management course is also offered in the online Master of Science in Administration degree. Once a student has completed the course in the MSA program, the student is notified the course counts for two of the five required courses for the Project Management Certificate. The student has the option to complete the remaining three courses to receive the certificate. There is no reciprocity from certificate to the Master's program.

## **CSU Fresno**

### **Conflict Management**

The conversational process in “How to Avoid Conflict” is revolutionary, in that discussion of a topic is usually driven by the myth that the person who speaks first governs the conversation. However, with the conflict avoidance approach, the reverse is true; the conversation is driven by

asking questions first. This begins with understanding one's own mental framework on an issue to be discussed, then understanding the mental framework of the other party to the discussion. This is accomplished by asking the other person open-ended questions, listening attentively and empathetically to all verbal and non-verbal statements, and restating what is said so that you really understand what has been said. The logic to this approach is that, having learned the true nature of the mental framework of the other party to the dialogue, you will be able to avoid erroneous assumptions and be able to state your position in a positive fashion which will be more absent of potential conflict and therefore, more effective.

### **SAP program (Systems, Applications and Products) Software.**

The Systems, Applications, and Products (SAP) software program is used in many manufacturing plants, and in all aspects of a plant, from business to engineering. SAP is well-known for its Enterprise Resource Planning (ERP) and data management programs, which can be used in many aspects of manufacturing. The SAP software is commonly used in operations management, inventory, and accounting, among others. It is a skill all students looking to work in a manufacturing environment should learn.

We have not started development of this program but it will include many aspects of the program offered at CSU Chico. The program is non-credit and is designed for professionals new to the SAP Enterprise Reporting System (ERP), as well as, SAP users who want to expand their general knowledge of ERP business processes. Students will look at the Fundamental integrative business processes in these components within the SAPERP application: procurement, production, planning, project management, sales, customer service, asset management, financial accounting, human resources, and analytics.

As we work to make our students more successful in the manufacturing environment, we would like to add these skills to their resume. Being in an area that is heavily populated by manufacturing companies, it is important that we are able to provide future employees with new skills as the technology is developed.

## CSU Stanislaus

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### Food Safety

The Food Safety Program is a joint effort among the Departments of Biological Sciences, Chemistry, and Agricultural Studies, and is still in development. The employment outlook in the food safety sector is very positive. Stanislaus State commissioned a marketing research study by the Educational Advisory Board (EAB) to analyze the demand for food safety professionals. According to EAB, employer demand nationwide increased 60 percent from 2013 to 2016. In looking at the state of California, demand increased 23 percent during this period. And more specifically, in the northern Central Valley, demand increased 65 percent. But this growth does not appear to be sustainable because employment statistics from the Bureau of Labor Statistics project a growth rate of 6.5 percent from 2014 to 2024. Thus, while there is currently strong and fast growing demand for food safety specialists, these double-digit increases should not be expected over the next eight years. Nevertheless, this is a key sector in the Central Valley, with the food/agriculture industry being one of the largest employers in the region. The Food Modernization Act of 2010 increased the focus of food safety to prevention. As a result, food safety is crucial to the food industry and to the consumers dependent on that industry. The current food safety program at Stanislaus State focuses on courses in microbiology, quantitative analysis, and parasitology. An internship is also a recommended course.

## Appendix B

### Best Practices in Manufacturing and Education Partnerships

California State University,  
Bakersfield

Report Submission by:



June 2016

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## I. Objective/Overview

The California State University, Bakersfield was awarded a grant to identify best practices in the training and education of those working in the manufacturing sector. It has requested assistance in gathering and analyzing exploratory data to guide partnership development between the university and manufacturing companies.

- The goal of this environmental scanning effort is to answer the following questions:
- What are the most important issues that a university/manufacturing partnership needs to address regarding manufacturing education and training programs?
- What are the best practices that would result in a successful partnership between a university and a manufacturing company?
- What is being done regionally and nationally in the arena of university/manufacturing partnerships?

## II. Methodology

The University Professional and Continuing Education Association (UPCEA) and its Center for Research and Marketing Strategy conducted an environmental scan that includes a review of industry trends, occupational demographics, in-depth interviews with seven industry opinion leaders, and seven manufacturing education opinion leaders, and a competitive analysis. Industry interviews were conducted with companies such as BASF, Lamb Research, Bolthouse Farms and Esterline, as well as others. Industry leaders hold titles such as senior manager for leadership and development programs, leadership development manager, and senior manager of learning and development. University leaders from institutions including Rutgers, Penn State, University of Kansas, North Carolina State, Purdue and Stony Brook were also interviewed.

Environmental scanning is a cost-efficient and insightful exploratory research method for program assessment, design, and delivery. This report can help to facilitate internal stakeholder engagement and program planning.

## III. Key Findings

- California, with its wealth of agricultural and technology production, is ranked first in the United States for manufacturing jobs, number of firms and gross output. In 2013, California manufacturing accounted for 11.4% of the total U.S. output and generated \$239.0 billion.
- Electronic computer manufacturing is projected to experience the largest growth of any manufacturing industry in California in the next decade, adding over 17,000 new jobs. Ten other industries are expected to add 3,000 or more new jobs by 2025, including huge growth in magnetic/optical media and recording/controlling devices.
- The Bakersfield region is projected to lose nearly 16,000 manufacturing jobs related to aeronautical guidance systems and aircraft by 2025, but 61% growth in missile/space vehicle manufacturing will add over 5,550 new jobs. Production of household furniture (37%), wine (31%), and perishable foods (30%) also expect robust growth (4,440+ jobs).
- Leaders from the education sector consistently validated the concerns, needs, and demands that emerged from conversations with industry leaders, indicating alignment between higher education providers and the manufacturing sector.
- Expert feedback pointed to gathering momentum behind exploring more and deeper tactical relationships for professional development in manufacturing. Three of seven industry opinion leaders had experience with such arrangements, and all but one education leader reported partnering with one or more companies.
- Continuous communication and relationship building are vital to successful partnerships with manufacturers. Higher education providers need to cultivate a consultative, support-oriented mindset. In terms of program content and design, consultation and customization are preferred, probably even expected.
- Companies place value on the presence of industry veterans serving on the faculty and within administration. Industry and education leaders noted that faculty with professional experience working in manufacturing settings – preferably within a specific industry segment when possible – are desirable.



- Funding is another issue that was frequently noted by all participants as a constant challenge. Providers should be sensitive to these issues and seek out avenues of cost control like group discounts and availability of grant funding.
- Timeliness and relevance are two of the most significant obstacles to productive partnerships with educational institutions. Institutions should regularly assess program content to identify changes or emerging trends that should be reflected in training curricula.
- In addition to established partnerships with universities, working relationships with two-year institutions (technical schools and community colleges) are important aspects of workforce development for the manufacturing sector. Familiarity with regional institutions seems to be the most influential driver behind formation of partnerships.
- National Manufacturing Extension Partnerships –National Institute of Standards and Technology (NIST), Accelerating U.S. Advanced Manufacturing Partnership (AAMP), and National Center for Defense Manufacturing and Machining (NCDMM) – promote and support U.S. manufacturing and partner with institutions including UC system schools.
- marketing and outreach efforts.
- Develop advisory bodies. These can be composed of industry experts willing to consult on curriculum content and related issues. Offer seats to representatives from potential partners – local businesses and appropriate national and international organizations that are a good fit.
- Develop a plan for annual reassessment. Consult with industry leaders and consultants (a good function of advisory boards) and also tap the expertise of faculty in relevant departments (e.g., business, engineering) to identify changes or emerging trends that should be reflected in training curricula.
- Identify avenues to ameliorate financial strain. Funding will almost always be an obstacle to launching or expanding a partnership, so institutions should prioritize exploring creative solutions – such as group discounts or grant funding – to control costs. This increases likelihood of participation, but also demonstrates good will.
- Develop internal criteria for assessing suitability of potential partners. Ideally, a good working relationship can represent a long-term commitment; just as companies will evaluate providers, the institution should endeavor to identify a good match. Work with internal stakeholders to develop a profile for optimal partnerships.

## IV. Recommendations

- Consider cultivating a consultative mindset in any program. Demonstrating a deep and sustained interest in a potential partner’s unique needs is key in forging a strong, long-term relationship. Plan for constant communication, collaboration, site visits, and customization of content to figure prominently in delivering professional development offerings.
- Emphasize engagement and collaboration in outreach and marketing efforts. Communication with the target audience should highlight an institution’s willingness (and track record) to work with partners to design and update an offering that addresses their needs in terms of content and, importantly, flexible delivery.
- Recruit faculty and adjuncts with professional experience. This emerged as a key selling point for attractive partnerships with universities. If targeting specific industry segments within the region, find those with an applicable background. These individuals should also figure prominently in
- Leverage and strengthen existing relationships. Treat undergraduate internship and career placement pipelines as an avenue for establishing relationships. Consult with companies on curriculum content, engage them on case studies. These traditional connections were cited as a key pathway to developing deeper partnerships.
- Include leadership training/coaching options. Development programs for executives, managers, and younger employees already in a leadership track were consistently cited as areas of need. Universities are particularly well-suited to deliver this type of training, either tied in with full degree programs (e.g., MBA) or through standalone offerings.
- Explore certificate program options. Employers increasingly value offerings that focus in on specific needs, addressing them in a relatively short amount of time and at reasonable cost. Providers can easily work with an organization to develop an end product that addresses their demands.

## V. Trends

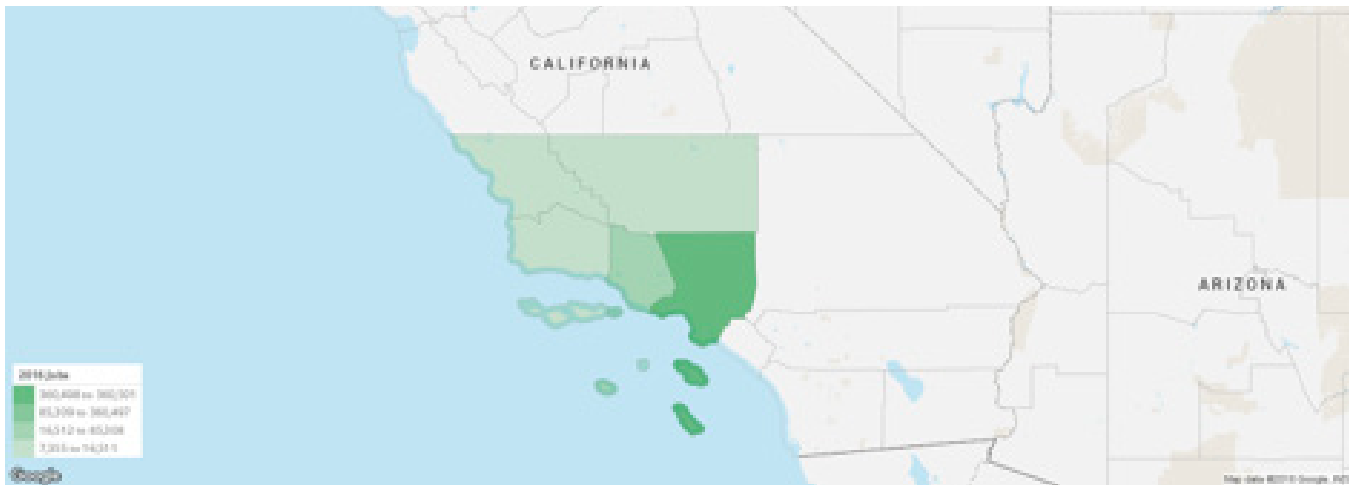
- The temperate environment and current economic climate in California bodes well for the future of manufacturing. Certain industries such as food production and manufacturing are only possible in climates similar to California's. Additionally, with the technological dominance of Silicon Valley, manufacturing related to technology will continue to play a critical role in the manufacturing world.
- “California, the world’s ninth largest economy, is ranked first in the United States for manufacturing jobs, number of firms and gross output. California manufacturing accounted for 11.4% of the total U.S. output and generated \$239.0 billion in 2013.”-*Future of Manufacturing in California, Industrial Research*
- According to industry leaders, manufacturing is on the cusp of a potential boom in business. James Manyika, a director at McKinsey Global Institute has said, “Manufacturing is entering a dynamic new phase. By 2025, a new global consuming class will have emerged, and the majority of consumption will take place in developing economies.”
- National Manufacturing Extension Partnerships (MEPs) exist between universities and businesses to promote and support the manufacturing industry within the U.S. and provide these industries with qualified, skilled workers.
- There are predominantly three major MEP conglomerates: National Institute of Standards and Technology (NIST), Accelerating U.S. Advanced Manufacturing (AAMP), and National Center for Defense Manufacturing and Machining (NCDMM).
- NIST has more than 400 centers nationally including one in every state as well as Puerto Rico. Approximately 1,200 MEP experts and over 2,800 third-party service providers work together through NIST to help make the U.S. manufacturers—and the U.S. economy—stronger.
- AAMP exists to enable innovation, secure the talent pipeline, and improve the business climate for manufacturers in the United States.
- The mission of NCDMM is to “enhance quality, affordability, maintainability, and rapid deployment of existing and yet-to-be developed defense system. Collaborate with government, industrial, and academic organizations to promote the implementation of best practices to key stakeholders through the development and delivery of disciplined training, advanced technologies, and methodologies.”
- President Barack Obama was quoted as saying the following about the AAMP program: “The purpose of this partnership is to prove that the United States of America has your back, is going to be supporting you — because that’s the kind of adventurous, pioneering spirit that we need right now.”
- The American Chemical Society recently stated that NIST’s Advanced Technology Program “strengthens the ability of small and large companies across industrial sectors to pursue and accelerate high-risk research and technologies that would not likely be funded absent government support. Small start-up firms, for example, have relied on ATP funding to achieve technological advances that would not otherwise be possible given scarce venture capital funding in many long-term research areas.”

## VI. Occupational Analysis

For the purpose of this research the Bakersfield region is defined as the following California counties: Kern, Los Angeles, San Luis Obispo, Santa Barbara, and Ventura. For industries related to manufacturing, electronic computer manufacturing has the highest number of total jobs and is projected to retain that status in 2025.

Going forward the job outlook looks mixed for manufacturing jobs in the Bakersfield region. Los Angeles County houses the vast majority of manufacturing positions in this region and is expected to lose more than 50,000 jobs over the next ten years. The shrinking size of manufacturing industry in LA and Ventura County is expected to reduce the total number of manufacturing jobs in the region by over 48,000 by 2026. While manufacturing jobs continue to leave LA County, Santa Clara County is expected to continue to add occupations in that sector, highlighting the relative strength of manufacturing in Silicon Valley.

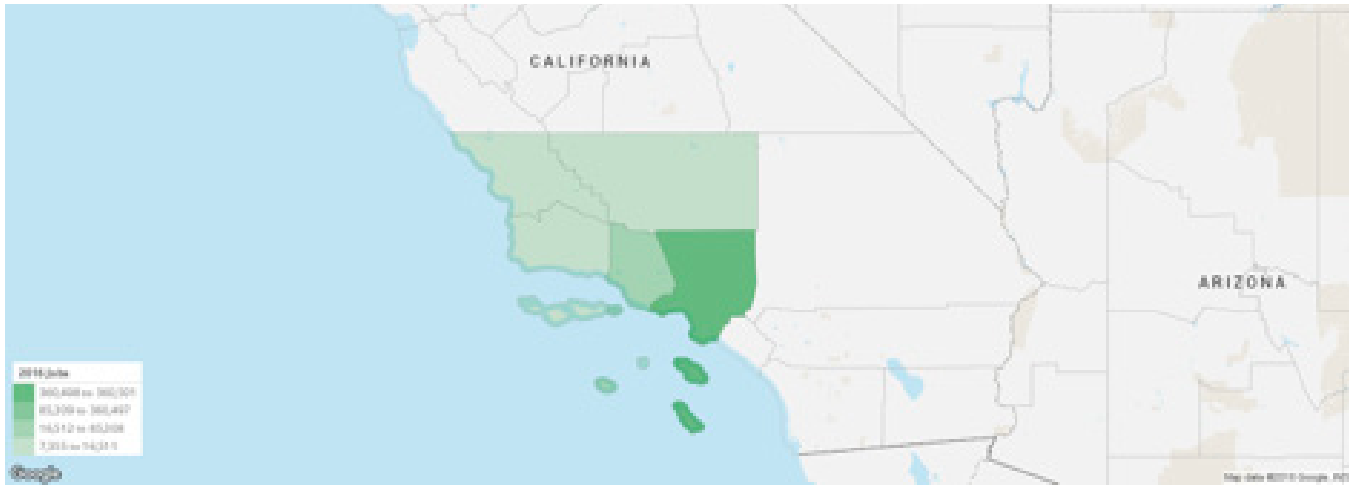
**Map 1: Manufacturing Jobs in Bakersfield Region by County<sup>1</sup>**



| County | County Name                | 2016 Jobs | 2026 Jobs | 2016-2026 Change | 2016-2026 % Change |
|--------|----------------------------|-----------|-----------|------------------|--------------------|
| 6037   | Los Angeles County, CA     | 360,498   | 310,151   | -50,347          | -14%               |
| 6111   | Venture County, CA         | 30,737    | 29,468    | -1,269           | -4%                |
| 6029   | Kern County, CA            | 14,104    | 16,180    | 2,076            | 15%                |
| 6038   | Santa Barbara County, CA   | 13,853    | 14,297    | 444              | 3%                 |
| 6079   | San Luis Obispo County, CA | 7,355     | 7,813     | 458              | 6%                 |

<sup>1</sup> Data from EMSI 2016.2

Map 2: Manufacturing Jobs in California by County<sup>2</sup>



| County | County Name                | 2016 Jobs | 2026 Jobs | 2016-2026 Change | 2016-2026 % Change |
|--------|----------------------------|-----------|-----------|------------------|--------------------|
| 6037   | Los Angeles County, CA     | 360,498   | 310,151   | -50,347          | -14%               |
| 6111   | Venture County, CA         | 30,737    | 29,468    | -1,269           | -4%                |
| 6029   | Kern County, CA            | 14,104    | 16,180    | 2,076            | 15%                |
| 6038   | Santa Barbara County, CA   | 13,853    | 14,297    | 444              | 3%                 |
| 6079   | San Luis Obispo County, CA | 7,355     | 7,813     | 458              | 6%                 |

Within the Bakersfield Region, the Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing industry remains the largest manufacturing industry by employment, highlighting the importance of the military on the local economy. However, due to a projected 47% decline in employment, this industry is expected to be eclipsed by several others over the next ten years.

<sup>1</sup> Data from EMSI 2016.2 – The rest of the county level jobs data can be found in the Appendix

**Table 1: Current Top Manufacturing Industries in the Bakersfield Region<sup>3</sup>**

| Occupation                                                                                              | Number of Jobs |        | Change 2015 - 2025 |         |
|---------------------------------------------------------------------------------------------------------|----------------|--------|--------------------|---------|
|                                                                                                         | 2015           | 2025   | Number             | Percent |
| Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing | 17,635         | 9,281  | -8,354             | -47%    |
| Other Aircraft Parts and Auxiliary Equipment Manufacturing                                              | 16,288         | 18,155 | 1,867              | 11%     |
| Women's, Girls', and Infants' Cut and Sew Apparel Manufacturing                                         | 15,568         | 14,166 | -1,402             | - 9%    |
| Aircraft Manufacturing                                                                                  | 14,668         | 6,279  | -8,389             | -57%    |
| Commercial Printing (except Screen and Books)                                                           | 12,125         | 7,521  | -4,604             | -38%    |
| Machine Shops                                                                                           | 10,939         | 9,953  | -986               | -9%     |
| Pharmaceutical Preparation Manufacturing                                                                | 10,208         | 10,414 | 206                | 2%      |
| Guided Missile and Space Vehicle Manufacturing                                                          | 9,133          | 14,665 | 5,532              | 61%     |
| All Other Plastics Product Manufacturing                                                                | 5,693          | 4,115  | -1,578             | -28%    |
| Toilet Preparation Manufacturing                                                                        | 5,337          | 5,860  | 523                | 10%     |
| Bolt, Nut, Screw, Rivet, and Washer Manufacturing                                                       | 5,259          | 6,420  | 1,161              | 22%     |
| Perishable Prepared Food Manufacturing                                                                  | 5,060          | 6,592  | 1,532              | 30%     |
| Petroleum Refineries                                                                                    | 4,693          | 5,051  | 358                | 8%      |
| Electroplating, Plating, Polishing, Anodizing, and Coloring                                             | 4,678          | 4,132  | -546               | -12%    |
| Textile and Fabric Finishing Mills                                                                      | 4,671          | 3,863  | -808               | -17%    |
| Upholstered Household Furniture Manufacturing                                                           | 4,580          | 6,258  | 1,678              | 37%     |
| Semiconductor and Related Device Manufacturing                                                          | 4,418          | 4,022  | -396               | -9%     |
| Wineries                                                                                                | 4,030          | 5,277  | 1,247              | 31%     |
| Commercial Screen Printing                                                                              | 3,926          | 4,144  | 218                | 6%      |
| Surgical Appliance and Supplies Manufacturing                                                           | 3,925          | 3,382  | -543               | -14%    |

In the Bakersfield region, guided missile and space vehicle manufacturing has the largest projected increase in employment over the next decade. Commercial and military influence is representative of growth in the region.

<sup>3</sup> Data from EMSI 2016.2

**Table 2: Top Manufacturing Industries of Growth (2015-2025) in the Bakersfield Region<sup>4</sup>**

| Occupation                                                                                                             | Number of Jobs |        | Change 2015 - 2025 |         |
|------------------------------------------------------------------------------------------------------------------------|----------------|--------|--------------------|---------|
|                                                                                                                        | 2015           | 2025   | Number             | Percent |
| Guided Missile and Space Vehicle Manufacturing                                                                         | 9,133          | 14,665 | 5,532              | 61%     |
| Other Measuring and Controlling Device Manufacturing                                                                   | 2,467          | 4,397  | 1,930              | 78%     |
| Other Aircraft Parts and Auxiliary Equipment Manufacturing                                                             | 16,288         | 18,155 | 1,867              | 11%     |
| Upholstered Household Furniture Manufacturing                                                                          | 4,580          | 6,258  | 1,678              | 37%     |
| Perishable Prepared Food Manufacturing                                                                                 | 5,060          | 6,592  | 1,532              | 30%     |
| Bolt, Nut, Screw, Rivet, and Washer Manufacturing                                                                      | 5,259          | 6,420  | 1,161              | 22%     |
| Electronic Connector Manufacturing                                                                                     | 1,464          | 2,452  | 988                | 67%     |
| Surgical and Medical Instrument Manufacturing                                                                          | 3,057          | 3,949  | 892                | 29%     |
| Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables | 1,954          | 2,748  | 794                | 41%     |
| Fluid Power Valve and Hose Fitting Manufacturing                                                                       | 3,187          | 3,816  | 629                | 20%     |
| Coffee and Tea Manufacturing                                                                                           | 1,320          | 1,923  | 603                | 46%     |
| Other Industrial Machinery Manufacturing                                                                               | 1,724          | 2,272  | 548                | 32%     |
| Medicinal and Botanical Manufacturing                                                                                  | 2,098          | 2,642  | 544                | 26%     |
| Toilet Preparation Manufacturing                                                                                       | 5,337          | 5,860  | 523                | 10%     |
| Textile Bag and Canvas Mills                                                                                           | 1,044          | 1,565  | 521                | 50%     |
| Iron and Steel Forging                                                                                                 | 835            | 1,335  | 500                | 60%     |
| Motor Vehicle Transmission and Power Train Parts Manufacturing                                                         | 614            | 1,090  | 476                | 78%     |
| Printed Circuit Assembly (Electronic Assembly) Manufacturing                                                           | 1,962          | 2,402  | 440                | 22%     |
| Irradiation Apparatus Manufacturing                                                                                    | 810            | 1,237  | 427                | 53%     |
| Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing                                                           | 1,180          | 1,603  | 423                | 36%     |

The top two industries in California, Electronic computer Manufacturing and Semiconductor and Related Device Manufacturing, reflect the state's reputation of being a hub for the development of computer technology.

<sup>4</sup> Data from EMSI 2016.2

**Table 3: Current Top Manufacturing Industries in California<sup>5</sup>**

| Occupation                                                                                              | Number of Jobs |        | Change 2015 - 2025 |         |
|---------------------------------------------------------------------------------------------------------|----------------|--------|--------------------|---------|
|                                                                                                         | 2015           | 2025   | Number             | Percent |
| Electronic Computer Manufacturing                                                                       | 54,290         | 71,826 | 17,536             | 32%     |
| Semiconductor and Related Device Manufacturing                                                          | 44,066         | 42,935 | -1,131             | -3%     |
| Pharmaceutical Preparation Manufacturing                                                                | 34,622         | 39,254 | 4,632              | 13%     |
| Wineries                                                                                                | 34,092         | 42,166 | 8,074              | 24%     |
| Machine Shops                                                                                           | 33,562         | 32,197 | -1,365             | -4%     |
| Commercial Printing (except Screen and Books)                                                           | 31,655         | 23,157 | -8,498             | -27%    |
| Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing | 29,890         | 19,598 | -10,292            | -34%    |
| Other Aircraft Parts and Auxiliary Equipment Manufacturing                                              | 29,548         | 32,583 | 3,035              | 10%     |
| Cut and Sew Apparel Contractors                                                                         | 26,918         | 13,932 | -12,986            | -48%    |
| Surgical and Medical Instrument Manufacturing                                                           | 24,494         | 27,553 | 3,059              | 12%     |
| Guided Missile and Space Vehicle Manufacturing                                                          | 20,244         | 23,992 | 3,748              | 19%     |
| Aircraft Manufacturing                                                                                  | 19,235         | 13,095 | -6,140             | -32%    |
| Women's, Girls', and Infants' Cut and Sew Apparel Manufacturing                                         | 18,483         | 17,054 | -1,429             | -8%     |
| All Other Plastics Product Manufacturing                                                                | 16,189         | 13,815 | -2,374             | -15%    |
| Other Electronic Component Manufacturing                                                                | 15,990         | 16,345 | 355                | 2%      |
| Retail Bakeries                                                                                         | 15,686         | 17,879 | 2,193              | 14%     |
| Commercial Bakeries                                                                                     | 15,256         | 14,170 | -1,086             | -7%     |
| Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing                   | 14,817         | 16,766 | 1,949              | 13%     |
| Fruit and Vegetable Canning                                                                             | 14,543         | 13,924 | -619               | -4%     |
| Sheet Metal Work Manufacturing                                                                          | 13,614         | 16,867 | 3,253              | 24%     |

Although it is already the top manufacturing industry in the state, electronic computer manufacturing is projected to experience the largest growth of any manufacturing industry in California. Blank magnetic and optical recording media manufacturing is projected to see growth of 114%, the largest percentage among industries profiled.

<sup>5</sup> Data from EMSI 2016.2

**Table 4: Top Manufacturing Industries of Growth (2015-2025) in California<sup>6</sup>**

| Occupation                                                                               | Number of Jobs |        | Change 2015 - 2025 |         |
|------------------------------------------------------------------------------------------|----------------|--------|--------------------|---------|
|                                                                                          | 2015           | 2025   | Number             | Percent |
| Electronic Computer Manufacturing                                                        | 54,290         | 71,826 | 17,536             | 32%     |
| Wineries                                                                                 | 34,092         | 42,166 | 8,074              | 24%     |
| Other Measuring and Controlling Device Manufacturing                                     | 7,391          | 12,538 | 5,147              | 70%     |
| Pharmaceutical Preparation Manufacturing                                                 | 34,622         | 39,254 | 4,632              | 13%     |
| Blank Magnetic and Optical Recording Media Manufacturing                                 | 3,530          | 7,563  | 4,033              | 114%    |
| Printed Circuit Assembly (Electronic Assembly) Manufacturing                             | 9,260          | 13,060 | 3,800              | 41%     |
| Guided Missile and Space Vehicle Manufacturing                                           | 20,244         | 23,992 | 3,748              | 19%     |
| Sheet Metal Work Manufacturing                                                           | 13,614         | 16,867 | 3,253              | 24%     |
| Surgical and Medical Instrument Manufacturing                                            | 24,494         | 27,553 | 3,059              | 12%     |
| Breweries                                                                                | 6,276          | 9,321  | 3,045              | 49%     |
| Other Aircraft Parts and Auxiliary Equipment Manufacturing                               | 29,548         | 32,583 | 3,035              | 10%     |
| Medicinal and Botanical Manufacturing                                                    | 4,788          | 7,131  | 2,343              | 49%     |
| Perishable Prepared Food Manufacturing                                                   | 9,497          | 11,836 | 2,339              | 25%     |
| Retail Bakeries                                                                          | 15,686         | 17,879 | 2,193              | 14%     |
| Upholstered Household Furniture Manufacturing                                            | 6,689          | 8,701  | 2,012              | 30%     |
| Electronic Connector Manufacturing                                                       | 4,898          | 6,876  | 1,978              | 40%     |
| Radio and Television Broadcasting<br>and Wireless Communications Equipment Manufacturing | 14,817         | 16,766 | 1,949              | 13%     |
| Other Industrial Machinery Manufacturing                                                 | 4,919          | 6,681  | 1,762              | 36%     |
| Bolt, Nut, Screw, Rivet, and Washer Manufacturing                                        | 9,198          | 10,672 | 1,474              | 16%     |
| Dental Laboratories                                                                      | 10,977         | 12,319 | 1,342              | 12%     |

<sup>6</sup> Data from EMSI 2016.2



## VII. Opinion Leader Research

### Industry Opinion Leaders

Seven manufacturing sector executives participated in in-depth research interviews. While these conversations included some evidence of strong relationships already in place with institutions of higher education, the general consensus pointed more toward an area of emerging, but still highly underleveraged, opportunity.

**Marketplace Conditions:** Highlights of opinion leader feedback on key trends and needs relating to higher education for the manufacturing sector includes:

- Several participants, regardless of their organizations' current level of engagement with higher education providers, indicated gathering momentum behind exploring more and deeper tactical relationships in employee training and professional development.
- It was noted that, in addition to established partnerships with one or more universities, working relationships with two-year institutions (technical schools and community colleges) are important aspects of workforce development for the manufacturing sector.
- Academic institutions are viewed as valuable partners in that they have the resources and expertise to build out programs that provide necessary training, thus alleviating manufacturers of the burden of performing this function while also delivering better results.
- Universities also benefit from developing programs in partnership with companies, because the content that is important in one case can typically have similar relevance across the entire industry segment. This results in a more marketable product for the providers, one that is attractive to other corporate partners as well as applicants seeking professional mobility.
- Timeliness and relevance are two of the most significant obstacles to productive partnerships with educational institutions. Due mostly to rapid technological developments, the needs of the manufacturing sector are changing and evolving quickly, sometimes dramatically, and higher education providers sometimes struggle to keep up.
- Understanding the “why” behind a process is critical to high performance, and successful training programs should emphasize this element. A firm grasp of why things are a done a certain way facilitates more efficient problem solving.
- Manufacturers need to recognize how the workplace environment – professional and physical – influences productivity. The most successful workers are those who are empowered to “get the job done” by their surroundings.
- Fundamental communications skills remain an area needing improvement across several job functions in the manufacturing sector. Improved internal communication ability – with peers, teammates, superiors, and subordinates – will always be welcome along with better external client/vendor/customer communications.



I guess from my seat, and my perspective is unique, but one of the things that we really struggle with in terms of partnering with local educational organizations is, one, is the organization able to keep up with technology changes or system changes that we as a company are constantly going through. We've had different partnerships with different educational organizations and those have ended almost entirely because the material that they were bringing to train and to teach was already past where we were trying to work.

- Leadership Dev't Mgr., dairy company

Universities tend to deal in theoretical and they reach the application stage in either the research side of what they do or through case studies. If you really want a partnership, then the university needs to find a way to leverage their academic expertise and apply it directly in the real world. They need to be prepared to work with manufacturing companies and not just to set best practices, which is the easy part. If they want to be relevant they need to solve my problem on my floor

- Senior Mgr. Learning and Development, semiconductor

- Along with core communication abilities, fundamental math and statistics acumen can also be improved.
- Critical analysis and strategic problem solving were mentioned as higher order management skills in need of improvement. Leadership development was mentioned several times as an area of general need, one where universities can potentially play a valuable role.
- Tension exists between the increasingly complicated processes required of modern manufacturers and the heightened emphasis on cost control through contract work and offshoring, which results in lower costs at the expense of less specialized expertise and reduced workforce engagement levels.

**Program Details:** Interviewees also offered their needs and desires for offerings from the higher education realm. Key learnings that emerged from these discussions include:

- Continuous communication and relationship building are absolutely vital to successful partnerships with manufacturers. A key aspect of this process is a fundamental (and consistent) vigilance on the part of the institution about the evolving needs of the industry at large and partner organizations in particular. Site visitations and advisory roundtables are examples of methods for facilitating crucial communication.
- Companies place value on the presence of industry veterans serving on the faculty and within administration. Any instructors and university staff with relevant professional experience should be prominent collaborators with partners in the private sector.
- Workforce development assistance on the front end of the hiring process is important as well. When universities help a company build a strong workforce through internship pipelines and connect hiring officers with promising graduates, it strengthens the relationship between the institution and the employer.
- Higher education providers need to cultivate a consultative, support-oriented mindset. Universities become trusted partners in the manufacturing sector by focusing on the ways in which their resources and expertise can improve conditions within the industry. Ask the question, “How can we help a company become better?”
- Applied learning opportunities are highly valued. Determining ways to integrate hands-on experiences into the educational process helps to ensure that employees fully absorb concepts and return to the workplace prepared to make an immediate impact.
- Universities must be sensitive to the financial impact of participation for partner organizations. In addition to the direct costs of tuition assistance, companies often must also absorb the short-term cost of paying overtime or otherwise accounting for lost productivity. Price controls and assistance in identifying sources of supporting revenue can solidify and strengthen partnerships.
- In terms of program content and design, consultation and customization are preferred, probably even expected. In many cases, this type of a custom-tailored curriculum may be a baseline condition of the partnership.
- Despite the stated preference for customization, some opinion leaders indicated that their organizations will make tactical use of standalone programs.
- Participation in case study projects, where faculty and students (often, but not always, at the graduate level) conduct research around a real-world problem faced by a company and then present their results and recommendations, can often pave the way to a closer working relationship between the organization and provider.
- **Opinion leaders offered several specific examples of valuable training or certifications that could be offered through a university. These include:**
  - LEAN**
  - Six Sigma**
  - Compliance training**
  - Language courses**
  - Quality control**
  - Project management**
  - Consumer intelligence (understanding the customer)**

**Competitors:** Opinion leaders were asked about colleges or universities that come to mind when thinking about best practices or high performing relationships in manufacturing education. Highlights from their responses include:

- CSUB was not strongly associated with the manufacturing sector, although awareness of the university among regional opinion leaders was relatively high with positive connotations. The school was mentioned several times, and some participants noted past or existing partnerships.
- Familiarity with regional institutions seems to be the most influential driver behind formation of partnerships. Industry experts tended to think first of local schools. Among those in California, Cal Poly San Luis Obispo was mentioned multiple times.
- As noted previously, local technical/community colleges are also valued players in this space. Five institutions mentioned during the interviews were Brazosport College (TX), Frank Phillips College (TX), Henry Ford College (MI), Kern Community College District (CA), and River Parishes Community College (LA).
- In addition to CSUB, 12 institutions were mentioned at least once:

Brigham Young University  
California Polytechnic State University-San Luis Obispo  
California State University-Fresno  
Louisiana State University  
Oregon State University  
San Jose State University  
Seattle University  
Texas A&M University  
University of California-Berkeley  
University of California-Stanislaus  
University of Louisiana-Lafayette  
University of Washington  
Education Opinion Leaders

## Education Opinion Leaders

Seven opinion leaders from institutions of higher education took part in in-depth research interviews. Responses tracked with industry input, indicating alignment between higher education providers and the manufacturing sector. Leaders from the education sector consistently validated the concerns, needs, and demands that emerged from conversations with industry leaders.

**Marketplace Conditions:** When questioned about prominent needs and trends relating to higher education and the manufacturing sector, opinion leaders offered several insights, including:

- A range of delivery options may actually rank alongside the program content itself in assessing an offering's appeal. As noted by industry leaders, maintaining productivity levels is critical, so a flexible delivery model that accommodates work schedules and minimizes downtime presents great value.
- Academic leaders confirmed that faculty with professional experience working in manufacturing settings – preferably within a specific industry segment when possible – are desirable.
- Constantly assessing and refreshing program content to ensure it remains relevant is also of paramount importance. Institutions should regularly consult with industry leaders and consultants and also tap the expertise of faculty in relevant departments (e.g., business, engineering) to identify changes or emerging trends that should be reflected in training curricula.
- As expected, funding is another issue that was mentioned by several education leaders as a constant challenge. Determining what sorts of training options are best for a particular organization – customized programs, advanced degrees for certain job types, focused certificates, leadership coaching, etc. – will help determine how the financial burden can be divided between the employer and the individual. Providers should be sensitive to these issues and seek out avenues of cost control like group discounts and availability of grant funding.
- Education leaders also stressed the importance of strong consultative relationships with partner companies, stressing communication and engagement to understand strategic goals, organizational philosophy, and business processes in order to tailor learning options to their needs. This could be as simple as identifying degree programs that would best serve employees or as complex as a fully customized training regimen.

- Forging these types of relationships strengthens an institution's ability to work with partner HR departments to identify options for tuition assistance, time off, and other accommodations that support employee learning while minimizing impact on operations.
- While there appears to be a place for online training and many organizations will find ways to take advantage of it, the top-of-mind association for manufacturing sector partnerships trends more toward face-to-face, custom-tailored products.
- From the providers' perspective, coaxing faculty into the relationship-building process can become a challenge. Institutions must have a strategy for convincing the staff and educators who work on these programs to fully invest in a genuinely consultative relationship with partner organizations.
- One participant noted that the incentive of additional revenue coming directly back to the department as a result of these relationships can effectively motivate departments seeking to close budget gaps, add resources (like equipment or additional travel), or expand their programming.
- Several interviewees reinforced the growing value of certificate programs and other non-credit training options. The ability to focus on specific needs and address these in a relatively short amount of time and at reasonable cost makes

these types of offerings attractive to companies. Employees appreciate the professional development through acquiring a certificate, and providers can easily work with an organization to develop an end product that addresses their demands.

**Partnership Development:** Education leaders were asked whether their institutions employ a standardized process of developing an education and training plan with a partner company:

**Program Design:** Opinion leaders described the processes employed by their institutions in servicing the manufacturing sector. Key takeaways include:

- Six of the seven participants reported that their institutions regularly partner with (usually several) companies in training and employee development programs. These tend to involve long-standing relationships built on trust developed over time. Specific corporations that were mentioned include:

|                              |                        |
|------------------------------|------------------------|
| Air Industries               | Akzo Novel             |
| Alcoa                        | Anneal pharmaceuticals |
| Barrie Plastics              | Boeing                 |
| Cascade Tissue Group         | Caterpillar (CAT)      |
| Este Lauder                  | GKN aerospace          |
| Leopold pharmaceuticals      | Lockheed Martin        |
| Meade Johnson                | NuCor Steel            |
| Sabic Plastics (formerly GE) | Telefonics             |
| Toyota                       |                        |

The university's ability to adapt training to meet industry needs. Online training isn't flexible or sometimes not completely applicable. Online training is typically open sourced. Face-to-face is always best. We can teach lean 6 Sigma training adapted to specific projects at a company. The students get to work with their own data. Also, cost savings. Industry wants to train groups.

- Assistant Director for Engineering and Technology Programs, university

We try to align education programs that employees are seeking that are in alignment with their company's strategic goals. A lot of times, this is returning for a masters or advanced degree. The university needs to partner with the company's benefit department to define what can be used for tuition reimbursement, etc.

- Sr. Director of Marketing Strategy, university

Being able to really understand the organization. Many times, when starting out and touring facilities, I was viewed as not knowing what was going on, a state employee, a school, a woman, a state university. My very existence was in question, so going in there and really knowing your customer and having done your homework about the company is very important, understanding their needs and concerns and bringing in people that can speak to their concerns. You have to get them convinced that they can trust you and that you really do have an understanding for their industry sector. You don't have to be an expert in food safety or aerospace but you do have to have a sensitivity to the plight of manufacturers and large and small industries have different and similar issues."

- Executive Director, Corporate Education and Training, university

- Consistent with feedback from industry opinion leaders, education sector participants noted the mutual value created by deep relationships that include extensive internship and case study connections between partner and provider. Businesses reap significant value from the resulting identification and contributions of young talent, while students gain valuable experience and enhance their employment prospects.
- Just as companies are selective in finding a provider committed to a deep, consultative relationship, institutions should develop criteria for vetting potential partners. Desirable qualities mentioned during the interviews included commitment to continuous improvement; investment in people; respect for the institution; open lines of communication; proactive posture; valuing education; clear sense of key needs; ability to clearly describe the business model; willingness to accommodate employee education; and availability of tuition reimbursement or other education assistance.
- A question on the ratio of online training to face-to-face yielded no consistent answers. Based on the feedback gathered from these interviews, this appears to be highly variable and based on the priorities of each institution along with the needs of partner organizations.
- All seven opinion leaders from the education sector reported experience with custom-tailoring their programs for partner organizations. Most indicated that they deliver a mixture of standardized credit and non-credit programs as well as personalized offerings, with clients sometimes utilizing both.
- Participants reinforced the degree to which program content is consistently re-evaluated. Most indicated that the content of each offering as well as the full portfolio of available programs undergo review on at least an annual basis.
- Several sources of information guide the review process, including student feedback, consultation with key contacts at partner organizations, site visitations, consultation with trade associations, satisfaction surveys (students/employers), and faculty input.



We certainly have a process. It begins with understanding which direction we need to go. Are we altering an existing course to customize it to a specific need? Do we need to augment a credit program to be better aligned? Do we need to develop a non-credit program to fit the need?

- Sr. Director of Marketing Strategy, university

We really don't because they come to us in all different formats. Sometimes our faculty takes the lead and sometimes our corporate partners come to us. We have special relationships with some partners that we have faculty assigned to developing deeper relationships and making sure their needs are being met.

- CMP Associate Director, university

Yes, Continuing Ed has a process it follows. It includes a Program Development Committee and a Program Manager. They put together content, budget, staffing to be included in a proposal. This can be done quickly. Many of the programs have been taught before and it is easier the more times it is rolled out. We have one instructor that has taught the same class many times and she can easily modify the content to meet specific needs and the budget would be similar to past classes so the whole process can be pretty quick.

- Assistant Director for Engineering and Technology Programs, university

Somewhat. We try to understand that need and fill the gaps. Sometimes they say they need something but they really need something else. Sometimes they say they need excel training but really what they need is statistics training. We have a pre-consult guide that we do interviews before we roll out training.

- Director of Outreach and Engagement, university

I don't know if it is really documented but we do have a process. We are very careful at the start and clients can impatient at the beginning. Understanding what the outcomes should be. Interviewing at higher levels and lower levels. Talking back and forth. The thorough understanding takes time. Companies, most of the items, are not experts in soft skills and are more outcome based. We build accountability loops and determine how to measure success. Having a problem discipline to find all the hidden needs is important. Communication at all steps is key with all stakeholders. At the end of the process, the decision makes and instructors do a "trial run" or walkthrough of the program to make sure nothing was missed.

- Program Manager, School of Business, university

## VIII. Competitive Analysis

Table 5 provides an overview of potential competing programs in California, ranging from certificates to bachelor's degrees. Requirements for program completion vary among institutions, from credits to units and quarter units.

**Table 5: In-State Competitors<sup>7</sup>**

| Institution                                  | Program                                                                               | Credits | Delivery  | Tuition  |              |
|----------------------------------------------|---------------------------------------------------------------------------------------|---------|-----------|----------|--------------|
|                                              |                                                                                       |         |           | In-State | Out-of-State |
| UCLA                                         | Manufacturing Engineering Certificate                                                 | 32      | On Campus | \$34,062 | \$60,744     |
| California Polytechnic State San Luis Obispo | Bachelor of Manufacturing Engineering                                                 | 60      | On Campus | \$8,523  | \$14,880     |
| California State University-Northridge       | M.S. Manufacturing Systems Engineering and Management                                 | 33      | On Campus | \$8,382  | \$12,276     |
| National University                          | BS in Manufacturing Design Engineering                                                | 180     | On Campus | \$12,384 | \$12,384     |
| De Anza College                              | Certificate of Achievement: Manufacturing Systems Technician                          | 22.5    | On Campus | \$698    | \$698        |
| Cerritos College                             | Verification of Completion: Machine Design and Manufacturing                          | 17      | On Campus | \$782    | \$4,403      |
|                                              | Verification of Completion: Plastics Manufacturing Technology Specialty               | 5.5     | On Campus | \$253    | \$1m424      |
|                                              | Verification of Completion: Wood Working Manufacturing Technologies                   | 14      | On Campus | \$644    | \$3,626      |
| El Camino College                            | Associate in Science and Certificate of Achievement: Manufacturing Technology         | 37      | On Campus | \$1,702  | \$10,656     |
| Santa Ana College                            | Manufacturing and Industrial Technology: Manufacturing Technology (A.A & A.S. Degree) | 39      | On Campus | \$14,376 | \$18,552     |

<sup>7</sup> Data is from each institution's respective website

A list of competitors was compiled for degrees offered in California related to the manufacturing industry.

**University of California, Los Angeles** - Manufacturing Engineering Certificate: UCLA Extension, an open enrollment branch of UCLA designed specifically for working adults, college students, and lifelong learners, offers a 32-credit manufacturing engineering certificate. The program is designed to give students a foundational understanding of manufacturing engineering, which UCLA defines as: “the application of science and math to convert raw materials into manufactured products according to an organized plan and in response to market demands”. The course focuses on a practical approach that allows students to develop the ability to apply manufacturing principles and practices in a work environment. The estimated cost for this certificate is \$9,850.

**California Polytechnic State San Luis Obispo** – Bachelor of Manufacturing Engineering: Cal Poly offers a 192-unit Bachelor’s degree in manufacturing engineering. This program applies “engineering analysis and methods to the production of all manufactured goods and services.” Students will learn “to plan, develop, and optimize the processes of production including methods of manufacture, and designs of tools and equipment for manufacturing.” This program is marketed as one of the most hands on programs at a school “known for hands-on learning”. Classes are small, and students are able to learn in laboratories stocked with “state of the art equipment”. The extensive curriculum covers economics, computers, mechanics, materials, software, math physics, and more.

**California State University – Northridge** – M.S. Manufacturing Systems Engineering and Management: CSU – Northridge offers a 33-credit degree in manufacturing systems engineering and management. The program aims to guide students in the “acquisition and development of the specialized knowledge and skills essential to the professional practice in the fields of engineering management, manufacturing systems engineering, and materials engineering.” The program is founded in computer based and automated design, materials and processes, and quality and management. The curriculum is currently evolving, but “contemporary laboratory facilities” afford students the flexibility to pursue a versatile field of study with a “wide range of career opportunities”.

**National University** – Bachelor of Science in Manufacturing Design Engineering: National University, located in San Diego California, offers a 64.5 Quarter Unit Bachelors of Science in Manufacturing Design Engineering. This program seeks to provide students the theoretical, practical, and team skills to develop and design complex engineering devices and systems. This course focuses on the blending of interdisciplinary skills attained from traditional engineering curricula and practical aspects of management and modeling so as to provide the student with an all-around knowledge of manufacturing engineering.

**De Anza College** – Certificate of Achievement: Manufacturing Systems Technician: De Anza College requires the completion of 22.5-units in order to reach this certificate level. The program teaches students to understand and utilize basic as well as specialized machinery. They also learn numerous safety skills and “operate manual mills, lathes, and surface grinders as well as construct entry-level programs for operation of CNC Mills...” By the end of this program, students will be able to utilize various types of equipment, analyze diagrams and other elements to repair different units, and exhibit basic programming skills for technological based machinery.

**Cerritos College** - Verifications of Completion in 3 categories: Machine Design and Manufacturing, Plastics Manufacturing Specialty, Wood Working Manufacturing Technologies.

Machine Design and Manufacturing includes design fundamentals including AutoCAD, AutoCAD, Machine Design Applications using Solid Modeling, Statics and Strength of Materials, and Design and production technology with Solid modeling.

Plastics Manufacturing Technology Specialty includes a specialty plastics lab, plastics materials and processes, and Plastics technology.

Wood Working Technologies includes CNC Woodworking, Architectural Millwork, and Hand Tools. CNC Woodworking requires introduction to faceframe Cabinetmaking, 32mm system of cabinetmaking, Introduction to computer operations for cabinetmaking and design, and CNC woodworking. Architectural Millwork requires Introduction to faceframe

cabinetmaking, architectural millwork, and mantel and wall systems. Hand tools requires Introduction to woodworking, wood carving for furniture, woodworking with hand tools, Windsor chair, and special topics in hand tools.

**El Camino College** - Associate in Science and Certificate of Achievement: Manufacturing Technology requires the completion of 37-units in order to reach certificate level. The program prepares students for employment in fields related to manufacturing. The program teaches student’s valuable skills like computer aided design, machining, electronics, technical mathematics and welding. By the end of the program, students will have a basic foundation in the skills listed above.

**Santa Ana College** - Engineering Industrial Technology: Manufacturing Technology Program (A.A. Degree, A.S. Degree) requires 36-units in order to reach certificate level. The program teaches students how to be mechanics, supervisors, technicians in private industries areas like production planning, quality control, inspection and testing, and production.

## IX. Appendix

### National Manufacturing Extension Partnerships

National Manufacturing Extension Partnerships (Table 6) exist to promote and support the manufacturing industry within the United States and provide these industries with skilled and qualified workers. They are designed to partner with universities and institutions to encourage good business locally rather than outsourced internationally. The largest conglomerates in the manufacturing Industry are categorized into three groups: The National Institute of Standards and Technology (NIST), Accelerating U.S. Advanced Manufacturing Partnership (AAMP), and the National Center for Defense Manufacturing and Machining (NCDMM). Both NIST and AAMP each have over 50 partners with major corporations spread across the nation including Honeywell and Siemens. NCDMM doesn’t share any partners with the other two conglomerates; however, it still maintains influence in the manufacturing industry. NCDMM, while similar to the other groups, focuses on manufacturing for the military.

**Table 6: National Manufacturing Extension Partnerships<sup>6</sup>**

| Institution                                                                                     | Year Founded | NIST/AAMP/NCDMM |
|-------------------------------------------------------------------------------------------------|--------------|-----------------|
| Alabama Technology Network                                                                      | 1988         | NIST            |
| California Manufacturing Technology Consulting Corporation for Manufacturing Excellence (Manex) | 1988         | NIST            |
| Arizona Commerce Authority                                                                      | 1988         | NIST            |
| Arkansas Manufacturing Solutions                                                                | 1988         | NIST            |
| Delaware Technical and Community College                                                        | 1988         | NIST            |
| Purdue University                                                                               | 1988         | NIST/NCDMM      |
| Polytechnic Institute                                                                           | 2014         | AAMP            |
| Alcoa                                                                                           | 2014         | AAMP            |
| Massachusetts Institute of Technology                                                           | 2014         | AAMP            |
| University of California Berkeley                                                               | 2014         | AAMP            |
| University of Akron                                                                             | 2014         | AAMP            |
| TMAC                                                                                            | 2014         | AAMP            |
| Oregon Manufacturing Extension Partnership                                                      | 2014         | AAMP            |
| University of California -LMAS                                                                  | 2006         | NCDMM           |
| RobbJack Corporation                                                                            | 2006         | NCDMM           |
| Penn State University                                                                           | 2006         | NCDMM           |
| University of Pittsburgh                                                                        | 2006         | NCDMM           |
| Georgia Institute of Technology                                                                 | 2006         | NCDMM           |
| SouthWest Research Institute                                                                    | 2006         | NCDMM           |
| Robert Morris University                                                                        | 2006         | NCDMM           |



NIST is a national network designed to promote and encourage small to mid-sized manufacturers in the US. Its goal is to improve upon the standards and processes of U.S. manufacturing by helping institutions of higher learning design and develop their curricula to create knowledgeable and skilled workers. NIST wants to create value with a focus on small to mid-sized manufacturers (SMEs). SMEs represent 99% of manufacturing firms in the U.S. To be able to have this kind of coverage NIST is divided into subcategories called technology acceleration centers. There are 5 centers: Defense/Aerospace Supply Chain, Southeast Automotive, Food Processors, Transportation, and Great lakes.

NCDMM exists to improve costs, quality, and processes of existing and future defense systems. It offers a variety of services addressing several needs such as Project/Program

Management, Sustainable Manufacturing, Manufacturing Engineering, and Supply Chain Management. One of its cornerstone portfolio pieces is Advanced Manufacturing Enterprise (AME) which is intended to improve industry-wide use of tools and practices, reducing waste, increasing sustainability and increasing productivity.

Accelerating U.S. Advanced Manufacturing 2.0 is a Presidential order that was implemented in 2014 to improve the manufacturing industry in the United States. This decree is an improvement from a previous version from 2012 titled Capturing Domestic Competitive Advantage in Advanced Manufacturing. The goals are to enable innovation, secure a talent pipeline, improve the business climate, and implementation of roles and responsibilities from recommendations aforementioned in the document.

#### Additional County Employment Data (Map 2)

| County | County Name                       | 2016 Jobs | 2026 Jobs | 2016-2026 Change | 2016-2026 % Change |
|--------|-----------------------------------|-----------|-----------|------------------|--------------------|
| 6071   | San Bernardino County, CA         | 55,798    | 53,859    | -1,939           | -3%                |
| 6065   | Riverside County, CA              | 44,504    | 42,998    | -1,506           | -3%                |
| 6111   | Ventura County, CA                | 30,737    | 29,468    | -1,269           | -4%                |
| 6019   | Fresno County, CA                 | 26,376    | 26,230    | -146             | -1%                |
| 6081   | San Mateo County, CA              | 25,871    | 26,260    | 389              | 2%                 |
| 6097   | Sonoma County, CA                 | 22,486    | 23,380    | 894              | 4%                 |
| 6067   | Sacramento County, CA             | 21,830    | 22,146    | 316              | 1%                 |
| 6099   | Stanislaus County, CA             | 21,004    | 21,229    | 225              | 1%                 |
| 6077   | San Joaquin County, CA            | 20,022    | 20,481    | 459              | 2%                 |
| 6013   | Contra Costa County, CA           | 15,739    | 14,687    | -1,052           | -7%                |
| 6029   | Kern County, CA                   | 14,104    | 16,180    | 2,076            | 15%                |
| 6083   | Santa Barbara County, CA          | 13,853    | 14,297    | 444              | 3%                 |
| 6055   | Napa County, CA                   | 12,506    | 14,289    | 1,783            | 14%                |
| 6107   | Tulare County, CA                 | 12,332    | 13,276    | 944              | 8%                 |
| 6095   | Solano County, CA                 | 12,231    | 13,766    | 1,535            | 13%                |
| 6075   | San Francisco County, CA          | 11,325    | 12,351    | 1,026            | 9%                 |
| 6047   | Merced County, CA                 | 10,959    | 11,360    | 401              | 4%                 |
| 6999   | [California, county not reported] | 10,585    | 11,981    | 1,396            | 13%                |
| 6079   | San Luis Obispo County, CA        | 7,355     | 7,813     | 458              | 6%                 |
| 6087   | Santa Cruz County, CA             | 7,085     | 7,520     | 435              | 6%                 |
| 6061   | Placer County, CA                 | 6,925     | 6,331     | -594             | -9%                |
| 6113   | Yolo County, CA                   | 6,562     | 7,787     | 1,225            | 19%                |
| 6053   | Monterey County, CA               | 5,929     | 5,769     | -160             | -3%                |
| 6031   | Kings County, CA                  | 4,949     | 5,807     | 858              | 17%                |

|        |                       |           |           |            |            |
|--------|-----------------------|-----------|-----------|------------|------------|
| 6041   | Marin County, CA      | 4,425     | 6,552     | 2,127      | 48%        |
| 6039   | Madera County, CA     | 3,873     | 4,347     | 474        | 12%        |
| 6007   | Butte County, CA      | 3,731     | 4,037     | 306        | 8%         |
| 6017   | El Dorado County, CA  | 2,779     | 3,407     | 628        | 23%        |
| 6045   | Mendocino County, CA  | 2,708     | 2,681     | -27        | -1%        |
| 6089   | Shasta County, CA     | 2,502     | 2,504     | 2          | 0%         |
| 6069   | San Benito County, CA | 2,440     | 3,077     | 637        | 26%        |
| 6023   | Humboldt County, CA   | 2,309     | 2,087     | -222       | -10%       |
| 6103   | Tehama County, CA     | 1,939     | 1,918     | -21        | -1%        |
| 6057   | Nevada County, CA     | 1,633     | 1,558     | -75        | -5%        |
| 6101   | Sutter County, CA     | 1,526     | 1,609     | 83         | 5%         |
| 6011   | Colusa County, CA     | 1,391     | 1,916     | 525        | 38%        |
| 6025   | Imperial County, CA   | 1,251     | 1,224     | -27        | -2%        |
| 6005   | Amador County, CA     | 921       | 1,132     | 211        | 23%        |
| 6109   | Tuolumne County, CA   | 866       | 823       | -43        | -5%        |
| 6093   | Siskiyou County, CA   | 759       | 719       | -40        | -5%        |
| 6115   | Yuba County, CA       | 752       | 820       | 68         | 9%         |
| 6021   | Glenn County, CA      | 661       | 773       | 112        | 17%        |
| 6063   | Plumas County, CA     | 498       | 375       | -123       | -25%       |
| 6033   | Lake County, CA       | 425       | 520       | 95         | 22%        |
| 6009   | Calaveras County, CA  | 402       | 453       | 51         | 13%        |
| 6027   | Inyo County, CA       | 286       | 335       | 49         | 17%        |
| 6105   | Trinity County, CA    | 254       | 283       | 29         | 11%        |
| 6043   | Mariposa County, CA   | 140       | 165       | 25         | 18%        |
| 6015   | Del Norte County, CA  | 95        | 96        | 1          | 1%         |
| 6051   | Mono County, CA       | 79        | 64        | -15        | -19%       |
| 6035   | Lassen County, CA     | 44        | 53        | 9          | 20%        |
| 6049   | Modoc County, CA      | 27        | 45        | 18         | 67%        |
| 6003   | Alpine County, CA     | 14        | 20        | 6          | 43%        |
| 6091   | Sierra County, CA     | <10       | <10       | Insf. Data | Insf. Data |
| Totals |                       | 1,322,620 | 1,288,603 | -34,017    | -3%        |

# Appendix C

## Prior Learning Assessment Best Practices

### Introduction

The increased level of uncertainty surrounding the value of a degree, coupled with the increasing cost and time commitment required, has brought the subject of prior learning assessment (PLA) to the forefront. In addition, there is a growing need to educate our workforce and to provide employers with job-ready employees. This has led institutions of higher education to seek ways to offer more innovative and flexible instruction, while maintaining rigor and high levels of academic quality.

PLA is one option that helps reduce tuition costs, reduce time to degree completion, eliminate redundant learning, and assess subject matter and interpersonal skills sought after by employers. This overview provides a definition of PLA, PLA policies within the California State University (CSU) system, and several examples of best practices.

### Definition

According to the Council for Adult and Experiential Learning (CAEL), a leading professional organization focused on educational opportunities for adult learners, prior learning is “learning that a person acquires outside a traditional academic environment. This learning may have been acquired through work experience, employer training programs, independent study, non-credit courses, volunteer or community service, travel, or non-college courses or seminars” (CAEL PLA). Professional certifications, such as those offered by the Society for Human Resource Management (SHRM), licenses such as a real estate license, and training through police and fire academies, may also be awarded credit hour equivalencies (ACE Learners Guide to PLA).

An important tenet of PLA is that academic credit is awarded for acceptable and documented college-level learning, and not just experience. Students must demonstrate that their experiential learning is equivalent to learning that is documented in the course’s outcomes. In general, vocational learning stemming from practical training in a trade, such as

auto body repair and cosmetology, is not considered to be college-level learning (Philadelphia University PLA Handbook).

Also according to CAEL, there are four generally accepted approaches to the assessment of prior learning which include (1) standardized exams such as Advanced Placement (AP) exams and College Level Examination Program (CLEP) exams; (2) challenge exams developed and administrated through a specific department within a college/university; (3) courses evaluated through the American Council on Education (ACE), which include military classes and training programs; and (4) individual student assessments of which portfolio assessments are most common. Credit may be given on a course-by-course basis or by taking a more holistic approach by awarding a set number of credits based on a comprehensive view of the student’s portfolio submission.

The term PLA is often used interchangeably with competency-based education (CBE) and there is some confusion as to what the difference is between the two. CBE is a more broad-based instructional approach that allows “learners to earn credentials by demonstrating mastery through multiple forms of assessment, often at a personalized pace” (Deconstructing CBE). In general, PLA is considered to be a dimension of CBE and can be used as one of many methods to assess a student’s learning outcomes.

Additionally, both PLA and CBE challenge the notion of “seat-time” as being one of the metrics used to demonstrate and assess student learning. Moreover, colleges and universities are showing increased interest in CBE and PLA programs because they often provide easier access for non-traditional students, decrease the time to complete a degree, and fit the needs of an ever-changing workforce (Deconstructing CBE). Well-known CBE-based programs include those offered through Western Governors University, Southern New Hampshire University, and the University of Northern Arizona.

## Prior Learning Assessment within the California State University System

The principles of higher education that guide the California State University System (CSU) are articulated in the 1960 Master Plan for Higher Education in California (Master Plan for Higher Education). These principles include the need to devise ways to support transfer students who may come in with prior experiences. Thus, the importance of PLA has had its roots in the CSU for over 55 years, but as noted in the 2017-18 Governor's Budget Summary (2017-18 Governor's Budget Summary), this basic principle is still relevant today. In addition, this principle is reflected in Governor Brown's renewed emphasis on improving the CSU's graduation rates, known as the Graduation Initiative 2025 (Graduation Initiative 20125). The implementation of PLA is one potential avenue that could help select students graduate sooner and at a lower cost.

The CSU is guided by executive orders that provide documentation and general guidance pertaining to the successful operation within the CSU system and individual campuses. The executive order describing PLA is titled Executive Order 1036: Systemwide Admission Eligibility and/or Baccalaureate Credit Awarded for External Examinations, Experiential Learning, and Instruction in Non-Collegiate Settings. All campuses are required to fully describe the objectives, policies, procedures, and bases for the awarding of credit for documented prior learning in their campus catalog and web site. The CSU has taken great strides in ensuring that prior military credit is awarded based on the ACE Guide to the Evaluation of Educational Experience in the Armed Services and the National Guide to Educational Credit for Training Programs. This has allowed our Veteran students to matriculate into the CSU with credits that can be applied toward their degree requirements, reducing the time to complete their degrees.

Executive Order 1036 designates the authority to determine if PLA credit is allowed to each individual campus. Each campus is given "the discretion to determine whether or not enrolled students may earn credit toward the baccalaureate for learning, knowledge, or skills acquired through experience" (Executive Order 1036). In addition, the assessment of the learning is the responsibility of the faculty who have the credentials and

competence in the discipline being assessed. Further, it is the responsibility of the faculty to then determine if credit should be awarded based on verifiable documentation which may include portfolios, personal interviews, demonstrations, and written exams. In addition, each campus is given leeway to decide how many credits can be awarded through PLA and into what course category (major, minor, or elective).

While this executive order outlines the potential to award academic credit for prior learning, PLA programs within the CSU have generally been associated with challenge exams, CLEP exams, and credit for military-based technical and training courses. The awarding of credit for prior learning based on work, life, and volunteer experiences is not as common. Just as there is some confusion and misunderstanding across academe surrounding the definition of PLA and its benefits for students, particularly non-traditional adult learners, these same uncertainties likely apply to faculty, staff, and administration within the CSU.

The popularity of PLA programs in other public and private universities is an indication that students are seeking alternative ways to earn credit toward their degrees. There is clearly untapped potential within Divisions of Continuing and Extended Education in the CSU to spearhead the understanding, acceptance, and implementation of robust PLA programs. A March 2016 report titled, *Prior Learning Assessment and Competency-Based Education: An Overview of Programs, Policies, and Practices* funded by the Ford Foundation through its Corridors of College Success initiative and authored by individuals from CAEL, Moran Technology Group, and the RP Group (the Research & Planning Group for the California Community Colleges) provides a thorough overview of PLA and CBE in the state of California (PLA and CBE Overview).

Three CSU campuses are highlighted for their PLA programs: (1) San Francisco State University offers Credit by Evaluation for Experiential Learning (CEEL), which allows students to earn up to 30 undergraduate units through the development of

a portfolio to be assessed by a faculty member; (2) California Polytechnic University offers students in the Bachelor of Interdisciplinary Studies degree the option to earn credit via a portfolio process; and (3) California State University, Bakersfield offers students the opportunity to earn up to 20 undergraduate units through a portfolio process assessed by a faculty member and approved by the student's advisor, chair of the department where the credit is earned, and the Dean of Undergraduate Programs.

## Examples of Best Practices

CAEL provides a list of “Ten Standards for Assessing Learning” that are embraced by the majority of colleges and universities who have implemented PLA (CAEL Ten Standards for Assessing Learning). These 10 standards are considered to be the cornerstone of best practices pertaining to PLA:

- 1) Credit or competencies are awarded only for evidence of learning, not for experience or time spent.
- 2) Assessment is integral to learning because it leads to and enables future learning.
- 3) Assessment is based on criteria for outcomes that are clearly articulated and shared among constituencies.
- 4) The determination of credit awards and competence levels are made by appropriate subject matter and credentialing experts.
- 5) Assessment advances the broader purpose of equity and access for diverse individuals and groups.
- 6) Institutions proactively provide guidance and support for learners' full engagement in the assessment process.
- 7) Assessment policies and procedures are the result of inclusive deliberation and are shared with all constituencies.
- 8) Fees charged for assessment are based on the services performed in the process rather than the credit awarded.
- 9) All practitioners involved in the assessment process pursue and receive adequate training and continuing professional development for the functions they perform.
- 10) Assessment programs are regularly monitored, evaluated and revised to respond to institutional and learner needs.

Among the colleges and universities that have embraced PLA, there are some commonalities and differences in how these programs are implemented. Best practices include:

- Having a designated central office, often titled the “Center for Prior Learning Assessment,” to oversee a PLA program, particularly the portfolio process.
- Having a director/coordinator oversee the PLA program.
- Ensuring that advisors/mentors, both academic, i.e., faculty, and professional advisors have buy-in into the process so that students can be advised appropriately.
- Ensuring that faculty portfolio assessors are thoroughly trained so that credit is awarded consistently and fairly.
- Providing students with a well-documented PLA handbook and/or a website with a complete list of frequently asked questions (FAQs) that includes, at a minimum, details pertaining to the steps required, the number of credits that can be awarded, and the costs associated with PLA.
- Providing students with a self-assessment to determine if PLA is a viable option for them to earn academic credit.
- Providing a class and/or workshops instructing students how to submit portfolios.
- Having a documented appeal process if students wish to have their portfolios reassessed.
- Ensuring that students are made aware of the PLA options early in their academic careers.
- Ensuring that the fees/costs to the student for PLA are reasonable and fair.

Six colleges and universities that exemplify these best practices are profiled here: (1) Central Michigan University; (2) Dalton State College; (3) Philadelphia University; (4) St. Leo University; and (5) SUNY Empire State College; and (5) Thomas Edison State University. Highlights of each of their PLA programs are noted.

## Central Michigan University

Central Michigan University (CMU) was established in 1892 and is among the nation's 100 largest public universities with more than 20,000 students on its Mount Pleasant campus and another 7,000 enrolled online and at more than 40 locations across North America. CMU offers more than 200 academic programs at the undergraduate, graduate, specialist and doctoral levels. CMU was a pioneer in awarding prior learning credit. They began in the early 1970s when they started to offer courses on military bases and needed to develop a way to award military personnel academic credit for their training. A team was assembled to develop a PLA process and assess learning. Since the PLA program's inception, over 10,000 portfolios have been evaluated.

- CMU's PLA model is based on "competencies" rather than on course "equivalents."
- Up to 60 undergraduate credits and up to 10 graduate credits may be awarded.
- Each portfolio is evaluated independently by three prior learning assessment team members, who are graduate faculty at CMU. Faculty must apply for membership and are selected based on their backgrounds and knowledge. They serve for 3-6 years and participate in extensive initial and on-going training for evaluating portfolios.
- Students are allowed one request for re-evaluation of their original award.
- There is a Prior Learning Assessment Office with a designated coordinator.
- Students are encouraged to submit early in their academic program so that a clear degree plan is followed.

## Dalton State College

Dalton State College (DSC) is part of the University System of Georgia (USG). The College offers select bachelor's degrees and a full range of associate's degrees and professional certificate programs.

- A two-credit hour portfolio building course is required for those who opt to submit portfolios.
- A trained advisor is assigned to each student to help identify areas of prior learning that apply to specific courses, document the learning, and submit the portfolio for review.
- DSC is part of a larger consortium of USG schools which provides access to assessors trained in other fields.
- Credit for prior learning will be awarded to students who submit Georgia Peace Officer Standards and Training (POST) Certification documents.

## Philadelphia University

Philadelphia University is a private university with 3,700 part- and full-time undergraduate and graduate students from 38 states and 30 countries. The University offers more than 60 undergraduate and graduate degree programs.

- The student handbook provides detailed information about the PLA process, complete with forms.
- There are two required courses to learn how to complete a portfolio. These courses follow the CAEL method and set of best practices for PLA.
- An assigned faculty member provides ongoing guidance and direction to the student in the developing of the PLA document.
- Students may be awarded a maximum of 12 credits for college-level learning they gained through successful completion of training in a municipal police or fire academy.

## Saint Leo University

Established in 1889 by the Order of Saint Benedict of Florida, Saint Leo University (SLU) serves more than 16,000 students from 49 states and 86 countries, ranking SLU among the five largest Catholic higher education institutions in the United States. Saint Leo is also one of the nation's 10 leading providers of higher education to the U.S. military.

- SLU requires a course titled, PLA 100 Prior Learning Theory and Practice, which is a 6-week, 3-credit course for students to take to learn how to develop and submit a portfolio.
- SLU partners with CAEL for the assessment of student portfolios. CAEL uses faculty from colleges and universities from all over the United States who evaluate and recommend the credits students shall be awarded.

## SUNY Empire State College

SUNY (State University of New York) Empire State College was established in 1971 as a distinctive statewide institution focused on nontraditional students and instruction by having faculty mentors guide students through designing an individual degree program within 12 broad areas. The college values learning gained from prior life and work experience and has a clear process for assessing and awarding credit for college-level learning gained through experience.

- Each year over 4,000 students take part in the PLA process.
- Approximately 50% of undergraduate students receive credits based on PLA.
- The website includes a video that provides an overview of the portfolio process and how it benefits students.
- Each student is assigned a mentor to assist in the PLA process.
- The iPLA request and approval process is managed through PLA Planner, an online tool developed by the college.

## Thomas Edison State University

Thomas Edison State University, chartered in 1972, is one of New Jersey's 11 senior public institutions of higher learning and one of the oldest schools in the country designed specifically for adults. The University offers associate, bachelor's, master's and doctoral degree programs in more than 100 areas of study as well as undergraduate, graduate and professional certificates to over 17,000 students.

The website provides a thorough list of FAQs, including information pertaining to financial aid. Since Portfolio Assessment credit does not receive a letter grade (A, B, C, D), it is not usually eligible for financial aid.

- A self-assessment is provided to students who would like to determine if the PLA program is the right option for them.
- The College requires completion of two courses prior to submitting portfolios.
- The College provides a database of over 4,000 courses for course equivalency, which includes student learning outcomes that must be documented in a portfolio.
- There is a designated "Office of Prior Learning Assessment" where students can go for assistance.
- Credit is awarded by subject-matter experts, faculty who teach or have taught courses in that subject area and are familiar with course requirements.

## References

### **2017-18 Governor's Budget Summary**

<http://www.ebudget.ca.gov/FullBudgetSummary.pdf>

### **ACE Learners Guide to PLA**

<http://www.acenet.edu/news-room/Pages/Adult-Learners-Guide-to-PLA.aspx>

### **CAEL Ten Standards for Assessing Learning**

<http://www.cael.org/ten-standards-for-assessing-learning>

### **CAEL PLA**

<http://www.cael.org/higher-education/prior-learning-assessment-services>

### **Central Michigan University PLA Handbook**

<https://www.cmich.edu/global/prior-learning/Documents/PLA-Student-Handbook.pdf>

### **Dalton State College Credit for Prior Learning Handbook**

<https://www.daltonstate.edu/skins/userfiles/files/PLAHandbook2015.pdf>

### **Deconstructing CBE**

<http://www.eduventures.com/2016/07/deconstructing-cbe-eduventures-and-ellucian-team-up/>

### **Executive Order 1036: Systemwide Admission Eligibility and/or Baccalaureate Credit Awarded for External Examinations, Experiential Learning, and Instruction in Non-Collegiate Settings**

<https://www.calstate.edu/eo/EO-1036.html>

### **Graduation Initiative 2025**

<https://www2.calstate.edu/graduation-initiative-2025>

### **Master Plan for Higher Education**

<http://www.ucop.edu/acadinit/mastplan/welcome.html>

### **Philadelphia University PLA Handbook**

<http://www.philau.edu/scps/inc/documents/PLAMannual-withsamplePLAs-rev2.pdf>

### **Prior Learning Assessment and Competency-Based Education: An Overview of Programs, Policies, and Practices**

[http://www.mtsac.edu/president/board-reports/2016-17/RP-Prior\\_Learning\\_Assessment\\_Competency-based.pdf](http://www.mtsac.edu/president/board-reports/2016-17/RP-Prior_Learning_Assessment_Competency-based.pdf)

### **Saint Leo University PLA**

<http://blog.centers.saintleo.edu/blog/earn-credit-for-your-life-experiences-through-pla>

### **SUNY Empire State College PLA Guide**

<https://www.esc.edu/degree-planning-academic-review/prior-learning-assessment/>

### **Thomas Edison State University Self-Assessment**

<http://www2.tesu.edu/pla/self-assessment.php>

### **Thomas Edison State University PLA FAQs**

[http://www.tesu.edu/degree-completion/PLA-and-Portfolio-FAQs.cfm#faq\\_1484331715619\\_2578](http://www.tesu.edu/degree-completion/PLA-and-Portfolio-FAQs.cfm#faq_1484331715619_2578)



## Appendix D

# Courses and Programs Related to Manufacturing California State University Campuses

## Bakersfield

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### Agricultural Business

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#### **AGBS 271 Principles of Agricultural Law**

A survey of legal issues and principles of practical concern that is applicable to transactions in agribusinesses. This foundation course introduces fundamentals of laws, regulations, and government practices affecting farming enterprises and related agriculture service and product industries, and addresses ethical principles associated with agricultural activities. Topics include government relationships; compliance requirements; contracts; tort liability; property law; employment law; and legal issues pertaining to agricultural cooperatives, soil, water, animals, and crops.

#### **AGBS 350 Agricultural Management**

Core management concepts and theories applied to agribusiness. Topics include individual dynamics (motivation, values); planning (demand, forecasts, budgets); organizing (strategy, structure, change); leadership (power, influence, negotiation, human resources); and control (product/inventory, financial management).

#### **AGBS 351 Agricultural Marketing**

Core marketing concepts applied to agriculture and the food system. Considers the conceptual foundations of effective marketing and industry practices by growers, processors and packagers, and intermediaries such as wholesalers, distributors, brokers, agents, and retailers. Imparts a forward-looking global perspective by incorporating research findings, technology trends, and international marketing strategies. Incorporates business cases, simulated decision scenarios, guest speakers, and field projects involving local enterprises. Ethical issues are considered and marketing strategies analyzed in the context of customer objectives and stakeholder concerns.

#### **AGBS 370 Agribusiness Accounting**

This course addresses accounting issues unique to agribusiness. Topics to be covered include: review of basic accounting concepts from the perspective of agribusiness, income taxes, management reports and data sources in agriculture, budgeting, financing, and ratio analysis. Students will learn the differences between cash accounting, accrual accounting, and crop/field accounting. They will also learn what method is most useful for different objectives such as field/crop management, overall farm management, overall farm reporting, tax reporting, reports for lenders, and reports for owners/shareholders.

#### **AGBS 371 Economics of Agriculture and Natural Resources**

Economic policy analysis of agriculture and natural resources with emphasis on California agriculture. Topics include the structure and organization of U.S.'s agriculture and food system, specifically the operation, financing, linkages, and functions of its components; the economic aspects of a wide range of environmental issues including air and water pollution, optimal forest and fisheries management; recycling; cost-benefit policy analysis case studies; and international issues

#### **AGBS 372 Agricultural Trade Policy**

An introduction to practical considerations of agricultural trade and trade policy analysis. Emphasis is placed on concepts of agricultural trade, analysis of trade policies of major trading partners and the export/import marketing of agricultural products. Also the interdependencies between the world's food, populations and equitability/poverty problems and possible solutions are explored

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### **AGBS 373 Agricultural Finance**

The objective of this course is to provide students with the tools necessary to evaluate and manage risk in the agricultural industry. This course provides an introduction to the economic theory, organization, and operating principles of agricultural commodity futures markets in the U.S. Emphasis is placed on speculating, hedging, and investing in agricultural commodity futures contracts from the standpoint of the agribusiness entrepreneur. Capital theory is also visited.

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### **AGBS 496 Internship in Agribusiness**

Internships may be arranged by the department with various agencies or businesses. Prerequisite: Permission of program coordinator who will determine credits and application of credit. May be repeated.

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## **Computer and Electrical Engineering**

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### **ECE 1618 Introduction to Engineering I**

This course will provide an introduction to the practice of engineering and the various areas within the engineering disciplines. Students will be informed of engineering curricula and career opportunities within the various engineering disciplines. This course will also introduce students to important topics for academic success, both at the major level and at the university level.

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### **ECE 1628 Introduction to Engineering II**

This course builds on the foundational skills in engineering design and practices developed in ENGR/ECE 1618. Students will design, build, test, and present engineering projects designed to solve specified problems within given constraints. Additionally, the impact of engineering from a global, social, economic, and environmental perspective is presented through case studies.

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### **ECE 2070 Electric Circuits**

An introduction to the analysis of electrical circuits. Use of analytical techniques based on the application of circuit laws and network theorems. Analysis of DC and AC circuits containing resistors, capacitors, inductors, dependent sources and/or switches. Natural and forced responses of first and second order RLC circuits; the use of phasors; AC power calculations; power transfer; and energy concepts.

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### **ECE 3040 Signals and Systems**

Time and frequency domain techniques for signal and system analysis. Fourier series and transforms, and Laplace transforms. Topics in differential equations and probability. Use of a numerical computing environment such as MATLAB.

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### **ECE 3070 Analog Circuits**

Design, construction, and debugging of analog electronic circuits. Diodes, filters, oscillators, transistors, JFETs, op-amps, and basic analog circuit design. Broadband applications in networking and communications.

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### **ECE 3200 Digital Circuits**

Introduce combinational logic and sequential logic designs, and microprocessors. Cover digital concepts, number systems, operations, and codes, logic gates, Boolean algebra and logic simplification, combinational logic and its functions, flip-flops and related devices, counters, shift registers, memory and storage, concepts of microprocessors, assembly language, computers, and buses.

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### **ECE 3220 Digital Design with VHDL**

Introduces logic system design using a hardware description language (VHDL). Covers the VHDL language in depth and explains how to use it to describe complex combinational and sequential logic circuits. Include a weekly lab where students will get hands-on experience implementing digital systems on Field Programmable Gate Arrays.

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### **ECE 3230 Digital Communications**

This course focuses on the representation of signals and noise, Gaussian processes, correlation functions and power spectra, linear systems and random processes, performance analysis and design of coherent and non-coherent communication systems, phase-shift-keying, frequency-shift-keying, and M-ary communication systems, optimum receivers and signal space concepts, information and its measure, source encoding, channel capacity, and error correcting coding.

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### **ECE 3250 Embedded Systems**

Introduce embedded systems. Cover embedded concepts, NI sbRIO embedded system devices, LabVIEW RT and FPGA modules, combinational and sequential logic circuits design, finite state machines, memory and storage, sensor and motor interface.

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**ECE 3280 Instrumentation, Control, and Data Acquisition**

Introduction to LabVIEW and NI Elvis board. Students learn how to use NI virtual instruments, such as function generators, oscilloscopes, etc., design a variety of projects on analog and digital inputs, outputs, and signal generations, and use both simulation and hardware test-beds to verify their projects and performance.

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**ECE 3340 Control Systems**

Introduce control system analysis and design. Cover control system modeling, time response, reduction of multiple systems, stability analysis, steady-state errors, root locus technique, PID controller, and fuzzy controller.

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**ECE 3370 Power Systems Fundamentals**

This course is an introductory subject in the field of electric power systems. Electric power systems have become increasingly important as a way of transmitting and transforming energy in industrial, military and transportation uses. The course covers basic elements of power system, three-phase circuit analysis, transformers, transmission line configuration, the per unit system and power flow.

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**ECE 3380 Power Electronics and Electrical Drives**

The course is an introduction to switched-mode power converters, electromechanical energy conversion systems, and electric drives. It provides a basic knowledge of circuitry for the control and conversion of electrical power with high efficiency. These converters can change and regulate the voltage, current, or power; dc-dc converters, ac-dc rectifiers, dc-ac inverters, and ac-ac cycloconverters are in common use. Applications include electronic power supplies, aerospace and vehicular hybrid power systems, and renewable energy systems.

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**ECE 4240 Microprocessor System Design**

Introduce microprocessor architecture and organization. Cover bus architectures, types and buffering techniques, Memory and I/O subsystems, organization, timing and interfacing, Peripheral controllers and programming. Design a microprocessor system.

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**ECE 4250 Wireless Communications**

In this course analytical characterizations of mobile communications channels are developed. The main techniques for mitigating the mobile communication channel effects such as Equalization, Diversity, etc. are examined. Multiple access techniques used in wireless communications, such as FDMA as well as digital TDMA and CDMA techniques are presented.

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**ECE 4260 Wireless Networks**

This course focuses on wireless data communications including wireless internet. The students acquire knowledge into the current and future state-of-the-art of technology in the field of wireless communications. Another goal of the course is to ensure student(s) can explain the impact of commercial, political, and regulatory factors on the design of wireless systems. The course will treat current relevant technologies, and the exact content may change from year to year.

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**ECE 4330 Mechatronics**

Intelligent electro-mechanical systems. Topics include electronics (A/D, D/A converters, op-amps, filters, power devices), software program design (event-driven programming, state machine-based design), DC and stepper motors, basic sensing and basic mechanical design.

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**Engineering Sciences**

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**ENGR 160 Engineering Orientation**

An introduction to the various areas within the engineering discipline. Description of engineering curricula and career opportunities within each of the various areas. Academic advising for engineering programs. Primarily for students planning to major in one of the fields of engineering

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**ENGR 161 Introduction to Engineering Design**

Introduces students to real-life engineering projects. Students design, build, tests and present engineering projects designed to solve specified problems within given constraints. Primarily for students planning to major in one of the fields of engineering

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**ENGR 162 Introduction to Engineering Computing**

Introduces the solution of engineering problems using spreadsheets, a numerical computing environment, and computer-aided design.

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**ENGR 207 Electric Circuits**

Circuit laws and analysis of DC and AC circuits. Physical properties, electrical characteristics and circuits of discrete and integrated electrical and electronic devices. Design and construction of circuits with instrumentation applications

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**ENGR 240 Analytic Mechanics, Statics**

Fundamental principles of force systems acting on particles and rigid bodies in static equilibrium. Applications to structural and mechanical problems, both two-dimensional and three-dimensional.

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**ENGR 241 Analytic Mechanics, Dynamics**

Topics include vector representation of kinematics and kinematics of particles; Newton's laws of motion; force-mass-acceleration, work-energy, and impulse-momentum methods; kinematics of systems of particles; kinematics and kinetics of rigid bodies.

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**ENGR 243 Mechanics of Materials**

This course covers stress and strain and mechanical properties of materials. The axial load, torsion, bending and transverse shear; combined loadings; stress transformation; pressure vessels, deflection of beams and shafts; and buckling of columns are reviewed as well.

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**ENGR 244 Properties of Materials**

Structure of matter. Physical and mechanical properties of materials including metals, polymers, ceramics, composites, and electronic materials. Equilibrium diagrams. Materials selection, corrosion phenomena. Heat treatment, cold deformation, brittle-ductile fracture behavior.

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**ENGR 270 Introduction to CAD in Engineering**

Use of computer-aided design software, such as AutoCAD, in engineering. CAD concepts including drawing setups, commands and system variables, layers and object properties, 2-dimensional entity creation, coordinate systems, creating objects, drawing with precision, plotting, and editing methods are applied to a variety of engineering applications.

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**ENGR 271 Intermediate CAD in Engineering**

Intermediate topics in computer-aided design using AutoCAD. Introduction to 3-dimensional drawing and modeling with engineering applications, adding text to drawings, creating dimensions, using blocks and external references, managing content with Autocad Design Center, creating a layout to plot, plotting your drawings, working with raster images, creating compound documents with OLE, and using other file formats.

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**ENGR 300 Engineering Modeling and Analysis**

Formulation of mathematical models for engineering systems; applying mass, momentum, and energy balances to derive governing differential equations; solution of differential equations and eigenvalue problems typically encountered within an engineering context; solving equations with the use of spreadsheets and other numerical computing environments such as Matlab; fitting linear and nonlinear models to experimental data; concepts in probability and statistics.

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**ENGR 301 Numerical Methods and Applications in Engineering**

Formulation and solution of mathematical models for engineering systems, continuation from ENGR 300. Numerical methods including: interpolation and polynomial approximation, numerical differentiation and integration, numerical solution of ordinary differential equations. Advanced methods in a numerical computing environment and computer-aided design.

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**ENGR 307 Principles of Electronics**

Circuit laws, theorems, equivalent circuits. Physical properties, electrical characteristics and circuits of electrical and electronic devices, discrete and integrated. Design and construction of analog and digital circuits with instrumentation applications.

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**ENGR 310 Thermodynamics**

Properties of working fluids and fundamental relations for processes involving the transfer of energy. First and second laws of thermodynamics, irreversibility and availability.

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**ENGR 320 Fluid Mechanics**

Hydrostatics and fluid dynamics. Viscous flow, boundary layer concepts, lift and drag, laminar and turbulent flow, compressible flow. Experiments involving flow measurement and control, conservation equations, pressure and velocity distributions, dimension analysis for lift and drag.

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**ENGR 330 Heat Transfer**

Introduces the analysis of steady and transient heat conduction, forced and natural convection, radiation heat transfer, and design of heat exchangers. Analytical and numerical methods in heat transfer and fluid mechanics. Topics include heat conduction and convection, gaseous radiation, boiling and condensation, general aspects of phase change, mass transfer principles, multimode heat transfer and the simulation of thermal fields, and the heat transfer process.

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**ENGR 340 Soil and Water Resource Management**

Soil and water management systems and practices including hydrology, surface drainage, open channels, and erosion, subsurface drainage, impoundments and irrigation.

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**ENGR 341 Engineering Principles of Agricultural Machines**

Application of machine systems to agricultural production and biological processing. Functional design and analysis of equipment. This course is designed to provide a broad foundation for understanding machine system. Machine systems are an integral part of many agricultural operations from field production to post-harvest processing, storage, transportation, and bio-based processing.

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**ENGR 342 Bioprocess Engineering**

Engineering principles, processes and techniques for using biological agents such as cells, enzymes or antibodies for the production of chemicals, food, biofuels and pharmaceuticals, and waste treatment. The course includes stoichiometry and kinetics of reactions that employ biological agents; design, analysis and operation of reactors; and product recovery and purification.

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**ENGR 351 Fundamentals and Transport in Petroleum Engineering**

Introduction to fundamental concepts in petroleum engineering. Topics include the origin, migration and accumulation of petroleum, properties of reservoir rocks and fluids. Introduces petroleum exploration, reservoir engineering, drilling technology, well completion, and production engineering.

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**ENGR 405 Machine Design**

This course is an introduction to the principles of mechanical design. Methods for determining static, fatigue, and surface failure are presented. Analysis and selection of machine components such as shafts, keys, couplings, bearings, gears, springs, power screws, and fasteners is covered.

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**ENGR 410 Power Systems Analysis**

Fundamentals, power transformers, transmission lines, power ow, fault calculations, power system controls. Unbalanced networks, symmetric and unsymmetrical faults, transient transmission line modeling, system protection.

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**ENGR 420 Operations Research**

Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks ows, and integer programs. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

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**ENGR 422 Project Management**

Projects are unique, strategically important, complex endeavors with definite beginning and ending dates. The course develops the skills required to manage the component processes of a project throughout its life cycle: scope, time and sequencing, cost, quality, human resources, communications, risk, procurement, and project integration management. The project life cycle encompasses development of the initiative out of strategic planning activities, articulation of project goals and objectives, planning project components and their integration, execution and control, project close out, and follow-up activities.

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**ENGR 424 Quality Management**

An overview of management literature relating to quality planning, quality control, quality assurance, and quality improvement. A consideration of the core principles and methods common to most quality improvement programs and their relationship to management principles. Comparison of prevalent quality improvement programs such as ISO9004: 2008, SixSigma, and TQM and the Malcolm Baldrige Standards.

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**ENGR 426 Economics of Engineering Design**

Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies.

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**ENGR 440 Biological Systems Applications**

Principles of heat and mass transfer in the context of biological (biomedical/bioprocessing/bioenvironmental) systems. Physical understanding of transport processes and simple reaction rates with application to examples from plant, animal, and human biology.

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**ENGR 441 Environmental Engineering**

An introduction to environmental engineering, including: water usage and conservation; water chemistry including pH and alkalinity relationships, solubility and phase equilibria; environmental biology; fate and transport of contaminants in lakes, streams and groundwater; design and analysis of mechanical, physicochemical and biochemical water and wastewater treatment processes.

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**ENGR 442 Food and Bioprocess Engineering  
Unit Operations**

Principles of the engineering design, testing and analysis of unit processing operations employed in the food and bioprocess industries, such as sterilization, pasteurization, freezing/refrigeration, drying, evaporation, and fermentation, along with physical, chemical and phase separations. Design and analysis of thermal, freezing, evaporation, dehydration; and mechanical, chemical and phase separations processes as governed by reaction kinetics and rheology of food and biological materials.

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**ENGR 452 Petroleum Production Engineering**

Covers topics in modern petroleum production engineering, including production technologies, production equipment, equipment design and optimization, well completion, tubing design, well performance evaluation (productivity index), inflow performance relationships (IPR), artificial lift and surface facilities.

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**ENGR 453 Reservoir Engineering**

Fundamental equations of fluid flow through porous media, reservoir material balances, aquifer influx, well testing, and decline curve analysis. Methods for forecasting reservoir performance are covered using analytical models.

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**ENGR 454 Drilling Engineering and  
Completion Technology**

Fundamentals of drilling equipment, engineering design calculations, wellbore diagrams, drilling fluids, cement calculations, and casing design. Additional topics such as directional drilling as well as completion technologies are covered using practical examples and field applications as applied in the oil and natural gas well drilling operations.

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**Business Administration: Marketing**

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**MKTG 3000 Marketing Principles**

A study of the nature and role of marketing in advanced economies in a managerial context presented in a lecture, case, and applied format. Analysis of consumer wants, motivation and purchasing power, and introduction to and development of effective mixes among product, pricing, distribution, and promotional variables. Internet and e-commerce issues are also discussed.

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**MKTG 4000 Marketing Research and Control**

A study of the concepts underlying the collection and analysis of data for marketing decision-making and control. Surveys the application of scientific methodology as an aid to problem formulation, exploratory research, basic observational and sampling requirements, data analysis, interpretation, reporting, and control. Student application of research techniques and data treatment is emphasized.

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**MKTG 4060 Marketing Channels**

A study of the distribution function including retail management, supply chain management, inventory management, transportation, and e-marketing distribution strategies. Includes study of relationship building with channel partners, channel leadership and integrated channel strategies.

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**MKTG 4200 Global Marketing**

Analysis of the development of international marketing strategies and programs from the determination of objectives and methods of organization through execution of research, advertising, pricing, distribution, financing, and human resource management activities. Emphasis on the design of optimal strategies under varying physical, economic, political, social and cultural environments and specific marketing situations.

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**MKTG 4300 Services Marketing**

An intensive study of the concepts, practices, and development of strategies involved in marketing of services. The course will focus on the unique aspects of services marketing, such as demand management and quality control, and will cover a wide variety of services, including professional and business services.

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**MKTG 6000 Seminar Marketing Management**

This course presents development of marketing strategy for the organization and design of integrated product/service, promotion, and distribution programs utilizing systems analysis. It includes intensive analysis of management's marketing problems, including market analyses, pricing, channels of distribution, promotion, competition, product strategies, and marketing research. Applications are emphasized to include research, quantitative, and business analytical techniques through the development of case and project assignments.

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**MKTG 6060 Seminar in Marketing Channels and Logistics**

A study of the distribution functions including retail management, supply chain management, inventory management, transportation and e-marketing distribution strategies. Includes study of relationship building with channel partners, channel leadership and integrated channel strategies.

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**Business Administration: Management**

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**MGMT 3000 Organizational Behavior**

Students are provided with theoretical and conceptual frameworks drawn from the social sciences for understanding human behavior in business organizations. Emphasis is placed on the application of these theories and concepts to management and behavioral issues in organizations. Topics include individual differences, perception, motivation, learning, groups, communication, leadership, decision-making, diversity, total quality management, international OB, politics, and ethics.

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**MGMT 3020 Introduction to Operations Management**

An introduction to the system for planning, operating, and controlling the processes that transform inputs into outputs of finished goods and services in both profit and nonprofit organizations. Topics include: operations strategy, operations technology, product and service design, project planning and scheduling, facility location planning, facility layout, materials management, Six Sigma, and quality management and control. Computer software is used to analyze operations management functions.

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**MGMT 3090 Career and Managerial Skills**

This course has three primary objectives: increase understanding of relevant career options through completion of the comprehensive career assessment plan, increase understanding of managerial and employee survival skills and increase understanding of work/life balance issues through completion of a comprehensive work/life balance assessment balance.

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**MGMT 3100 Human Resource Management**

This course provides an overview of the functional areas of Human Resource Management. The course begins by examining environmental factors such as legislation, organizational strategy, labor, and global issues. Next the HR process is examined-recruiting, training, compensation, benefits, performance appraisal, and termination. Throughout the course, students are provided with the opportunity to engage in HR practice and develop HR policy.

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### **MGMT 3450 Small Business Management**

This course is designed to facilitate the acquisition of knowledge and skills needed to manage an ongoing small business. The focus is on owner/manager decision-making. Topics covered include ownership, personal selling, advertising, sales promotion, financial analysis, record keeping, personnel management, and the like.

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### **MGMT 4050 International Management**

An examination of contemporary issues related to managerial training, political structure, foreign receptivity to United States business, cultural factors, organizing, and controlling the international firm.

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### **MGMT 4300 Negotiation, ADR, and Conflict Management**

Comprehensive survey of current trends in the theory and practice of negotiation as a means of transacting business, including the resolution of conflict and reaching agreement. Principles of Alternative Dispute Resolution (ADR) will be introduced as a tool for resolving disputes by non-litigious approaches, such as third party intervention, mediation, arbitration, etc. Topics include: integrative and distributive methods; internal team management and pre-negotiation analysis; tactics and strategies; context and dynamics; diversity impact of culture, gender, and personality types; implementation, monitoring, and follow-up; and multilateral negotiation.

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## **Environmental Resource Management**

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### **ERM 2900 Introduction to Occupational Safety and Health**

This course reviews basic concepts that are necessary to succeed in the safety industry and the Occupational Safety and Health Concentration. Topics covered are, but not limited to: statistical concepts for the safety industry, survey of physical and life sciences, focused on their applications to the safety industry.

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### **ERM 3010 Introduction to Occupational Safety and Health Management**

Introduction to the safety profession including basic components of accident prevention and hazard control. Also covered will be introduction to occupational health and safety programs, safety and health legislation, ergonomics, hazard analytical tools, communication techniques in safety and health management, emergency preparedness, industrial hygiene concepts, and measuring safety program success.

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### **ERM 3100 Hazardous Materials Management**

Provides an in-depth examination of federal, state and local regulations and requirements for hazardous materials and wastes. Includes definitions of toxic and hazardous material; storage and treatment; transportation; emergency response planning; air and water quality; community concern issues; and risk assessment.

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### **ERM 3200 Industrial Hygiene Fundamental**

Introduction to the safety profession including basic components of accident prevention and hazard control. Also covered will be introduction to occupational health and safety programs, safety and health legislation, ergonomics, hazard analytical tools, communication techniques in safety and health management, emergency preparedness, industrial hygiene concepts, and measuring safety program success.

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### **ERM 4110 Environmental Law I**

The course will introduce students to the major federal, state and local environmental statutes and regulatory programs that address resources management. The course will emphasize the organization of the government regulatory agencies, the techniques of environmental regulation, the interplay of federal, state and local environmental regulation, environmental enforcement, and environmental litigation. The federal and state Administrative Procedure Acts, National Environmental Policy Act (NEPA), California Environmental Quality Act, Clean Water Act, Porter-Cologne Water Quality Control Act, Safe Drinking Water Act, Comprehensive Environmental Response Compensation and Recovery Act, Resource Conservation and Recovery Act, Clean Air Act, federal and state Endangered Species Acts, and local land use controls, including zoning law, will be the main statutes and regulatory schemes used to illustrate the workings of environmental law. In addition, common law doctrines and environmental torts will be covered.



## **Business Administration: Supply Chain Logistics**

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### **MGMT 4400 Logistics Management**

This is an introductory survey course of the history, current issues, and basic principles of logistics. It will examine the basic activities of logistics operations, the role of information technology, benefits of strategic partnerships, procurement, customer service, warehousing, transportation, and regulation. All will be discussed within the context of globalization.

### **MGMT 4450 Purchasing and Supply Chain Management**

This is a survey course of the current issues and basic principles of purchasing and its role in the era of global supply chains. It will examine the traditional role of purchasing and supply management in cost containment and revenue enhancement. As well, the more recent responsibilities of environmental, social, political, and security concerns that have arisen with the expansion of supply chains into developing countries will also be examined.

### **MGMT 4060 Marketing Channels and Logistics**

A study of the distribution function including retail management, supply chain management, inventory management, transportation, and e-marketing distribution strategies. Includes study of relationship building with channel partners, channel leadership, and integrated channel strategies.

### **PPA 4500 Contract Management**

This course examines principles, practices, and issues of contract management activities within government, nonprofit, and commercial/business organizations. A comprehensive evaluation of the process addresses the fundamentals of managing the entire contract life cycle of small to large transactions in a management systems approach. Participants develop practical competencies in using different planning, development, implementation, monitoring, and close-out templates and guidelines, as well as techniques relating to critical thinking, problem solving, and decision making. Federal Acquisition Regulations' principles are integrated into the transaction process to address the extended range of contracting complexities associated with expanded expectations, such as delivery of advanced technology systems or logistical issues involving intricate delivery schedules.

## **Certificate Programs - Extended University Project Management - Continuing Education Units**

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### **MGMT 8010 Introduction to Project Management**

This course introduces the concepts, processes, and knowledge areas of projects.

### **MGMT 8020 Project Planning and Scheduling using Microsoft Office Project**

In this course, you will learn how to plan and schedule your projects using Microsoft Office Project.

### **MGMT 8030 Managing the Project Team**

Management of project teams is difficult because of the unique dynamics of a project team. This course emphasizes how improved communication in project teams can help achieve project success.

### **MGMT 8040 Project Procurement and Quality Management**

This course addresses how to procure quality goods and services for your projects. You will also learn how to implement quality management principles in your projects to help improve the quality of your products and services.

### **MGMT 8050 Project Ethics and Risk Management**

This course addresses the ethics involved in projects from the perspective of the PMI® Code of Ethics. You will also learn how to determine what risks may affect your project, how to assess the potential impact of these risks on your project, and how you can protect your project from these risks.

## **Occupational Safety and Risk Management - Continuing Education Units**

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### **BA 8010 Intro to Occupational Safety & Risk MGMT**

This is the first course of the safety professional development program providing an educational foundation to establish the underlying competencies of common safety elements in the general industry standards. This course covers topics to introduce the student to the occupational safety, health, and environmental industries, develop writing and basic recordkeeping techniques, and understand the fundamental general industry safety along with introducing the students to regulatory interpretation.

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**BA 8011 Core Occupational Safety & Risk MGMT**

This course continues the instruction of regulatory and legislative material by reinforcing further the subjects within the general industry standards, strengthening the elements of behavior and the human factor in safety, and diversifying the regulatory instruction with a focus on agricultural, MSHA, and environmental regulations to balance the students' understanding in safety and risk management fields. Augmenting the students' soft-skills by developing research competencies complement the safety and risk management readiness by preparing students to locate and discover facts for the decision-making process and promoting a safe workplace.

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**BA 8020 Advanced Occupational Safety & Risk MGMT**

The program concludes the instruction with a focus on construction and oil & gas industries. Expanded concentration on workers' compensation elements, regulatory and statute interpretation, change management techniques, and incident investigation are combined to balance the students' understanding in safety and risk management fields. The development of presentation skills round off the coursework in preparing students to conduct effective on-the-job safety meetings.

## Fresno

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### Industrial Technology

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#### **IT 52 Electricity and Electronics**

Introduction to electricity including fundamentals of electrostatics, alternating and direct current electrical circuits, electrical calculations, magnetism, circuit applications, electrical measuring, and test equipment. Schematics and wiring diagrams, standards, and codes.

#### **IT 71 Metallurgical Processes**

Fundamentals of metallurgy; properties and characteristics of metals; survey of metal welding processes, equipment, and procedures; theory-discussion and laboratory experience in oxygen-fuel welding, cutting, brazing, and shielded metallic arc welding

#### **IT 74 Manufacturing Processes**

Study of how consumer and industrial products are manufactured, focusing on how raw materials (primarily metal and plastic) are changed into finished products. Topics include production processes of material addition, forming, casting, removal, separation, assembly, and finishing

#### **IT 92 Safety Management**

Principles of safety management in an industrial and agricultural environment; safety legislation and programs; management/supervisory and employee responsibilities and attitudes; physical hazards associated with chemicals, equipment, fire, compressed gases; other topics include eye, stress, drugs, lifting office, and noise safety.

#### **IT 102 Industrial Computer Concepts and Applications**

Introduction to computer systems hardware and software, operating system basics and installation, computer maintenance and troubleshooting

#### **IT 104 Product Design**

Elements, principles, and methods of design. Emphasis will be placed on the development of models and prototypes with attention to standard components, productivity, and packaging.

#### **IT 106 Energy Conversion and Utilization**

Fundamental sources of energy, including the following energy conversion systems: direct mechanical, external combustion, internal combustion, solar power, wind power, electrical and atomic systems. Experiments and demonstrations.

#### **IT 106 Energy Conversion and Utilization**

Fundamental sources of energy, including the following energy conversion systems: direct mechanical, external combustion, internal combustion, solar power, wind power, electrical and atomic systems. Experiments and demonstrations.

#### **IT 107 Facilities Planning and Materials Handling**

Facility planning techniques as applied to facility location, zoning, building codes, line balancing, shipping-receiving, offices, material handling, storage, project scheduling, and computerized layout.

#### **IT 112 Industrial Process Control Systems**

Process control principles; components and principles; transducers, actuators, sensors, and instrumentation; computer interface software, terminologies, standards, and trends in control technologies. Programmable logic controller principles, hardware, and software

#### **IT 114 Industrial Materials**

Chemical and physical properties of metals, polymers, ceramics, composites. Atomic structure and phases of matter emphasizing crystalline and amorphous solids. Mechanical properties, strength and testing of materials including impact, hardness, and tensile. Metallographic, microscopic inspection of electronic, and metallic specimen

#### **IT 117 Quality Assurance**

Quality assurance principles and practices in industry: quality assurance systems, acceptance sampling, testing, source surveillance; probability and statistical concepts, process control techniques and measurement procedures as applied to quality.

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**IT 118 Product operations**

A survey of production manufacturing operations: quality assurance, work sampling, testing, time and motion study; routing, scheduling, and inventory control; flow processes, material handling, and automation.

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**IT 156 Automated Systems**

Study and analysis of the characteristics and industrial applications of electric/hydraulic/pneumatic motor control. Special emphasis on programmable, solid state, and electromechanical motor controllers for applications in manufacturing and agriculture.

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**IT 184 Advanced Manufacturing Technology**

Production processing, using metallic and nonmetallic materials, including product design, work cells, tooling, capacity planning, material handling, scheduling and flow chart

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**IT 185 Advance Manufacturing Systems**

A comprehensive study of modern manufacturing systems. Topics include plant layout, material control and transfer, operations measurement, transfer lines, CNC and DNC, machine tool network, computer-integrated manufacturing, flexible manufacturing systems, group technology, robotics, and manual assembly systems.

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**Mechanical Engineering**

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**ME 1 Introduction to Mechanical Engineering**

Introduction to engineering design; case studies in mechanical engineering; problem-solving using the engineering approach; introduction to engineering code of ethics, mechanical engineering profession, and career opportunities.

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**ME 2 Computer Applications in Mech Engineering Lab**

Students develop fundamental skills in basic analytical and design tools used in mechanical engineering. Topics covered include spreadsheet applications, graphing data, technical communication, programming concepts, and computer-aided design (CAD)

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**ME 31 Engineering Materials**

Fundamental nature and properties of engineering materials; structure of matter and its effect on mechanical, electrical, magnetic, and thermal properties.

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**ME 95 Product Development**

Examines the overall process of product development including preliminary design, drafting, material selection, fabrication, inspection, assembly, and testing. Laboratory component introduces basic machining and fabrication skills.

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**ME 112 Engineering Mechanics: Dynamics**

Development of principles of kinematics and kinetics in engineering.

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**ME 116 Fluid Mechanics**

Fundamentals of fluid mechanics as applied to engineering problems.

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**ME 118 Fluid Mechanics Laboratory**

Applications of experimental methods used in engineering practice to fluid systems.

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**ME 122 Dynamic Systems and controls**

Modeling of mechanical systems; mechanical feedback systems; time domain analysis; stability, frequency response, and root locus plots; performance criteria, and system compensations; applications of different measuring devices and techniques used in engineering systems

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**ME 125 Engineering Statistics and Experimentation**

Provides fundamentals of statistical and uncertainty analysis applied to engineering measurements, experimental methods, product design, and manufacturing processes. Includes probability distributions, data sampling, confidence intervals, quality control, reliability, life testing, and analysis of uncertainty in experimental measurements.

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**ME 134 Kinematics of Machinery**

Analytical, graphical, and computer solutions applied to design problems in machinery, mechanisms. Cam design, different types of followers, cam manufacturing considerations. Gear design, different types of gears, gear trains. Students will be assigned class projects related to the topics covered in class.

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**ME 140 Advance Engineering Analysis**

Development of finite element method of engineering analysis; applications to heat flow, fluid flow, vibrations, and stresses in mechanical design using appropriate numerical techniques and closed-form solutions of partial differential equations.

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**ME 159 Mechanical Engineering Laboratory**

Analysis of mechanical engineering and measurement systems. Students conduct experiments dealing with advanced thermal and mechanical systems. Using knowledge and experience gained from experimentation, students design and conduct their own group experiments. Both written and oral technical reports are required.

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**ME 193 Mechanical Engineering Cooperative Internship**

Engineering practice in an industrial or government installation. Each cooperative internship period usually spans a summer-fall or spring-summer interval.

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**Electrical Engineering**

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**ECE 1 Introduction to Electrical and Computer Engineering**

Orientation to electrical and computer engineering via hands-on exercises and projects; introduction to circuits, components, instrumentation, and electronic prototyping; computer productivity tools; hardware and software trouble shooting

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**ECE 72 Introduction to Electrical and Computer Engineering Tools**

Introduction to engineering applications; use of Matlab software in analysis and synthesis, basic commands, data arrays, plotting and data presentation, data transfer, computation with loops, iterative solutions, integration with C programming, and technical problem solving.

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**ECE 90 Principles of Electrical Circuits**

Direct-current circuit analysis; circuit theorems; transient phenomena in RL and RC circuits, introduction to operational amplifiers, phasor concept; AC steady-state circuit analysis, sinusoidal steady-state response; power and RMS calculations in single-phase alternating-current circuits; principles of electrical instruments; computer solutions circuit simulation using Spice or other contemporary software tools

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**ECE 90L Principles of Electrical Circuits Laboratory**

Experiments on direct transient, and single phase alternating current circuits. Use of basic electrical instruments, development of laboratory techniques, and verification of basic circuit laws and principles

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**ECE 91 Introduction to Electrical Engineering**

Direct current circuit analysis, transient and AC steady state circuit analysis, basic electronics, diodes, transistors, digital systems, digital logic circuit, simple microprocessors, DC and AC machines.

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**ECE 91L Introduction to Electrical Engineering Laboratory**

Experiments on direct and alternating current circuits, basic electronics, digital logic circuits, and electric machines

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**ECE 102 Advance Circuit Analysis**

Single and polyphase AC circuits, transfer functions, mutual inductance, transformers, two-port circuits, pole-zero analysis, Bode plots, stability concepts, circuit response to periodic inputs, Laplace solution techniques, frequency response, passive and active circuits, design and circuit simulation tools.

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**ECE 128 Electronics I**

Characteristics and properties of solid state devices; theory and analysis of electronic circuits; power supply design; device and circuit models; single- and multi-stage amplifier analysis and design; analysis of digital circuits; circuit stimulation using Spice or other contemporary software tools.

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**ECE 128L Electronics I Laboratory**

Experiments on static and dynamic characteristics of solid state devices in analog and digital electronic circuits; computer solutions as appropriate

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**ECE 151 Electrical Power Systems**

Power system networks and equipment, power flow, symmetrical components, short circuits analysis, introduction to economic dispatching and stability analysis, applications and use of software in power system analysis.

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**ECE 224 Advance Signals and Systems**

Theory of continuous time (CT) and discrete time (DT) multidimensional systems; state variable representations; systems state equation solution; Lyapunov and input-output stability, controllability, observability, and realizability, feedback systems. System simulations using MATLAB.

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**ECE 240 VLSI Circuits and Systems**

Review of CMOS logic circuits; CMOS circuit analysis; interconnect modeling; dynamic logic; timing and clocking strategies; datapath component design; test and verification strategies; ASIC Design Methodologies.

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**Geomatics Engineering**

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**CE 121 Mechanics of Materials**

Applications of principles of mechanics to find stresses and deformations in machine and structural members.

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**CE 121L Mechanics of Materials Laboratory**

Application of principles and methods of testing to verify theory and determine limitations of principles of mechanics of materials.

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**Construction Management**

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**CM 140 Building Mechanical, Electrical, and Plumbing**

Survey of building mechanical, electrical, and plumbing systems. Orientation to the design fundamentals and construction of various sustainable and environmentally friendly systems and equipment. Lectures, field trips, and guest speakers

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**Business Administration: Logistics and Supply Chain**

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**MKTG 100S Marketing Concepts**

Learn how marketing activities such as pricing, promotion, packaging, and distributing goods and services in international, national, profit, not-for-profit, service, consumer, and industrial markets are used to facilitate satisfaction of consumer needs. S sections include a service-learning requirement

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**MKTG 101 Marketing Research**

Examination of the role of marketing research in management decision making, using the Internet as a source of information and as a marketing tool. Also covers the marketing research process, including questionnaire development, surveys, and how to understand and use statistical data analysis.

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**MKTG 114 Principles of Logistics and Supply Chain**

Analyzes how firms utilize collaborative distribution intermediaries to gain a competitive advantage in local and global markets through integration of Logistics and SCM. Examines the management of the physical flow of products and information throughout the entire supply chain. Other topics: plant and warehouse location analysis, transportation, fleet, warehousing and storage management.

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**MKTG 126 Purchasing and materials Management**

Purchasing and supply chain management planning, policies, and procedures; purchasing organization; sources of supply, pricing; contract negotiation; value analysis; traffic management; quality assurance; inventory management; public purchasing; and legal and ethical aspects of purchasing.

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**MKTG 140 Global Marketing**

Examination and evaluation of business policies and practices of firms engaged in world trade; the marketing area; organization, product, channels of distribution, marketing research, demand creation and other management problems.

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**MKTG 144 Service Marketing**

Service strategies in industries representing 75 percent overwhelming majority of the national job market, including telecommunications, healthcare, financial services, fine arts, professional services, distribution, entertainment, and not-for-profit organizations. Emphasis is on the distinctive approach necessary for successful long-term marketing of services.

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**Business Administration: Management**

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**MGT 110 Administration and Organizational Behavior**

Development of management skills with emphasis on organization, communication networks, leadership, reward systems, conflict management, change, ethics, and stress. Case analysis, written projects, small group exercises.

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**MGT 124 Production/ Operations Management**

Production/operations systems and problems in manufacturing and service organizations, including product development and process selection; facility location and design; operations planning and control; materials handling; inventory and quality control; project management. Lecture discussion; computer simulation.

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**MGT 127 Contemporary Leadership**

Individual and team leadership development. Leadership potential assessment, contemporary leadership theories, and oral and written communications skill development. Guest speakers, experiential exercises, and case studies.

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**MGT 131 International Management**

A review of the unique issues, problems, and challenges of managing enterprises in an international environment. Comparative analysis of management styles and cultures, managerial processes and strategy formulation. Focuses on American, European, and Japanese enterprises. Seminar discussion and cases.

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**MGT 158 Project Management**

Fundamental concepts and techniques addressing all phases, process groups, and knowledge areas in the Project Management Body of Knowledge; software tools for planning, scheduling, and control of projects; satisfies education requirements for Project Management Institute PMP and CAPM certifications.

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**MGT 187 Seminar in Strategic Management**

Focuses on strategic management, industry analysis, global competitive environment, formulation and implementation of strategy, ethical issues, mergers and acquisitions, and management of strategic alliances. Case analysis/computer simulations included.

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**Business Administration: Entrepreneurship**

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**ENTR 151 Opportunity Assessment**

Presents tools and techniques for evaluation and assessment of opportunities for new businesses are presented. Idea assessment, market and competitive analysis, trends, distribution systems and customer needs are evaluated to determine if launching a business is feasible. Assessments will be made across industries including retail, manufacturing, distribution, services, and technology. The course provides the foundation for writing a business plan.

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**ENTR 153 Business plan Model**

Provides the student with both (1) an understanding of what is required to launch a new firm and (2) the skills needed to craft a business model that will meet the standards for attracting funding by an investor or financial institution

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**Certifications**

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**(PMP) Project Management Professional**

Obtained by completion and passing grade of class MGT 158 Project Management. Course number(016574)

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**(CAPM) Certified Associate in Project Management**

Obtained by completion and passing grade of class MGT 158 Project Management. Course number(016574)

## Stanislaus

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### **Business Administration: Operations Management (OM)**

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#### **ACC 2110 Financial Accounting**

Introduction to financial statements of business entities. Underlying principles and procedures. Measurement of periodic income and financial position.

#### **ACC 2130 Managerial Accounting**

Analysis, use, interpretation, and synthesis of accounting and financial data for and by management for planning, control, and decision making purposes.

#### **BLW 2060 Law, Environment and Ethics**

Law applicable to businesses; legal, ethical, political, and social environments in which businesses operate; sources of law; legal reasoning and procedure; law of contracts, agency.

#### **BUS 2090 Ethics and Social Responsibility for Businesses and Businesspeople**

Course provides an initial exposure to theories of ethics, structured decision-making, and the concepts of social responsibility. This is a service learning course.

#### **ECON 2500 Principles of Macroeconomics**

Macroeconomics: scope, method, economic resources, monetary system, income determination, economic stability-instability, public finance.

#### **ECON 2510 Principles of Microeconomics**

Microeconomics: price system and market structures, public policy, and income distribution. Fundamentals of international economics; international trade, principles and problems of economic growth and development, analysis of economic systems. Special problem areas in American economy: urban economics, environmental economics, agricultural economics.

#### **MATH 1500 Finite Mathematics**

Counting processes, elementary probability, systems of linear equations and inequalities, matrices, linear programming, simplex method, Markov chains, selected applications.

#### **MATH 1610 Statistics for Decision Making**

Introductory course for students in business administration. Data summarization, review of probability distributions, estimation, hypothesis testing, correlation, regression. May use statistical computer packages.

### **Business Administration**

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#### **BUS 4901 Business Professionalism**

Consideration of the practical issues facing students as they transition from academe to industry careers in a wide range of fields. Reiteration of the tools and skills required to increase the likelihood of success following graduation. Emphasis will be on the importance of professionalism in both written and oral communication in the context of problem solving and ethical decision-making.

#### **CIS 3700 Information Technology for Management**

Overview of the value and applications of IT to business organizations with a management perspective. Topics of interest may include: current trends of IT infrastructure, strategic roles of IT, enterprise systems and supply chain management, e-Commerce and EDI, knowledge management, decision making model, DSSs, artificial intelligence and expert systems, data mining, data base management, multidimensional data bases, and IS planning and development. Lab projects will focus on the application of IT to the design and development of models for improving managerial decision making.

#### **FIN 3220 Business Finance**

Risk and rates of return, valuation of securities, financial statement analysis, financial planning, determination of funds requirements, capital structure and cost of capital, analysis of investment opportunities.



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**FIN 3225 Financial Statement Analysis**

Students examine balance sheet and income statement using current, real-world company statements. Students also learn to compute a firm's cash flows and use financial metrics (ratios) to examine key financial relationships.

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**MGT 3310 Management Theory and Practice**

Introduction to the concepts, issues, and practices of contemporary management. Theory, research, and real world contributions to management are all presented. Emphasis is on the basic functions of management and introduction to behavioral theories, research, and practices.

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**MGT 3400 Seminar in International Business**

A comprehensive course covering the international environmental forces and their influence in all of the functional areas of the international firm — finance, management, marketing, personnel, production, the multinational's ethical responsibility to the host countries, balance of payments, foreign exchange risk hedging strategies, and international accounting.

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**MGT 4900 Business Policy**

Consideration of the business enterprise as a total system in a total environment. Analysis and evaluation of the problems, opportunities, and ethical responsibilities which face the chief executive of a business firm. Emphasis will be on the formulation and implementation of various strategies. Extensive use of the technique of case problem analysis.

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**MKT 3410 Principles of Marketing**

Marketing process with emphasis on the management point of view. Consideration is given to the role played by marketing in the economy, dynamics of consumer motivation and behavior, and problems including ethical considerations confronted by the business firm establishing an overall marketing program.

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**OM 3010 Operations Management**

Management of production and operations in manufacturing and service enterprises, including product design, process selection, location and layout of the facility, control of quality and productivity, and production planning. Emphasis is on modern operations management techniques.

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**OM 3020 Management Science**

Use of management science techniques to analyze and solve business problems; topics include linear programming, decision analysis, network models, project management, forecasting, inventory and queuing analysis. Computer applications in management science also will be included.

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**OM Concentration**

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**OM4530 Materials and Inventory Management**

The design and operation of integrated production and inventory control systems. Detailed and aggregate scheduling of operations under deterministic and probabilistic demand conditions.

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**OM4570 Quality and Productivity Management**

Establishing and managing a company-wide quality and productivity program. Emphasis is placed on quality assurance, continuous process improvement, problem-solving techniques, statistical process control, and productivity management.

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**OM4580 Supply Chain Management**

Course introduces basic concepts of how supply chain management influences all areas of the firm. Explores how managers can improve the firms' competitive position by employing latest practices and techniques of supply chain management in the global marketplace.

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**OM4600 Lean Operations Strategies**

Understanding the tools and procedures of Lean Systems, as well as their applications in manufacturing and service operations. This course also emphasizes plant tours, cases, and analysis of operations in regional companies.

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**Electives**

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**COMM 3110 Organizational Communication**

Theory, problems, and practices of communication in organizations. Examination of organizational communication systems, cultures, and contemporary developments related to ethics and technology.

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**MGT 4340 Executive Leadership**

A definitive study in the function of leadership in the management of business government and not-for-profit organizations, focusing on top management.

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**MGT 4620 Seminar in Labor Management Relations**

Perspectives on the internal relationship between management and unionized employees.

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**MKT 4450 Channel Institutions and Retail Management**

Focus on the role of marketing in the management of channel activities and product flows. Emphasizes management of purchasing, retailing, wholesaling, and physical distribution functions.

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**OM4560 Management of Technology**

Course provides basic concepts and issues involved in technological strategy of an organization. Emphasis is placed on analysis of technological development and management of technology and innovation to gain and sustain competitive advantage in the marketplace.

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**OM4590 Global Operations Strategies**

Applications of contemporary global operations management concepts and strategies in manufacturing as well as service operations. The instruction emphasizes the case method.

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**OM4890 Business Forecasting and Planning**

Developing strategic plans with emphasis on product-market relationships and business forecasting techniques. Goal setting, objective specification, environmental definition and assessment, analysis and evaluation of the competitive situation, formulation of plans.

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**OM4940 Internship**

Supervised field experience in a selected area of production and operations management. Formal written report(s) will be required. May be repeated for a total of 6 units.

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**MBA/Executive MBA**

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**BUS 5350 Supply Chain Management**

Course shows how managers can improve a firm's competitive position by employing the latest practices and techniques of supply chain management in the global marketplace. It will discuss the main components and concepts of the supply chain and will explain how to manage best the entire supply chain.

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**OM 5630 Seminar in Quality and Productivity Management**

Study of the management of quality and productivity of products and services. Emphasis will be on customer focus, business process re-engineering, benchmarking, suppliers, management, continuous improvement, Just-In-Time systems, and statistical process control.

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**Agricultural Studies**

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**AGEC 4400 Agribusiness Entrepreneurship**

Examination of the process of starting and managing agribusinesses, and the challenges faced by entrepreneurs in the agricultural industry.

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**AGST 4450 Research Methods in Agricultural Sciences**

Examination of the process of scientific investigation and the communication of research findings in the context of agricultural research. The course balances the development of a conceptual framework for scientific research with the development of applied research skills.

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**GEOG 4750 Geographic Information Systems**

The use of computers for input, storage, representation, analysis, and retrieval of spatial data for cartographic purposes; GIS as a tool in information management and decision-making.

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**GEOG 4770 Remote Sensing of the Environment**

Theories and techniques of remote sensing. Methods of image acquisition, correction, enhancement, classification, and analysis will be examined. Examples from geography, planning, hazards, agriculture, biology, soil science, hydrology, and atmospheric science.

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**AGST 3950 Tree and Fruit Crop Production and Management**

Current principles and cultural practices of tree fruit and nut production, and vine fruit production in California and in other regions of the World. Major emphasis will be on practical aspects of production and management practices based on a foundation of the underlying biology and physiology of the plants.

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**AGST 4080 Sustainable Agriculture**

The study of natural resource sustainability in agriculture integrating theoretical aspects of agricultural sustainability with field-based exercises.

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**GEOG 4070 Agricultural Geography**

Examines a variety of agricultural systems in the world from an agro-ecological approach. The natural resources and cultural factors which interact to shape and change agricultural systems are studied in detail.

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**ECON 4640 Economics and Agriculture**

Resource allocation and decision making environment of agricultural markets; study of the complex issues in agriculture and related markets including market structures, international trade, resource use, and government agriculture policy.

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**PSCI 4326 Agricultural Policy and Regulations**

Examines the roles of the public and political structures in agricultural policy development process. Focus is on the effects of agricultural policies and regulations at the local, state, national, and international levels.

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**AGST 3100 Leadership and Labor Issues in Agriculture**

Introduces students to leadership and labor issues in the food and agriculture industry. The course provides students with an overview of labor productivity and practices pertinent to agribusiness and farm operations. Students will observe, practice, and develop leadership skills necessary to succeed as managers in a variety of agricultural settings.

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**AGST 4940 Agricultural Studies Internship**

Supervised work in an agriculture-related agency or business, designed to emphasize technical and employability skill development including construction of a professional portfolio. The experience will be under the joint supervision of the employer and faculty member. A total of 45 hours per unit of credit. Course may be repeated for up to 8 units total.

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**AGST 3900 Integrated Pest Management**

Introduction to the theory, principles, and practice of integrated pest management systems in major agronomic and horticultural crops. Analysis of ecological patterns and mechanisms of agro-ecosystems with emphasis on biodiversity linkages between plant, weeds, pests, and diseases. Course will include: identification and symptoms of plant pest; intraguild predation; modes of pesticide action; pesticide resistance; plant induced resistance mechanisms; effective and safe use of herbicides, insecticides, fungicides, and other crop protection chemicals.

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**BOTY 3000 Principles of Plant Propagation**

Techniques, facilities, and materials used in the propagation and maintenance of horticulturally important plants. The water, temperature, and light requirements of domesticated plants also are considered, as well as methods of pest/disease control.

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**AGEC 3300 Farm Management**

Economic principles and modern decision-making techniques applied to farm management; organization and operation of farm and ranch businesses, analysis of production risks and evaluation of the business for increased efficiency and profit.

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**AGEC 4320 Appraisal of Agricultural Property**

Principles of agricultural appraisal with focus on row crops, orchards, livestock, and transitional properties; physical and economic factors affecting property values; estimation of real estate value using income, cost, and market data approaches; case studies and field problems involving the valuation of local farm and ranch properties.

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**AGEC 4930 Strategic Management of Agribusiness Firms**

Application of basic economic and management concepts to decision making in agribusiness firms. Problem solving strategies involving quantitative and conceptual analyses of production, investment, pricing, change, human resources and risk management decisions are covered.

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**ECON 4560 Natural Resources and Environmental Economics**

Examines how people choose to allocate scarce natural and environmental resources to try to meet our unlimited wants; how these resources affect production, consumption, and wellbeing; and how production and consumption affect the natural environment.

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**AGST 4090 Geography of Wine**

Introduction to geographic origins, diffusions, distributions, and patterns of global viticulture. Emphasis on complex relationships existing between environmental variables, such as climate, soils and landforms, and human factors such as cultural practices. Examines characteristics of wine regions and landscapes.

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**GEOG 4710 Field Methods**

Methods of field observation; techniques of data collection and analysis; fieldwork, report writing, and presentation required.

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**Food Safety Emphasis**

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**CHEM 2010 Quantitative Analysis and Basic Instrumental Techniques**

Principles and practice of analytical chemistry. Topics include error analysis and statistical treatment of data, gravimetric and volumetric analysis, electroanalytical techniques, chromatography, and selected quantitative instrumental techniques.

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**CHEM 4400 Biochemistry I**

Basic chemistry of proteins, lipids, and carbohydrates. An introduction to enzymology and biochemical thermodynamics is also included.

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**MBIO 3010 Bacteriology**

Morphology, physiology, cultivation, and control of bacteria and other selected microorganisms; their role as agents of change in the natural process important to industry, agriculture, and health.

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**MBIO 3032 Bacteriology Laboratory**

Laboratory experiments and demonstrations to illustrate principles and techniques of bacteriology. This course is acceptable for section 1.c requirement for the major.

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**MBIO 4300 Medical Microbiology**

Principles of medical microbiology, including pathogenic microbes, epidemiology, infection, disease, and treatment.

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**MBIO 4500 Bacterial Physiology**

Examination of bacterial physiology including discussions of cell structure and function, energetics, regulation of growth and metabolism, and environmental adaptation.

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**MBIO 4600 Food Microbiology**

Basic concepts related to biochemical changes by microorganisms in food, including food-borne illnesses, food production, food spoilage, food preservation, and measures to prevent food spoilage and food-borne illnesses. Students will have hands-on opportunity to observe and practice the principles of food microbiology.

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**ZOOL 4280 Physiology of Human Systems**

Human physiology presented at cellular and organ system levels: membrane transport, nerve excitation, muscle contraction, cardiovascular physiology, kidney function, hormone function, reproduction, and digestion.

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**ZOOL 4440 General Parasitology**

Parasitism with emphasis on parasites of humans.

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**BIOL 4940 Internship in Biology**

Supervised work in an agency or business related to the biological sciences. Six to twelve hours per week. A weekly one-hour seminar will be held to discuss career-related topics and the work experience aspect of the course. Course may be repeated, but a maximum of 1 unit may be applied toward a biology degree.

## Appendix E

### RFP Requirements for This Study

#### **Analyze Existing Curriculum**

Assist in identifying best practices whereby existing curriculum is analyzed against needs of businesses in the manufacturing field. This includes degree and non-degree programs.

#### **Analyze Processes Whereby said Curriculum was Vetted by Employers**

Identify individual classes that may be of interest to local businesses and if employers have hired.

#### **Identify Best Practices**

The relevance of developing programs on how businesses review coursework.

#### **Identify Coursework for Stackable Credentials**

Creation or identification of “stackable credentials” in industry specific training based on the job analysis of the employer.

#### **Identify Mixed Coursework (credit/not for credit) for Certificate Programs in Manufacturing**

Explore the creation of a mixture of non-credit and for credit classes within non-credit certificate programs wherein formal admission and acceptance to the University is not a requirement to pursue a stackable credential.

#### **Analyze Existing Processes for Prior Learning Assessments**

Analyze prior learning assessment policies locally as well as other states. Identify best practices and replicate.

# Appendix F

## Sample Central Valley Manufacturer Survey

Dear Central Valley Community Employer,

Stanislaus State recently received a grant from the Fresno Workforce Investment Board (FWIB). The FWIB would like to learn more about how our campus connects with local employers with regards to curriculum, program offerings, and overall student employment success rates.

Please take a few minutes to complete the attached questionnaire and mail it back to us in the postage paid envelope by November 28. Please be assured that your responses will be kept confidential.

Your time and input is very much appreciated.

### Questionnaire: Central Valley Community Employers

How many college graduates has your company hired in the last 3 years?

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Do you provide internships for college students? If so, how many internships do usually provide each year?

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What majors do you typically hire and why?

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What types of positions are college students and graduates usually hired into?

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What skills and attributes are most important to you when hiring college students and graduates?

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Which college campuses have you hired from and why?

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If additional information is needed, would you be willing to be contacted? If so, please provide contact information:

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