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Department Chairs/Program Leads: Please press the edit symbol in the right-hand corner to update. Below, the text in bold corresponds both to the name of the box when editing this page and also to the first-column on the APRU worksheet. If you have questions, please contact: papemary@fhda.edu.

## Dept - (B/CS) Design & Manufacturing Technologies

**For 2017-18 Submitted by::** Mike Appio

**APRU Complete for:** 2017-18

**Program Mission Statement:** Mission

The Design and Manufacturing Technologies Department offers broad yet in-depth curriculum that imparts a strong foundation for direct employment and engagement in local industries or transfer to a four-year college. Diversification is the hallmark of the program. The program outcomes are based on skills required to gain or enhance employment by means of program innovation, which focus on critical thinking, peer communication and personal responsibility for career success.

Program Description

The Design and Manufacturing Technologies, which is a combination of Manufacturing / CNC Technology (MCNC) and CAD Digital Imaging (CDI) program (accurate data for DMT only available for two years ) offers state-of-the art advanced manufacturing instruction in computer aided design (CAD), reverse engineering (scanners), 3D printing (additive manufacturing), laser scanning systems, computer numerical control (CNC) machining, model making/rapid prototyping and materials processing. The curriculum is ideally suited to those who are new to the field, as well as drafters, lab technicians, conventional machinists and machine operators who wish to update their skills and advance in this rapidly changing industry. Certificate of Achievement in CAD-Mechanical and CNC Machinist are the initial point of entry into the Design and Manufacturing program. Students who complete the program will have a solid foundation in design and manufacturing systems with the opportunity to choose a further specialization in the areas of CAD design and additive manufacturing (3D Printing), advanced CNC set-up, CNC operation, CNC programming, metrology and inspection.

The program is also a primary choice for many Silicon Valley engineers, designers, planners and purchasers who wish increase their “hands on” skills and overall knowledge of the design and manufacturing process in order to advance their careers.

Examples of career possibilities include: CAD drafters, Additive Manufacturing Technicians (3D printing) Computer Numerical Control Machinist, Product Model Maker, Computer Numerical Control Programmer, CNC/Research & Development Machinist, Inspection and Quality Assurance, Manufacturing / Engineering, Industrial Engineering Technician.

DeAnza College's Design and Manufacturing Technologies program offers state-of-the-art classroom and lab facilities. Students have the opportunity to work with CAD/CAM workstations, 3D printers, Laser Scanning equipment, CNC lathes with C/Y axis live tooling, CNC vertical machining centers with 4th and 5th axis capabilities, as well as a 4 axis horizontal machining center. In 2018, a Fanuc robot will be added to a cnc machine to teach automatic part loading, which will have an increased presence in manufacturing facilities in the bay area in the near future. The students also have access to automated coordinate measuring machines, inspection equipment, conventional machining equipment and three CAD/CAM programming labs. Design and Manufacturing Technologies offers an accelerated day program, designed for those who need to reenter the workforce quickly. Courses are also offered in the evening to accommodate incumbent workers. The program is also approved by the California Department of Apprenticeship Standards, which currently teaches apprenticeship classes for the International Association of Machinists and Aerospace Workers and the California Tooling & Machining Apprenticeship, with current programs at Northrup Grumman, FM Industries and contact vendors, as well as internships at Lockheed Martin and NASA. The DeAnza DMT program also has the distinguished honor of being one of three community colleges in the state that is a NIMS (National Institute for Metalworking Skills) certified facility. The department chair is a member of the California Manufacturing and Product Development Advisory Committee for the California Department of Education, member of the 2017-18 Haas Technical Eduction Council representing community colleges and the educational board member of the NTMA SF chapter (National Tooling and Machining Association) . DeAnza will officially become the "Gene Haas Center for Design and Manufacturing" in May of 2018. The Gene Haas Foundation has donated 1 million dollars to upgrade the CNC labs to ensure the program is teaching cutting edge CNC technology well into the future. To enhance this advanced technology, Siemens Corporation continues to grant 100 NX CAM software seats, valued at $59,000 per seat, as well as other software. The DMT department is the west coast training center for Siemens CNC controls.

De Anza College earned California Strong Workforce Stars recognition in the Advanced Manufacturing sector for its Design and Manufacturing Technology (DMT) program; 100% of students who participate in this program report securing a job in their field of study.

DeAnza college is entering the fourth year of its partnership with HAAS Automation (largest manufacture of CNC machines in North America) to provide teacher CNC training , which teaches High School and College instructors in the western states how to better utilize their CNC equipment. Haas also entrusts a five axis vertical mill (UMC750SS) and multiple training simulators valued at over $250,000. The equipment is not only used to teach instructors throughout the US, it is used by our students on a daily basis in advanced CNC courses.

The main strengths of the DMT program are our close ties to industry, as well as ties to high school and four-year college programs. Major companies such as TESLA, NASA, Northrup Grumman, Loral Space Systems, Lockheed Martin, Google, Apple Inc., Stanford Linear Accelerator, Lawrence Livermore National Lab, as well as local manufacturing facilities are closely involved in our advisory committee. These companies depend on the DMT program to enhance the skills of their existing and future employees in high tech manufacturing. The

program also has articulating agreements with two local high school programs and the Industrial Technology program at San Jose State.

I.A.1 What is the Primary Focus of Your Program?: Career/Technical

I.A.2 Choose a Secondary Focus of Your Program?: Transfer

I.B.1 Number Certificates of Achievment Awarded: 49

I.B.2 Number Certif of Achievment-Advanced Awarded: 13

I.B.3 #ADTs (Associate Degrees for Transfer) Awarded:

I.B.4 # AA and/or AS Degrees Awarded: 13

I.C.1. CTE Programs: Impact of External Trends: Employment opportunities for Design and Manufacturing program graduates exist in high tech, research/ development, large manufacturing facilities and small, independent design shops. Individuals with a background in manufacturing technology can also parlay their skills into other related positions in the industry: CAD design, Engineering, Additive Manufacturing, CAD/CAM programmers, CNC set-up operation, PLC programmers, and Rapid Prototyping and Quality Assurance.

EMSI Program Market Demand (Growth 2018- 2023) - DMT: CNC Machining,Product Model Making, and Quality Control Technician
Machinists +5.98% / CNC Operators +11.19% / CNC Programmers +6.06% / CNC Machine Set-up +4.00%

EMSI Program Market Demand (Growth 2018- 2023) - DMT: CAD
CAD Mechanical Drafters +3.85% / CAD Drafters (all other) +10.00%

While the above is a sampling of the CNC and CAD career opportunities available, the DMT program serves a variety of other careers. Over the years the program has provided Mechanical Engineers, Industrial Engineers, Program Managers, Manufacturing Planners and Purchasers with career advancing knowledge and skills. These jobs represent a significant number of current career positions, as well as job growth in the Bay Area.

Advanced curriculum in multi-axis, live tooling automation, quality assurance and advanced 3D printing/ design is being continuously developed with SWP and Regional funds, which will increase enrollment as it is implemented into the DMT department.

In addition to the local EMSI Program Market Demand Data , the Design and Manufacturing program provides training to many other areas. DeAnza offers the only Design and CNC program in the surrounding counties. As of 2018 DeAnza serves a vast area, such as Monterey, San Benito, Santa Cruz, San Mateo and San Francisco Counties where no existing Design and CNC manufacturing programs exist.

I.C.2 CTE Programs: Advisory Board Input: Developing an advanced manufacturing program to advance new and incumbent workers: As a recommendation of our advisory group, the DMT department continues to add advanced manufacturing equipment and curriculum with the help of our industry partners. With the addition of the $1 million dollar donation from the Gene Haas Foundation and the continuous support of HAAS Automation, and Siemens Corp., the DMT department is one of the most advanced manufacturing programs at a community

college in the country. With continued support from companies such as SolidWorks, PTC, Autodesk, Stratysys, Markforged, Sandvick Coromat, Mastercam and Blasercut, the college continues to train at a high level using advanced manufacturing equipment, such as touch probes, carbide tools, high speed machining, advanced cad-cam software, coolants, advanced CAD software, 3D printers and scanners. As recommended and supported by our advisory and the State of California, the DMT department has completed a Quality Technician Certificate of Achievement, which will create another untapped employment avenue for DMT students. (due to inspection lab renovation schedule overrun, the program will debut in Summer/Fall 2018) With the advancement of technology, the DMT department will supply the labor market with higher skilled employees capable of very successful careers in advanced manufacturing and design. The advisory continues to applaud the addition of advanced manufacturing software and equipment with ongoing funds supported by SWP and the Regional Workforce program.

I.D.1 Academic Services & Learning Resources: #Faculty served:

I.D.2 Academic Services & Learning Resources: #Students served:

I.D.3 Academic Services & Learning Resources: #Staff Served:

I.E.1 Full time faculty (FTEF): 6.7

I.E.2 #Student Employees:

I.E.3 % Full-time : PT Faculty decreased 10%

I.E.4 #Staff Employees: 2

I.E.5 Changes in Employees/Resources: N/A

II.A Enrollment Trends: The DMT department (combined MCNC/CDI) has only two years of solid data as per FHDA Program Review data sheet:

Due to the sudden high demand in the bay area for DeAnza Design and Manufacturing students in 2016-17 there was a solid increase in enrollment from 2015-16.

2015-16 - 2016-17 Enrollment Data

| | | | | | |
|---|---|---|---|---|---|
| Unduplicated Headcount | 2015-16 | 499 | 2016-17 | 590 | 18.2% Increase |
| Census Enrollment | 2015-16 | 1,397 | 2016-17 | 1,551 | 11.0% Increase |

The economy in the bay area will predict future enrollment trends. In recent discussions with Applied Materials mangers, their local large manufacturing contractors are at capacity due to shortage of manufacturing employees. This might predict a future of more students going to work without completing their educational goals (Certificate of Achievement and AS Degrees), but having skills needed to work in industry to provide for their families. The department goal is to continue to create advanced classes with SWP and Regional funds to retain students to continue their eduction goals, which will increase their career and wage opportunities, as well as attract new students into the field.

II.B.1 Overall Success Rate: Data for DMT program for 2015-16 / 2016-17

Success rate holds steady at 80% , increasing 1% from 2015-16

To increase successes rates the department has increased student tutors / mentors and added more available “hands-on” labs and special project assignments throughout the quarter. The

extra weekend student tutorial sessions have been generously donated by instructors without receiving pay.

The department is currently completing SLOAC assessments for beginning to advanced classes to increase success at the introductory level. As we continue our assessments, changes will be implemented to help a higher percentage of students complete the program certificates and degrees.

Extra emphasis will be placed on introductory and on line courses that have a tendency to have lower success rates.

II.B.2 Plan if Success Rate of Program is Below 60%: N/A

II.C Changes Imposed by Internal/External Regulations: There have not been any direct regulations that have impacted our department.

III.A Growth and Decline of Targeted Student Populations: Data for DMT program 2015-16 / 2016-17

The targeted student population program success rate has increased 3% percent (72%-75%) over the last two years. The difference between our targeted and non targeted success rate is down to 7% (75%-83%)

Targeted student population total enrollment has also increased from 356 to 444 (25%) over the last two years. The department continues to reach out to students who are in need of our services available at DeAnza to gain employment skills, which enable them to provide for their themselves and many times their families.

Our female total enrollment has increased almost 50% (99-187) from 15-16 to 16-17. Although this is a very low number in our program, we are making great strides in the department to recruit females into rewarding design/manufacturing careers.

III.B Closing the Student Equity Gap: The progress is due to availability of educational tools at little or no cost to the college.

The DMT faculty will continue with the existing plan of actively providing counseling on course selection and scheduling to students, as well as increased exposure of the DeAnza Design and Manufacturing program. Expanding our lab times and increasing the amount of tutors/mentors and open lab time for those students who do not have computer access.

Free home version software, Mastercam, SolidWorks, NX and Autodesk Inventor, and learning tutorials such as Solid Professor have also been added for those with internet access. For those without access, the software can be used in the expanded lab hours. Free SolidWorks associate and professional certifications are offered free at DeAnza CAD lab

NIMS ( National Institute for Metalworking Skills) skills / project certificate tests are are now available at no charge to the students. These certificates are part of a national accredited

training program that is provided by the DMT department, which is a accredited training program. The cost is covered with lottery funds.

III.C Plan if Success Rate of Targeted Group(s) is Below 60%: The program is at 75%

III.D Departmental Equity Planning and Progress: Continued speaking engagements at career days at High Schools, as well as an articulation agreements, have opened up more career opportunities to underrepresented populations, which will help the department attain our goal of lowering the equity gap.
Continued efforts to make software and on line educational tools  no charge and available away from the college is allowing all students the equal access.

IV.A Cycle 2 PLOAC Summary (since June 30, 2014): Still in process of migrating MCNC/CDI data. CDI 100% complete. MCNC 20%. DMT department report incomplete data. Completion date goal June 2018

IV.B Cycle 2 SLOAC Summary (since June 30, 2014): 50% courses complete...DMT data still being migrated (MCNC/CDI) to DMT page in Trac Dat. Completion date goal June 2018

V.A Budget Trends: Planning, implementation and assessment are major parts of training highly skilled students for the current workforce. When lack of funds becomes an issue within the program, one or more of the areas will be affected. The result would be students finishing the program without the necessary skills to compete for high wage employment. Fortunately, there have been and continue to be generous external donations and consignments, which have allowed the department to implement “hands on” training and assess student needs to become extremely desirable employees. Unfortunately, the "B" budget has been the same for the last six years and is lower than it was seven years ago. With increased funds the donated and entrusted equipment can be used to its full potential.

The addition of SWP and Regional Workforce funds have advanced the program tremendously. These funds have allowed the department technology to keep pace and in some cases move ahead of some of the manufacturers in the bay area.

V.B Funding Impact on Enrollment Trends: The current college funding over the past three years (“B” and CTE) has allowed the program to keep up with its current demand of enrollment, but at the same time limiting growth in other advance manufacturing areas.
The HAAS $1million dollar external donation and ongoing SWP and Regional Workforce funds allow the DMT program will be able to better serve students in advanced manufacturing. These additional funds will allow the program to serve a new population of manufacturing students in the future, adding new enrollment in  advanced technology courses. In a recent department survey over 50% of the students who received certificates would come back and take new advanced CNC classes. Incumbent workers, who never took introductory courses at DeAnza also have expressed interest in advanced manufacturing courses.

V.C.1 Faculty Position(s) Needed: Replace due to vacancy

V.C.2 Justification for Faculty Position(s): Faculty justifications based on advisory meetings:

CAD / Replacement – Loral Space Systems, Lockheed Martin, Northrup Grumman, Google among others noted that in order to better serve the community with high paying jobs, the

new advanced CAD courses need the support of another qualified full time faculty. With the retirement of a CAD instructor five years ago and the CAD program down to one full time instructor, the program needs a committed full time instructor to develop curriculum, both on-line and in class, to align with the rapidly changing needs of industry and the future employment of DeAnza students.

V.D.1 Staff Position(s) Needed: None needed unless vacancy

V.D.2 Justification for Staff Position(s):: N/A

V.E.1 Equipment Requests: Over $1,000

V.E.2 Equipment Title, Description, and Quantity: Two HAAS HRT210 4th Axis Rotary (instructional equipment) New / 2 year warranties included / Life expectancy 10+ years / Item does not require change in infrastructure

Two HAAS 5C 4th Axis Rotary (instructional equipment) New / 2 year warranties included / Life expectancy 10+ years / Item does not require change in infrastructure

One HAAS VF2SS 4/5 axis capabilities (instructional equipment). Replacement of 1999 HAAS CNC machine / 2 year warranties included / Life expectancy 10+ years / Item does not require change in infrastructure

Three 14" Engine Lathes (instructional equipment). Replace current Lathes that are now over 35 years old. / 1 year warranty included / Life expectancy 20 years / Item does not require change in infrastructure

Three vertical Bridgeport milling machines (instructional equipment). Replace 25 yr old machines / 2 year warranties included / Life expectancy 20 years / Item does not require change in infrastructure

One CMM Rotary Table (instructional equipment). New / 1 year warranty included / Life expectancy 10 years / Item does not require change in infrastructure

One each CMM / CMM Manager Software (instructional equipment) / B&S 7.10.7 Upgrade Software / B&S MicroVal New Software / Tesa New Software. Life expectancy 10 years

OKUMA LB 3000 and HAAS ST20 Y Axis Lathe / Workholding (instructional equipment) Life expectancy 10 years / Item does not require change in infrastructure

One Formlabs: Fuse SLS powder bed nylon 3D Printer (instructional equipment) New / 1 year warranty included / Life expectancy 7 years / Item does not require change in infrastructure

One Stratasys: F123 Series Printer (instructional equipment) New / 1 year warranty included / Life expectancy 7 years / Item does not require change in infrastructure

One Markforged 3D Metal Printer (instructional equipment) New / 1 year warranty included / Life expectancy 10 years / Item could possibly require change in infrastructure

One PostProcess Technologies - Support Removal Product Series system (instructional equipment) New / 1 year warranty included / Life expectancy 10 years / Item does not require change in infrastructure

One 3D Systems SLA printers (instructional equipment) New / 1 year warranty included / Life expectancy 10 years / Item does not require change in infrastructure

One Robotic arm for automation of CNC machine (instructional equipment) NEW (funded regional 2017-18) Item does not require change in infrastructure

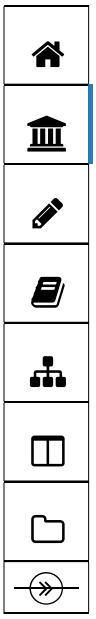
SOFTWARE FOR EXISTING PROGRAM (ANNUAL PURCHASE/PAID WITH LOTTERY FUNDS IN THE PAST)

Mastecam annual update
NIMS National Certification annual
Vericut Simulation annual update
SoilidWorks CAD annual update
NX (both cad and cam) annual update
Creo CAD annual update
Solid Professor (CAD Training Software)

After the initial SLO assessment process, it was determined outcomes were based differently for skills in classes based on the equipment the student was using. Assessments vary on equipment that is not up to date and in need of constant repairs. New equipment will allow the department to include more advanced assessments.

The correct use of software is the SLO/PLO assessment method in Inspection, CAD, 3D Printing and CAD/CAM classes

V.E.3 Equipment Justification: The advisory committee annually asses the existing equipment in the DMT lab.
The equipment, which is used by students in the program and used in 100% of our classes, must meet both outside standards and not exceed life expectancy (annual wear for long periods of time)
Information gathered from our advisory meetings determined that some of the basic skills equipment needed replacement in order for student success. In order for the student to be successful, the student must be able to test their skills against equipment that is working within the manufactures tolerance. If not, the student is not sure if they need to improve or equipment failure. This can lead to false student learning assessments. Currently 10 mills and lathes have reached their life expectancy (20 years / some are over 40 years old!!!).
The advisory also recommended replacing CNC Vertical Mills and adding additional 4th axis rotary equipment to existing CNC machines. The one mill is closing in on their 20 year life cycle and CNC rotary axis are to expand into new advanced classes where students can expand their skills, which leads to more job opportunities and higher wages.
Additive manufacturing (3D printing) is the fastest growing technology in industry. Operating 3D printers that can manufacture parts out of many different materials are desirable job skills



that lead to high wages.
Adding this equipment aligns with our college and department commitment to innovation, equity and critical thinking. Without resources to help the community succeed would make our mission statement and strategic goals just words.

V.F.1 Facility Request: At this time the DMT facility is almost complete (Spring 2018) a partial renovation by means of a $1 million dollar donation by the Gene Haas Foundation. The current E23 computer has been reconstructed as a machine tool lab and the E25 “chalkboard room” is now a 28 student computer lab.

Future 3D printing lab to be considered. At this time the lab is a combination CAD lab and 3D printing lab..Equipment and computer lab would best be suited for classes if the lab was made into two separate labs.

Equipment to complete the advanced manufacturing labs has been and will continue to be funded with SWP and Regional Workforce funds

V.F.2 Facility Justification: The DMT Advisory Board supported the GHF donation wholeheartedly. Many of the corporations on the advisory board have donated donate smaller values of tooling, fixtures, coolants etc. as the facility is being completed.

The DMT Advisory Board also supported a separate 3D printing lab to better utilize the equipment and support equipment needed for the 3D printers

New and existing students will use this new innovative lab to increase their job opportunities and increase their salary. (job security and higher wages promote physical/mental wellness and personal responsibility)

V.G Equity Planning and Support: At this time the DMT department has determined a need for continued funding for software and on line training tools, which has been supplemented with lottery funds. As we move forward and develop more strategies such as our work centered around success centers and other small group individual learning environments, funds would be required for ongoing support and future development. Cost to sustain these programs would be evaluated as we move forward.

V.H.1 Other Needed Resources: Continued college funds to support tutors/mentors and a CTE counselor who is well versed in DMT courses and assigned to the DMT program. Student teachers to support success centers, extended lab hours and other individual/small group learning environments. Many of our positive assessments have pointed directly to access to tutors. The needed changes have pointed the lack of a designated counselor for incoming DMT students who they can seek out for advice when entering the program.

V.H.2 Other Needed Resources Justification: The data that supports the need would be growth and success rates of students, especially our targeted population.

V.J. "B" Budget Augmentation: At this time "B" budget is adequate to keep the department in supplies and material. This area will be re addressed in the next review.

V.K.1 Staff Development Needs: All instructors in the DMT department use staff development funds. These funds allow us to innovate specific assessment options. It may not be a specific assessment that leads us in this direction, but how we can we improve assessments to align the student’s needs to gain employment.

V.K.2 Staff Development Needs Justification: After looking over SLO / PLO assessments from the department, it has become apparent that some instructors (large amount of part time instructors) need development in order to prepare assessments that align with the current need of the student. This will ensure we are providing the training to prepare students for employment.
Our advisory group also reminds us that if we don't continue to develop our skills we cannot help them maintain a steady flow of students who will lead their companies in the future.
V.L Closing the Loop: Over the last several years the assessments were established by the resources received. Naturally we are able to asses at a higher level as resources became available. SWP and Regional funds have played a major role and will allow the department to asses at a higher level that was previously imaginable. Evaluating assessments and outcomes will change dramatically over the next five years. When you add resources you add outcomes and assessments methods that were not possible in the past. Students can be assessed on more advanced curriculum and equipment. The assessments can be "hands on" like they would experience in the workplace. The cycle will forever improve as a result of the generosity of SWP/Regional funds the college has awarded the DMT department The results will increase the success of new and incumbent students in the workforce.

For 2016-17 Submitted by: Mike Appio appiomike@deanza.edu x8283

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