Delaware County Community College

TRAINING PROGRAM

Manufacturing Training

Partners
Through the generosity of **JP Morgan Chase** this program will help develop a pipeline of qualified entry level employees to help with the regional shortage of skilled workers in the advanced manufacturing industry.

Delaware County Community College
Manufacturing Alliance of Chester and Delaware Counties

Revised 2/2016

Delaware County Community College

FOREWORD

This program has as its objective, the training of a skilled workforce in all phases of the manufacturing industry. Delaware County Community College (College) and the Manufacturing Alliance of Chester and Delaware Counties (MACDC) recognizes that in order to accomplish this, there must be well-developed on-the-job learning combined with related instruction.

This recognition has resulted in the development of this training program.
The program was developed with content input from the regional manufacturing related employers along with instructional and curriculum personnel from the College and the MACDC.

DEFINITIONS

PARTICIPANT: Any individual enrolled in or applying for admissions into the program outlined in this Standards of Training document. *Student*

MANUFACTURING ALLIANCE OF DELAWARE AND CHESTER COUNTIES (MACDC): The Manufacturing Alliance of Chester and Delaware Counties is led by manufacturers to promote the growth of the regional manufacturing industry by providing workforce and economic development services to partnering companies.

TRAINING AGREEMENT: The written agreement between the participant and the College setting forth the responsibilities, expectations, and obligations of the participants.

MANUFACTURING ALLIANCE OF CHESTER AND DELAWARE COUNTIES TRAINING ADVISORY BOARD (Advisory Board): Advisory Board means those members of the MACDC who represent the manufacturing employer members training and education needs. The Advisory Board is also the review committee to the training program.

CERTIFICATE OF COMPLETION: The Certificate of Completion issued by Delaware County Community College represents successful completion of the training program requirements outlined in these Standards of Training.

EMPLOYER: Generally, an employer means any person or organization that employs a participant under these standards.

ON-THE-JOB LEARNING (OJL): Tasks learned on-the-job in which the participant will engage in training related structured, supervised work experience. Participant will work 16 hours per week. Compensation through payroll is at the discretion of the sponsor employer. Participant will be given a weekly stipend in the form of a preloaded gift card. This applies to the 2016 program ONLY. If funding for the stipends are not available, future participants will not receive the stipends

APPLICATION

SECTION I- MINIMUM QUALIFICATIONS

Applicants will meet the following minimum qualifications:

A. Age:

Apprentices must not be less than 18 years of age.

B. Education:

A high school diploma or GED equivalency is required. Applicant must provide an official transcript(s) for high school and post high school education and training. All GED records must be submitted if applicable.

Applicants must submit a DD-214 to verify military training and/or experience if they are a veteran and wish to receive consideration for such training/experience.

C. Physical

Applicants will be physically capable of performing the essential functions of the apprenticeship program, with or without a reasonable accommodation, and without posing a direct threat to the health and safety of the individual or others.

D. Aptitude Test

RAMSEY MECHANCIAL

Assesses: Mechanical aptitude
Test Format: 36 Items, Multiple-choice
Time Limit: 20 minutes
Language: English

Description

The Mechanical Aptitude Test (MAT) is a quick 20-minute evaluation of a person's ability to learn production and maintenance job activities. This test is not designed to measure specific knowledge and skills, but rather the potential to be successful in an apprenticeship or trainee program for maintenance jobs such as maintenance mechanics, industrial machinery mechanics, and millwrights, or production jobs such as machine operators and tool setters. It has been shown to have less adverse impact than earlier measures of mechanical aptitude.

Categories tested include:

- Household Objects
- Work - Production and Maintenance
- School - Science and Physics
- Hand and Power Tools.

E. Applicants scoring above the cutoff level established by the MACDC Training Committee Advisory Board for each of the tests in Section IV D will be considered

SECTION II- APPLICATION PROCEDURES

A. Applicants will be accepted until March 18, 2016. All persons requesting an application can call (610) 359-5362 to arrange a time drop off the application. Application cannot be mailed.

DIRECT ENTRY: Please see your supervisor for your application.

B. Applications will be identical in form and requirements. The application form for participants will be numbered in sequence. An applicant log will be kept to track application status. As application material is received it will be noted with the date and time received.

C. Before completing the application, each applicant will be required to review the program standards. Applicants will also be provided with information about the program. If the applicant has any additional questions on the qualifications or needs additional information to complete the application, it will be provided by either the recommending employer or the College.

D. Receipt of the properly completed application form, along with required supporting documents (proof of age, driver's license, birth certificate or other acceptable documentation; copy of high school diploma, GED Certificate or other acceptable documentation) will constitute the completed application.

E. Completed applications will be checked for minimum qualifications. Applicants deficient in one or more qualifications or requirements or making false statements on their application will be notified in writing of their disqualification. The applicant will also be notified of the appeal rights available to them. No further processing of the application will be taken.

F. Applicants meeting the minimum qualifications and submitting the required documents will be notified. Applicants will be required to take a mechanical aptitude test.

TESTING DATE:

Friday, March 25, 2016
8:00 AM until 2:00 PM
Delaware County Community College
901 S. Media Line Rd.
Media, PA 19063

Advanced Technology Center T222

SECTION III. - SELECTION PROCEDURES

The College will proctor the tests and score answer sheets.

Applicants scoring below the cutoff for any test will be notified of their disqualification from the acceptance process. Disqualified applicants will be allowed to re-take the tests at a later time if they desire and if the program funding continues. Test cutoffs and retesting guidelines shall be in accordance with the standards set by the MACDC Training Committee Advisory Board. Applicants scoring above the cutoff will be ranked and placed in a pool of qualified applicants to be interviewed.

The Manufacturing Alliance (MACDC) Training Committee Advisory Board along with the College will select the top ranked applicants at the rate of 125% of available seats and or funding in the program.

Applicants will be contacted via phone or email.

E. Applicants passing the testing score will remain in the tested pool of applicants for future interviews but will not be given any preference over additional entrants to the pool from subsequent testing.

F. The applicants will receive a score based on the application, test results, and review. Applicants will be placed on a "Ranking List" according to their scores, with the applicant having the highest score being at the top of the list, and all applicants then listed in descending order based on score.

G. As program openings/ cohorts become available, the highest ten (10) ranked applicants will be notified of consideration for placement by telephone or email. It will be the responsibility of the applicant to keep the College informed of their current mailing address, telephone number, and email.

H. A minimum of ten (10) highest ranked applicants will be presented to the MACDC Training Committee Advisory Board for acceptance as a program participant. The candidates not selected will remain in the ranking for future consideration if funding becomes available.

G. Selected applicants must respond to the notice of consideration for placement within 48 hours of notice. If applicants cannot be reached within two telephone calls and/or two emails, or if they fail to respond within the 48 hours the applicant's name will be removed from the list and will be returned to the pool of tested applicants for future consideration.

SECTION IV - DIRECT ENTRY

The College and the employers of the MACDC Training Committee Advisory Board and/or the Manufacturing Alliance of Chester and Delaware Counties who wish to invoke the direct entry provision may do so without regard to the existing selection procedure or minimum qualifications used for entry into the training program. Individuals selected into the program via direct entry shall only include those individuals described below who have received training or employment in an occupation directly or indirectly related to the program supported occupation(s).

Direct entry applicant must still meet the minimum qualifications related to age, education, and physical capabilities to perform the job. Direct entry applicants must still fill out an application in its entirety. Direct applicants will not take the MAT or be among the ranked applicants.

The qualification and procedure for direct entry shall include the following:

A. Military Veteran who completed military technical training school and/or participated in a registered apprenticeship program or related craft while in the military in the occupations registered in the manufacturing industry may be given direct entry into the training program. The MACDC Training Committee Advisory Board shall evaluate the military training received and make a recommendation. Entry of Military Veterans shall be done without regard to race, color, religion, national origin, or sex.

B. An employee of a participating MACDC Training Committee Advisory Board and/or Manufacturing Alliance of Chester and Delaware Counties employer will be admitted with the recommendation of the employer.

NOTE: At no time will Direct Entry applicants exceed 50% of the training/ funding/ scholarship availability. The placements will be done according to the completion and submission of the program application to the College.

SECTION V - EQUAL OPPORTUNITY PLEDGE

- The recruitment, selection, employment, and training of participants during their program shall be without discrimination because of race, color, religion, national origin, or sex.

SECTION VI- PROBATIONARY PERIOD

- All applicants selected will serve a probationary period of two weeks. During the probationary period either the participant, the employer, or the College may terminate the Agreement, without stated cause, by notifying the other party in writing.

- The records for each probationary participant will be reviewed prior to the end of the probationary period. Records may consist of periodic reports regarding progression made in both the OJL and related instruction, and any disciplinary action taken during the probationary period.

- Any probationary participant evaluated as satisfactory after a review of the probationary period will continue in the program.

- After the probationary period the Agreement may be canceled at the request of the participant, or may be suspended or canceled by the College or employer for reasonable cause after documented due notice to the participant and a reasonable opportunity for corrective action. In such cases, the College will provide written notice to the participant of the final action taken.

SECTION VII - MAINTENANCE OF RECORDS

The College will keep program and participant records including application, application log, interview summary, a summary, letters of recommendations, attendance, test scores, personal information such as demographics, assessment, completion, and employment according to the Records Retention Policies of Delaware County Community College.

SECTION VIII – ADVISORY BOARD

The Program will have an Advisory Board to ensure continuous program alignment. The Advisory Board will make participant recommendations and referrals, participate in the application and selection process, review program progress, student completion, and placement.

The Advisory Board will be comprised of members of the Manufacturing Alliance of Chester and Delaware Counties Training Committee, and the Dean for Workforce Development and Community Education at Delaware County Community College. Other members will be added on an as needed basis.

The advisory board will meet monthly to:

- Review the applications and progress of program participants.
- Recommend improvement or modification in training schedules, schooling and other training activities.

SECTION IX – PROMGRAM/ PARTICIPANT AGREEMENT

- After an applicant has been selected, but before the start of instruction or on-the-job learning the participant will sign a PARTICIPANT WAIVER FORM.

- Prior to signing, each selected participant will be given an opportunity to read and review these Standards of Training and the College's written rules and policies.

- Participants will receive monthly performance reviews from both the instructor and the employer. Students can be asked to leave the program for lack of progress.

SECTION X - HOURS OF WORK / WAGES

- Participants will work to complete the required OJL component on non-instruction days.
- Participants may or may not be compensated through hourly wages by the employer of the OJL component. That is at the discretion of the employer.
- Participants will be given a weekly stipend in the form of a preloaded gift card. This applies to the 2016 program ONLY. If funding for the stipends are not available, future participants will not receive the stipends.
- Participants who do not complete the required hours of OJL during the scheduled program may have the term of that requirement extended, pending employer approval, until the required number of hours of training are accrued. Stipends will not be given for make-up OJL.

SECTION XI- RELATED INSTRUCTION

- Every participant is required to participate in coursework.
- Coursework will include no less than 450 hours of prescribed industry related instruction.
- Any participant who is absent from classes or OJL, unless officially excused, the College and/or the employer may terminate enrollment after notice to the participant and opportunity for corrective action.
- If the participant's work performance and/or conduct do not meet expectations (including classwork and on-the-job work as well as attendance and punctuality), enrollment may be terminated. .
- To the extent possible, related instruction will be closely correlated with the practical OJL experience. The Advisory Board will monitor and document the participant's progress in the related instruction classes.

CORE:

All participants will receive 210 hours of full-time instruction prior to being placed in the OJL portion of the program. This does not apply to participants who are currently working with one of the employers.

TRACKS:

Once students successfully complete the CORE instruction they will begin OJL and continue taking the more in-depth modules in their identified track.

Applicants must identify the track during the application period.

MACHINING*:* *240 Hours*

- Prints, Layout, & Msrmnt for Machining
- Machining Technology
- CNC Machine Tool Operations
- CNC Program & Advanced OP
  (See appendix B for course syllabus)

INDUSTRIAL SYSTEMS: *240 Hours*

- Intro to Industrial Systems Technology
- AC / D C Analysis
- Electronics
- Electro Mechanical Systems
- Troubleshooting and Repair
  (See appendix C for course syllabus)

SECTION XIII- SCHEDULE *See Appendix D for detailed course listing and schedule*

- Core Modules
  CLASS START:
  April 18, 2016 – May 20, 2016
  8:00 AM – 5:00 PM (one hour – lunch)
  Monday, Tuesday, Wednesday, Thursday, Friday
  Delaware County Community College
  901 S. Media Line Rd
  Media, PA 19063
  Advanced Technology Center Room T 222

- Industrial Systems Track
  CLASS START:
  May 23, 2016 – July 22, 2016
  8:00 AM – 5:00 PM
  (One hour – lunch)
  Monday, Wednesday, Friday
  Delaware County Community College
  901 S. Media Line Rd
  Media, PA 19063
  Advanced Technology Center
  Room T 222

- Machining Track
  CLASS START:
  May 23, 2016 – July 22, 2016
  8:00 AM – 5:00 PM
  (One hour – Lunch)
  Monday, Wednesday, Friday
  Delaware County Community College
  901 S. Media Line Rd
  Media, PA 19063
  Advanced Technology Center
  Room T 222

- ON-THE-JOB LEARNING
  STARTS:
  May 23, 2016 – July 22, 2016
  Students work every Tuesday and Thursday
  Six (6) hours each day/ 12 hours per week.
  Tuesdays/ Thursdays
  COMPANY - TBD

SECTION XIV- SUPERVISION OF PARTICIPANTS

- The employers will be responsible for the training of the participant on the job.
- No participant will be allowed to work without direct supervision.

SECTION XV - RECORDS AND EXAMINATIONS

- Throughout the program, the Advisory Board will evaluate the participant's record to determine whether he/she has made satisfactory progress.

- If related instruction or OJL progress is found to be unsatisfactory, the Advisory Board may determine whether the participant will continue in a probationary status, or initiate a performance improvement plan.

- Should it be found that the participant does not have the ability or desire to continue the training, the Advisory Board will, after the participant has been given adequate assistance and opportunity for corrective action, terminate the Agreement.

Appendix A: Core Module Syllabus

MATHEMATICS FOR OCCUPATIONAL TECHNOLOGIES – MTT 108
60 hours
This course is designed to provide the student with relevant theory and skills in solving practical, industrially based mathematical problems. Topics of instruction will include, but will not be limited to, calculating arithmetic expressions involving whole numbers, fractions, decimals, ratio, proportion, and percentages. The appropriate use of English/metric conversions, exponents, square roots, basic graph interpretation, and basic algebraic expression (formulas) manipulation will be presented. In addition, the solution of geometric figures will be addressed. An introduction to the use of trigonometry for the solution of right and oblique triangles will also be included.

Upon successful completion of this course, students should be able to:

- Conduct arithmetic operations using whole numbers, fractions, and decimals for the solutions of typical technologically based concepts, processes and operations.
- Perform English and Metric computations involving numeric and literal problems.
- Demonstrate the use of a Cartesian and a polar coordinate system to interpret and construct basic graphs, such as; bar, pie, broken line, etc.
- Analyze data and select an appropriate method to construct a chart, or graph, as well as decipher relationships among topical data.
- Solve fundamental expressions and common formulas using algebraic rules for addition, subtraction, multiplication, division, ratio, proportion, percentages, powers and roots, and transposition of terms, to include mixed operators.
- Apply appropriate terminology and rules for solving problems involving basic geometric entities and figures.
- Communicate the rules of similarity and congruency and solve basic triangles.
- Identify and construct right triangles and utilize the Pythagorean theory, sine, cosine, and tangent functions and The Law of Sines/Cosines for the trigonometric solution of unknowns.

CREDITS: 3

PRINTS, LAYOUT, & MEASUREMENT FOR MACHINING – MTT 110
60 hours
This introductory course is designed to provide instruction in the theory and skills necessary to read conventional drawings commonly used in the machining industry. Instruction will be centered on object visualization and feature definition/recognition. Basic through intermediate difficulty multiview third angle (with lesser emphasis on first angle) projection, to include orthographic, isometric, sectional and auxiliary view drawings will be addressed. Piece-part feature terminology, tolerances, limits, fits, conventional dimensioning practices, surface finish and inspection issues will be stressed. Sketching, precision layout tools, measurement tools, and techniques of usage will be covered and utilized to demonstrate comprehension in print/part interpretation.

Upon successful completion of this course, the student should be able to:

- Discuss the purpose, the importance, the types, and various uses of engineering drawings, as they relate to the design and manufacture of parts.
- Communicate the purpose of a title sheet, and relate the value of each of its components to the process of completing a finished product.
- Decipher trade terminology and interpret operational notes related to drawings.

- Analyze the features of an object and develop representative sketch using the principles of orthographic projection.
- Interpret line work, dimensions, orthographic views, various section types, auxiliary views, and annotations associated with mechanical drawings.
- Visualize objects, describe geometric relationships, determine feature size and placement, and apply terminology in the interpretation of graphical representations of a tab, bevel, chamfer, neck, fillet, round, slot, keyway, flat, boss, pad, hole/pattern, countersink, counterbore, tapered surface, as well as English and metric thread forms.
- Describe, discuss and apply the techniques used in standard coordinate dimensioning methods to complete sketches, to layout parts, and perform inspection operations.
- Identify, and discuss the purpose, and the limitations, of various layout tools; and, of common precision measuring instruments.
- Demonstrate the use of various layout and precision measurement tools.

CREDITS: 3

WORKPLACE SUCCESS CAR 4291

30 hours

This course provides the foundation for success in employment. Regardless of a candidate's position there are key skills that will enable you to be successful and an added value to your organization.

Upon successful completion of this course, students will have developed skills in:

- Time Management
- Team Building
- Accountability - show up on time, don't leave early, etc…
- Communication (verbal and written)
- Conflict Management
- Problem Solving
- Leadership

NON CREDIT

BASIC TECHNICAL SKILLS – TME 115

60 hours

This course is designed to provide the student with the theory and experience necessary to appropriately plan, organize, and perform typical introductory job assignments of a technician, mechanic, or helper. Instruction will provide baseline coverage of a variety of technical topics in a cross-discipline manner. Specific subject matter deals with the manual operation of equipment as well as the use of hand and power tools. An introduction to fire prevention and safety, oxy-fuel heating and cutting, general layout and precision measuring instruments, electrical testing, basic rigging equipment and practices, as well as the use of leveling devices for rise/run calculations (require equipment installation/set-up and leveling applications) will be covered. Instruction will include appropriate levels of associated processes required to safely perform layout, fire prevention, fabrication and inspection, installation, repair/replacement/introduction start-up/operational procedures for a basic steam generator system, and plant equipment.

Upon successful completion of this course, students will have developed skills in:

- Apply basic accident-prevention practices and procedures relative to personal protection, start-up and operation of electrical/mechanical/steam producing equipment, to include an introduction to fire extinguishers and lock-out and tag-out procedures.
- Interpret sketches, drawings and schematics, and perform basic layout practices for the fabrication of piece-parts, and the installation and assembly of equipment.

- Use English and Metric rules, micrometers, vernier calipers, dial indicators and other instruments to make accurate measurements and layouts.
- Demonstrate the skills and knowledge required to utilize common hand tools, and power driven hand tools, as well as a drill press, a cut-off saw, angle grinder, and a sander.
- Perform basic electrical measurements, using analog and digital voltage/ohm/amperage meters and devices.
- Utilize basic jointing procedures to connect/disconnect fasteners and mechanically fastened electrical terminals, as well as PVC, copper, pneumatic and hydraulic tubing joints and connections.
- Conduct basic flame heating, bending, and cutting assignments.
- Complete basic (small payload) rigging and equipment moving procedures.
- Relate aspects of thermal science theory and allied phenomena associated with heat generating equipment and systems.
- Describe basic safety requirements, operational components (at an introductory level) and discussed the operational aspects of a basis steam generation systems.
- Present (appropriate for this course) technical information concisely and accurately.

CREDITS: 3

Appendix B: Industrial Systems Module Syllabus

INTRODUCTION TO INDUSTRIAL SYSTEMS TECHNOLOGIES – IST 100

45 hours

This is a hands-on introductory course intended to acquaint students with basic skills and knowledge required as a part of the Industrial Systems Technology program. This course is specifically designed to provide knowledge and skills required for installing, maintaining, and replacing various process equipment and systems. Specific instruction in this class will cover moving and rotary equipment including terminology, function, components and purpose. Heavy emphasis will be placed on drives, belts, chains, gears, couplings, alignment, lubrication, packing and seals. Safety practices and procedures regarding the use of hand and power tools for equipment installation, repair and replacement will be stressed. The proper use of equipment and installation manuals and standards will be addressed. This course is recommended for students who have little or no industrial equipment experience.

Upon successful completion of this course, the student should be able to:

- Identify motion equipment such as conveyors, pumps, drives, gears, etc.
- Select and install appropriate fasteners such as nuts, bolts, snap rings, pins, etc.
- Describe the primary function of motion equipment as it relates to a manufacturing or an industrial processing system.
- Describe and demonstrate various methods of shaft alignment.
- Research and explain manufacture's specifications, i.e., installation, operation, maintenance, service and repair.
- Define the criteria for measurement, usage, and application of various measuring instruments commonly found in industrial facilities.
- Interpret and use Process and Instrumentation Diagrams (P&ID's) for various pieces of mechanical equipment, to include instrumentation, piping and other devices.
- Describe equipment maintenance with regard to planning, scheduling, selection of parts, power and hand tool requirements with a strong emphasis on environmental, accident prevention, and health issues.
- Select the proper tools, equipment and instruments to install/align a drive unit and coupling.
- Compare and contrast belt, chain and gear drives.
- Calculate various drive ratios for speed and torque.
- Classify industrial drive systems and their applications.
- Utilize manufacture's specifications to determine replacement parts.
- Analyze lubrication and packing seals to assure appropriate equipment performance.
- Plan, schedule and employ practical preventive maintenance for various pieces of equipment as part of an industrial system.

CREDITS: 3

AC / D C ANALYSIS

60 hour course

The course covers the basic principles of alternating and direct current circuits. DC containing passive elements, including transient circuit analysis. Circuit theory and conversions will also be examined. Troubleshooting of basic resistive circuits with both a theoretical and a hands-on approach will be applied. AC (Alternating Current) circuit analysis incorporate time-varying voltages and currents. The basic behavior of capacitors and inductors are introduced and series/parallel circuits driven by sinusoidal sources are analyzed using both phasors (vectors/complex numbers) and computer circuit analysis programs. Theoretical concepts are illustrated in the weekly two-hour lab sessions where various test equipment are used to measure experimentally the various characteristics of sinusoidal voltages and currents. Power (real, reactive, apparent) in various AC circuit configurations, including series/parallel resonance, is analyzed.

Upon successful completion of this course, the student should be able to:

- Understand and use electric circuit terminology.
- Analyze resistive circuits
- Follow necessary safety precautions in dealing with electrical equipment.
- Connect simple circuits following schematic diagrams.
- Use basic electrical measuring equipment.
- Produce a readable, informative laboratory report.
- Convert circuit elements from time domain to phasor (complex) representation and from phasor back to time domain.
- Analyze currents and voltages in RL, RC, RLC circuits using phasors.
- Use PSPICE to obtain various currents and voltages in RL, RC, and RLC circuits.
- Calculate reactive, apparent and real power in single phase and multiphase circuits.
- Analyze series and parallel resonant circuits.
- Analyze transformer circuits.
- Use various test equipment properly.
- Produce an accurate and neat laboratory report.

NON CREDIT

ELECTRONICS – TEL 110
60 hours
Course Description
This course utilizes an integrated approach to learning. A topic will be introduced and discussed, developed into a practical circuit, analyzed for faults, and evaluated with a prelab using a commonly accepted software package. The circuits are built, tested and reported in the lab experiments. The course covers basic semiconductor theory, Diode theory, Zener diodes, special use diodes and LEDs. Biopolar transistors to include biasing, D.C. load lines, transistor operation and data sheets are discussed. Power supply circuits and transistor amplifiers are analyzed. Experiments are performed in conjunction with all major topics to reinforce theory. The use of the oscilloscope will be introduced.

Upon successful completion of this course, the student should be able to:

- Define the properties, characteristics and applications of semiconductors and diodes.
- Describe and demonstrate the concepts of biopolar transistors.
- Evaluate the different characteristics and properties of transistor amplifiercircuits.
- Define the characteristics and application of field effect transistors.
- Describe the properties and demonstrate the concepts of power supplies.

CREDITS: 4

ELECTRO/MECHANICAL SYSTEMS – TEL 200
60 hours
This course examines the behavior of electrical and mechanical components used in interfacing the machine environment to the outside world. The course concentrates on the behavior of input and output devices used to detect, measure and control mechanical, thermal, fluid, optical and electrical processes.

Upon successful completion of this course, the student should be able to:

- Analyze the characteristics and behavior of various input devices and transducers.
- Analyze the characteristics and behavior of various output devices.
- Describe various methods of modifying analog output signals of devices using amplification and filtering.
- Describe various methods of modifying digital output signals of devices using digital techniques and devices including analog-digital/digital-analog converters. Describe various feedback techniques (from detection, modification and control) used to control various processes.

- Develop skills to troubleshoot input sensors, output devices and controllers.
- Be able to use various test equipment to localize probable faults in a control system.

CREDITS: 4

Appendix C: Machining Module Syllabus

MANUFACTURING PROCESSES – MTT 213
60 hours
This course is designed to provide broad spectrum, first exposure, technical instruction in the fundamental processes (other than material removal) used to produce manufactured goods. Various aspects of manufactures' responsibilities in providing producer and consumer goods, as well as services, will be covered. Generalized methods of conversion of materials into various forms and shapes via processes such as casting, extrusion, injection molding, welding, etc., will be the primary focus of this course. Principles, terminology, as well as practical applications will be stressed. In addition to rounding-out educational experiences for manufacturing/mechanical/drafting and design students, this course is also suited for providing novice engineers, supervisors, and managers with practical experiences in varied manufacturing processes.

Upon successful completion of this course, students should be able to:

- Describe the design process and various considerations engineers typically ponder/explore before deciding on a process for manufacturing an article.
- Discuss the production of parts with respect to the fundamentals of the casting and molding processes.
- Demonstrate a basic understanding of the principles involved in the forming, rolling, drawing, extrusion and molding processes.
- Differentiate, document, and demonstrate flame/arc cutting and welding process variables.
- Compare and contrast various bonding, joining (to include welding and related processes), and mechanical fastening methods.
- Research, and describe in an oral presentation, a non-traditional material removal process, or prototyping process available to manufacturers, relating same to aspects of future human development.
- Distinguish between the common surface treatments and finishing processes.
- Relate the classifications of production systems and the impact automation has for each.
- Elaborate on the principles of Lean Production and the "Factory within a Department" concepts, suggesting their possible impact on the social fabric of the workplace.
- Summarize the concepts and criteria for reducing costs and increasing productivity on the shop floor.
- Utilize welding, melting, casting, and molding equipment to conduct laboratory exercises.
- Present examples of how artists can use manufacturing processes to create works of art.

CREDITS: 3

MACHINING TECHNOLOGY – TME 111
60 hours
This course provides an introduction to the knowledge and skills associated with various conventional chip making machine tools their design, application, set-up and operation. Theory and mathematical concepts and calculations associated with inspection techniques, tapers, digital readout quantifications, speeds, feeds, torque, horsepower, threading, indexing and unit cycle time determination will be covered. Emphasis will be placed on tooling and work holding requirements, and set-up and cutting tool materials (H.S.S., carbide, ceramic and diamond) selection. Additional topics include: an introduction to process planning, quality control charting - Statistical Process Control (SPC) techniques, and Geometric Dimensioning and Tolerancing (GD&T).

Upon successful completion of this course, students should be able to:

- Describe and perform practices and procedures required to safely complete operations involving cutoff and contour saws, drill presses, vertical and horizontal milling machines, engine lathes, pedestal and surface grinders.
- Identify the basic principles and terms associated with the interpretation of drawings for the manufacture and inspection of parts, with an emphasis on Geometric Dimensioning and Tolerancing.
- Implement various aspects of design, planning and organization for the production of manufactured parts.
- Discuss, in general terms, the nature, properties and types of materials used to produce manufactured parts.
- Refer to manufacturers' catalogs and the theory of cutting tools to determine the application and the identification of appropriate cutting tool holders, adapters, cutters and inserts, and to develop a machining operation plan, including set-up and job sheets.
- Perform algebraic and trigonometric computations associated with the manufacture of piece-parts to include speeds and feeds, tapers, threads and indexing; and other mathematical calculations related to various machining parameters, machine selection, set-up and inspection of piece-parts.
- Utilize engineering drawings and precision instruments to produce parts on machine tools, to include cut-off and contour saws, drill press, vertical and horizontal milling machines, engine lathe, pedestal and surface grinders.
- Describe, in basic terms, the various considerations associated with special purpose machines, processes, mass production, hard and soft automation, and assembly techniques.

CREDITS: 3

CNC MACHINE TOOL OPERATIONS – MTT 210
60 hours
This course is designed to provide appropriately prepared conventional machine tool operators with an introduction to Computerized Numerical Control (CNC) machine tool set-up and operation. Theory will be practical in nature and relate directly to shop based applications. Lathe, and mill, operations will be stressed; however, the theory and concepts will be applicable to various CNC machine tools.

Upon successful completion of this course, the student should be able to:

- Conduct commonly assigned CNC machine tool operator cleanup and maintenance activities.
- Describe the various axes and coordinate systems associated with differing CNC machine tool types.
- Apply accident prevention practices and procedures while interacting with the Machine Control Unit (MCU), as well as during program proof-out; and, while performing maintenance.
- Discuss the types and principles of MCU offset registers, and their usage.
- Analyze rudimental program problems and perform basic editing operations to modify G-code programs via Manual Data Input (MDI) operations.
- Edit canned cycle functions utilizing calculations/data prepared by others to create simple G-code programs via conversational graphics as well as by typing on a personal computer.
- Demonstrate upload/downloading and other Distributed Networked Computer (DNC) functions on a shop floor computer network.
- Set-up, align, and zero-out work holding devices, tooling adapters, and tool holders.
- Perform dry/first/production runs and inspections, adjusting various register values to assure tool qualification, and part dimensionality.
- Communicate and apply piece-part set-up and inspection procedures commonly associated with, advanced Lathe and Milling Operations.

CREDITS: 3

CNC PROGRAMMING AND ADVANCED OPERATIONS – MTT 220
60 hours
This course is designed to provide the experienced Computerized Numerically Controlled (CNC) machine tool operator with instruction in manual part programming and advanced operations. Mathematical applications for definition of location, set-up, and positioning and tool movement (absolute/incremental) within specific coordinate systems will be presented. Various aspects of intermediate to Advanced G and M code programming to include fixture offsets, thread milling, looping, macro, and sub program development/utilization/execution will be included. Criteria relevant to accident prevention practices and procedures, process planning, work-holding, tooling, machine set-up and operation, program proof-out, and quality control will also be addressed.

Upon successful completion of this course, the student should be able to:

- Via manual methods, interpret and convert basic piece-part drawings in order to produce proceduralized manufacturing process/operation, workholding, tooling documentation sheets, and job plans for a CNC mill (router on similar machine tool) and a CNC lathe.
- Apply principles of mathematics, engineering print interpretation and geometric analysis to describe part datum's, surfaces, and feature locations in terms of2 and 2_, axis machine/tool positioning.
- Prepare and proof a written manuscript for the production of parts on a CNC mill, (or similar machine), and a CNC lathe.
- Utilize mathematical calculations, and concepts of geometric relationships combined with techniques, hardware, software menus and computer system practices associated with a Computer Aided Machining/Distributed Numerical Control (CAM/DNC) system to manually write, save, retrieve and transfer CNC machine tool programs.
- Apply programming techniques (to include advanced canned cycle, loops, and macros).
- Develop programs involving advanced operations such as helical interpolation and thread milling operations.
- Program multiple and varied parts involving multiple operations per set-up to include the use of indexing devices.
- Describe the purpose and use of charting as it applies to Statistical Process Quality Control (SPQC) in the CNC machining environment.
- Discuss the principles and applications of parametric programming as they apply to advanced concepts such as group technology part programming.

CREDITS: 3

Appendix D: Expanded Course Syllabus

Course #	Course Title	Credits	Hrs	Start	End	Days	Times
MTT 108	Math for Occupational Tech	3	60	3/14/2016	3/25/2016	MTWRF	8:00 - 3:00 PM
CAR XXX	Workplace Success	0	30	3/14/2016	3/25/2016	MTWRF	3:00 - 5:00 PM
MTT 110	Blue Print Reading	4	60	3/28/2016	4/15/2016	MTWRF	8:00 - 12:00 PM
TME 115	Basic Tech Skills	3	60	3/28/2016	4/15/2016	MTWRF	1:00 - 5:00 PM
IST 100	Intro to Industrial Systems	3	60	4/18/2016	5/13/2016	MWF	8:00 - 12:00 PM
PDS XXX	AC/DC Analysis	0	60	4/18/2016	5/13/2016	MWF	1:00 - 5:00 PM
TEL 110	Electronics	4	60	5/16/2016	6/18/2016	MWF	8:00 - 12:00 PM
TEL 200	Electro Mechanical Maintenance	4	60	5/16/2016	6/18/2016	MWF	1:00 - 5:00 PM
MTT 213	Manu. Processes	3	60	4/18/2016	5/13/2016	MWF	8:00 - 12:00 PM
TME 111	Machining Technology	3	60	4/18/2016	5/13/2016	MWF	1:00 - 5:00 PM
MTT 210	CNC Operation	3	60	5/16/2016	6/3/2016	MWF	8:00 - 5:00 PM
MTT 220	CNC Programming/ Advanced Op	3	60	6/6/2016	6/18/2016	MWF	8:00 - 5:00 PM