Bucks County Community College
Center for Workforce Development
Course Outlines for Industrial Skills Stackable Micro-Credentials
(Completion of all eight credentials earns METALWORK TRAINING PROGRAM Certificate.)

Total Hours of Instruction: 288

Hours per credential:
Intro to Manufacturing, OSHA 10, Forklift and Public Safety: 36 hours
Hand Tool Use: 24 hours
Blueprint Reading and AutoCAD: 57 hours
Shop Math and Measurement: 54 hours
Machining: 60 hours
Welding: 42 hours
Personal Finance: 3 hours
Workplace Employability Skills: 12

Industry Recognized Credentials:
OSHA10
Forklift Safety
National Institute for Metalworking Skills (NIMS) exam for Measurement, Materials, and Safety Certification

Micro-Credential: **Intro to Manufacturing, OSHA 10, Forklift and Public Safety**	**Total No. of Days** **6**	**Total No. of Hours** **36**
Orientation • Intro of instructor, experience and interest in the craft • Student introductions, personal interests/experience • Description of the work environment, personal requirements for shop work • Brief historical overview • Role of metal, machining and fabrication in society, touches everything. • Introduce concept of "precision" • Manufacturing in the US, types of products, industrial, consumer, medical, etc. • Intro to machinery types, "machine tools" metal cutting, metal forming, edm, abrasive, laser, waterjet, welding, additive, etc. • Materials, types of, composition, classes and designation	1.5	9
Workplace Skills • Types of jobs, machinist, CNC machinist, CNC operator, welder, fabricator, etc. • Shift work, overtime, importance of deadlines • Shop "culture", pranks, gender roles, pinups, respect, collaboration, bathrooms • Personal skills required, physical, psychological. Responsible, reliable, attention to detail, accurate, team player • Further training opportunities, career planning	1	6

• Math skills, material knowledge and understanding, proficient with hand tools • Interest in the field, lifelong learning, new technologies • Computers and their use in the shop, not just CNC, email, ordering, job tracking, timesheets, etc.		
Overall Program Safety • Safety and personal responsibility, ability to predict outcomes, similar to driving and the drivers ed SIPDI principle (scan, interpret, predict, decide, execute) • OSHA, NIOSH • OSHA 10 Certification • Hazardous materials, MSDS, NFPA, • Personal Protective Equipment, eyes, ears, shoes, hard hats aprons, coveralls • Gloves, special case, when to use and not to use • Physical, lifting, trip hazards, slip prevention, heavy and large lifting and moving • Keeping workplace neat • Handling and storage of cutting tools, bandsaw blades, etc • Proper storage of materials stock, chemicals, oily waste, etc • Hazards of machines, guards, rotating spindles, removal of chips • Electrical, lock out/tag out • Compressed air safety and proper use • Gases, oxy, acetylene, welding gases, argon, C02, helium, etc. Safety, storage and use • Forklift safety training	3.5	21
Micro-Credential: **Hand Tool Use**	**Total No. of Days** **4**	**Total No. of Hours** **24**

Hand Tools, Materials, and Mechanical Hardware
• Basic hand tools and benchwork, a Right Tool for every Job, proper and safe use of:
  ○ Screwdrivers, Phillips, straight, offset, Torx
  ○ Pliers, slip joint, cutting, locking
  ○ Hammers, dead blow, soft metal, rawhide, plastic
  ○ Chisels, scribers, punches, prybars, etc
  ○ Wrenches, socket, open end, hex, adjustable, spanner, strap, pipe, etc
  ○ Bench Vise
  ○ Clamps, C, toolmakers, hinged welding, spring
  ○ Files and filing, other hand tools, de-burring, abrasives
  ○ Drills, taps, dies
• Materials, types of, composition, classes and designation
• Alloys and heat treatment
• Fasteners
• Intro to screw thread systems
• English & Metric
	3	18

• Nomenclature of bolts, head, shank, pitch, major diam, minor diam, grades and types of materials • Basic thread sizes • Types of threaded fasteners, cap screws, socket head, button head, set screws, machine table bolts, standoffs, locking, etc • Other special types, U bolts, eye bolts, hoists and lift • Nuts & washers, types, selection, sim to bolts • Rivets, type and installation tools, hand and machine • Pins: dowel, spring, taper, cotter, clevis • Misc Mechanical components: Shaft collars and couplings, retaining rings, keys and keyways, etc.		
Shop Machinery • Metal cutting saws; horizontal band, vertical band, cold saws, abrasive • Drill presses, types and use • Machine tools, milling and turning, manual and CNC • Grinders and belt grinders • Materials handling, pallet jacks, hand trucks, fork lifts, cranes	1	6
Micro-Credential: **Shop Math and Measurement**	**Total No. of Days** **9**	**Total No. of Hours** **54**
Measurement Tools & Systems • Define measurement types, basic, semi precision and precision • Define and discuss Tolerance, introduce concept of GD&T • Rules, types • English & metric systems • Exercises and practice in reading scales and tape measures • Other measuring tools, combination square, adjustable square, protractor, screw pitch gage • Exercises and practice in reading measurements with adjustable squares and angles • Precision measurement: • Concept of precision measurements • Calipers, vernier, dial, digital • How to read a vernier, exercise and practice • Micrometers, how to read, exercise and practice • Other precision tools, depth micrometers, inside micrometers, hole gages, etc • Dial indicator • Bevel protractors • Gages, go/no go • Surface finish and roughness • Introduce concept of QC, CMM's, inspection, classes of fits	4	24
Shop Math • Intro, English & Metric • Fractions and use of decimal math in shops, how to convert, common vocabulary	4	24

• Order of operations • Add and subtract fractions, convert to decimal • Converting metric/English back and forth • Circles and angles, basic geometry • Co-ordinate systems, concept of 0,0,0 • Basic trig and solving for angles		
NIMS Certification Prep	1	6
Micro-Credential: **Blueprint Reading & AutoCAD**	**Total No. of Days** **9.5**	**Total No. of Hours** **57**
Blueprint reading • The "landscape" of a print, title block, location stations, revs • Types of views, 3rd angle, 1st angle projection • Line types, object, dim., hidden, ctr line • Notes and abbreviations • Sections, cutting planes • Symbols, hole and thread notes, GD&T symbols • Exercises in reading and intercepting drawings • Fit classes • Basics of GD&T	2.5	15
AutoCAD	7	42
Micro-Credential: **Machining**	**Total No. of Days** **10**	**Total No. of Hours** **60**
Equipment Maintenance • Why important to have routine schedule • Cleaning, lubrication, types of oils, oils locations • Use of air around machine tools	0.5	3
Grinding Introduction • Types of grinders, "offhand grinding" • Wheel safety and identification, tool rests, spark shield • Intro to precision grinding	0.5	3
Band Saws and Blades • Types of saws, horizontal, vertical • Speeds and feeds(SFM), different types of materials • Bandsaw safety, cutting round stock on a vertical saw • Basic controls and how they work • Blade selection and use, ratio of blade size to radii • Handling of blades, removing and installing blades and coiling	0.5	3
Drill Press Intro • Types of drill presses, sizes • Drill press safety • Speeds and feeds, SFM • Basic controls and how they work • Operations performed on a drill press, drill, countersink, counterbore, reaming, tapping, etc.	0.5	3

Lathes • Intro, history, the "mother" of machine tools • Types of lathes, engine, precision, 2nd operation, CNC lathes • Basic concept of operation, basic controls, setting tools • Operations that can be performed on a lathe, turning, facing, boring, drilling, threading, cut off, knurling, etc • Speeds and feeds, SFM, IPM • Safety with lathes • Workholding and Toolholding methods • Types of cutters, intro to inserts • Finishes • CNC lathes	3	18
Milling machines • Types of milling machines, knee, horizontal, CNC mills • Basic concept of operation, basic controls(use knee mill for example) • Milling machine safety • What operations can be performed on a milling machine, pockets, facing, boring, drilling tapping, etc • Toolholding, and types of tools used in a milling machine, drills, types of cutters, etc • Cutters in depth, end mills, drills, face mills, saws, inserts • Feeds and Speeds, SFM, chip load, climb and conventional milling • Coordinate systems, x,y,z • Workholding, vises, squaring the vise, clamping to the table, other types of clamping methods • Basic machining, squaring a block, locating a workpiece, edge finders, DRO's, ABS & INC • Doing large work on a vertical mill, turret movements, clamping • Other advanced work, rotary tables, dividing and indexing • CNC versions of milling machines	3	18
CNC Machining • Intro to machine types, VMC, HMC, turning centers • Tool changers, offsets, cutter comp. • Programming, CAD, CAM, parts of a program, conversational programming • "Canned cycles" • Coordinate systems, Cartesian, polar • G codes, M codes	2	12
Micro-Credential: **Welding**	**Total No. of Days** **7**	**Total No. of Hours** **42**
Welding • Intro, how welding works • Types of welding gas, stick, mig, tig, which process and why • Other process, plasma cutting, etc	7	42

• Safety, respiratory, vision, hearing, gas safety • Interpreting drawings for weldments • Basics, work area, protective gear, set up, grounding, etc • Other tools required, grinders, chipping hammer, pliers, gas cups, storing and use of consumables • Use of hand held electric grinders • Grinding wheel types • Finishing wheel types • Set up of machines and gases for various materials • Joint preparation • MIG welding practice • Stick welding practice		
Micro-Credential: **Workplace and Employability Skills**	**Total No. of Days** **2**	**Total No. of Hours** **12**
Workplace and Employability Skills • Career path and planning, today entry level, tomorrow, ? • Job seeking • Networking • Resume and cover letter, references • Portfolio, certifications, awards • Further education • Interviewing • Employment skills, post-employment • Helping others new to the trade	2	12
Micro-Credential: **Personal Finance**	**Total No. of Days** **.5**	**Total No. of Hours** **3**
• Understand the concept and importance of budgeting • Develop and analyze a personal budget • Differentiate between wants and needs • Analyze the effects of education and training on income potential • Examine how limited resources affect financial decisions • Discuss consequences of poor financial decisions • Evaluate the concept of delayed gratification and its impact upon a budget • Explore consequences of relying on debt to balance a budget	.5	3
Completion of all Micro-Credentials = **Metalwork Training Program Certificate**	**Total No. of Days** **48**	**Total No. of Hours** **288**