

MANUFACTURING I

Content Standard 6: Materials and Processes: Students will know the origins, properties and processing techniques associated with the material building blocks of technology

Performance Standard i: produce products with raw and recycled materials by separating forming, combining, conditioning, and finishing

Content Standard 8: Production Systems: Students will understand and be able to demonstrate the methods involved in turning raw materials into usable products

Performance Standard p: demonstrate an ability to safely and accurately use the layout, form, separate, combine, treat and finish tools and processes in manufacturing a product

<i>Unit</i>	<i>Learning Objectives</i>	<i>Sample Activities</i>	<i>Assessment Strategies</i>	<i>Resources</i>
METAL LATHE	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Describe and use 10 safety rules & procedures ❖ Identify the 30 most important parts of the metal lathe and their functions ❖ Identify the main lubrication points on a lathe ❖ Identify standard, quick-change, and turret-type tool holders mounted on a lathe carriage ❖ Identify tool holding devices for the lathe tailstock ❖ Demonstrate the purpose of rake and relief angles, chip breakers, and form tools 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Internet research ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets ❖ View video 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Textbook: Modern Metalworking <p>Other References: Fundamentals of Machine Technology</p> <p>Machine Tools and Machining Practices</p> <p>Processes of Manufacturing</p> <p>Videos Modern Marvels: Machine Tools</p> <p>How to Knurl</p>

MANUFACTURING I

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METAL LATHE (Continued)	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Grind an appropriate roughing tool and finishing tool ❖ Describe the uses and care of independent and universal chucks ❖ Describe the set-up of a collet and draw bar ❖ Describe the limitations and advantages of collets and draw bars ❖ Describe the use of a face plate and lathe dog ❖ Correctly set-up a work piece and face the ends ❖ Correctly center drill the ends of a work piece ❖ Determine the proper feeds and speeds for facing a work piece 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Internet research ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets ❖ View video 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	

MANUFACTURING I

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METAL LATHE (Continued)	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Perform facing cuts and measure them ❖ Perform correct set-up procedure for turning between centers ❖ Select correct feeds and speeds for turning operation ❖ Turn a 1” diameter shaft with 6 shoulders to a tolerance of plus .010” minus .010” (per specifications provided) ❖ Check the alignment of lathe centers by taking a cut with a tool and measuring the work piece: then restore alignment by adjusting the tailstock with a dial indicator ❖ Set-up lathe for knurling, recessing, die threading and parting and complete each operation 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Internet research ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets ❖ View video 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	

MANUFACTURING I

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METAL LATHE (Continued)	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Demonstrate proper procedures for drilling, boring, reaming, knurling, parting, and tapping ❖ Cut and measure a taper ❖ Make a taper using the tailstock offset method 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Internet research ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets ❖ View video 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	

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PRECISION MEASURING	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Identify various kinds of rules and state their application ❖ Measure and record the dimensions of 10 objects, obtained from instructor, using a fractional rule ❖ Measure and record the inside, outside and depth dimensions of an object to an accuracy of plus or minus .010” using a Dial caliper ❖ Prepare a surface plate to use ❖ Describe common applications of surface plates 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment i.e.: Machinist rule, Dial caliber, Micrometer, Dial indicator, Small hole gauges, Telescoping gauges ❖ Teacher worksheets ❖ Textbook: <u>Modern Metalworking</u> Other References: <u>Machine Tools and Machining Practices</u> <u>Processes of Manufacturing</u>

MANUFACTURING I

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<p>PRECISION MEASURING (Continued)</p>	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Measure and record the dimensions of an object using outside micrometers, to an accuracy of plus or minus .010 ❖ Define comparison measurement ❖ Identify common comparison tools ❖ Select the proper comparison measuring tools for a given measuring situation ❖ Identify common angular measuring tools ❖ Complete fraction/decimal and decimal/fraction conversions 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	

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CASTING PROCESSES	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ List and employ all safety practices and equipment regarding casting processes ❖ Define the 5 types of casting <ul style="list-style-type: none"> ▪ Sand ▪ Investment ▪ Lost wax ▪ Injection mold ▪ Die ❖ Identify, explain and use the tools used in sand casting ❖ Properly temper molding sand ❖ Make a green sand mold ❖ Pour a casting ❖ Finish the casting 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Internet research ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance ❖ Rubric Evaluation 	<ul style="list-style-type: none"> ❖ Laboratory equipment (Foundry) ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> Other References: <u>Processes of Manufacturing</u> <u>Metallurgy Fundamentals</u> <u>Technical Metals</u>

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FORGING	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ List and employ all safety practices and equipment regarding forging ❖ Define forging ❖ Identify and explain the use of the tools used in the hand-forging process ❖ Explain the advantages of forging ❖ Light the forge ❖ Hand forge an object, after being given a drawing, materials and tools 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Internet research ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance ❖ Rubric Evaluation 	<ul style="list-style-type: none"> ❖ Laboratory equipment (Foundry) ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> Other References: <u>Processes of Manufacturing</u> <u>Forging and Welding</u>

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HACKSAW	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Employ all safety practices when using a hacksaw ❖ Select the proper hacksaw blade for a particular job ❖ Correctly install a hacksaw blade in the frame ❖ List 3 tooth sets common to hacksaw blades ❖ Explain the purpose of “set” in a hacksaw blade ❖ Use a hacksaw properly 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> Video: <u>Modern Marvels: The Tool Bench: Hand Tools</u>

MANUFACTURING I

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<p>HACKSAW (Continued)</p>	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Apply knowledge of procedures for the use of the hacksaw by sawing out a part as required by specifications and according to the following criteria: <ul style="list-style-type: none"> ▪ Secure material in vise ▪ Squarely cut within 1/32" of specified size ▪ Release pressure and lift blade on backward stroke ▪ Make 40 to 50 strokes per minute ▪ Use entire length of blade ▪ Decrease pressure on blade when approaching cut-off point 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	

MANUFACTURING I

Content Standard 8: Production Systems: Students will understand and be able to demonstrate the methods involved in turning raw materials into usable products

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PEDESTAL GRINDER	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Employ all safety practices when using a pedestal grinder ❖ Demonstrate offhand grinding techniques ❖ Dress a grinding wheel ❖ Use pedestal grinder correctly 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> Video: <u>Modern Marvels: The Tool Bench: Power Tools</u>

MANUFACTURING I

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HORIZONTAL BAND SAW	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Employ all safety practices when using a horizontal band saw ❖ Correctly use saw blade terminology ❖ Identify major parts of the horizontal band saw ❖ Properly install blades ❖ Use horizontal band saw properly 	<ul style="list-style-type: none"> ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Textbook: <u>Modern Metalworking</u> Other References: <u>Machine Tools and Machining Practices</u>

MANUFACTURING I

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Performance Standard e: experiment with the alteration of material characteristics

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HEAT TREATMENT	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Follow safety procedures ❖ Describe the metallurgical processes of hardening, tempering, annealing and normalizing steel ❖ Describe the proper heat treating procedures for most steels ❖ Correctly harden a piece of steel ❖ Correctly temper a previously hardened piece of steel 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> <p>Other References: <u>Fundamentals of Machine Technology</u> <u>Machine Tools and Machining Practices</u></p>

MANUFACTURING I

<i>Unit</i>	<i>Learning Objectives</i>	<i>Sample Activities</i>	<i>Assessment Strategies</i>	<i>Resources</i>
<p>HEAT TREATMENT (Continued)</p>	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Describe the grain structure in the Allotropic phases of steel ❖ Properly set up and read the hardness of a piece of steel on the Rockwell Hardness Tester 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory ❖ Worksheets 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance ❖ Self evaluation of laboratory performance 	<p>Other References: <u>Processes of Manufacturing</u> <u>Manufacturing Processes, Revised</u> <u>Metallurgy Fundamentals</u> <u>Technical Metals</u></p>

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DRILLING PROCESSES	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Follow all safety rules applicable to drilling processes ❖ List 10 safety hazards involving drilling machines ❖ Identify the various features of a twist drill ❖ Identify the 4 sizing systems for twist drills ❖ List 3 advantages and 1 disadvantage in the use of drill sharpening machines 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> Other References: <u>Fundamentals of Machine Technology</u> <u>Machine Tools and Machining Practices</u> <u>Processes of Manufacturing</u>

MANUFACTURING I

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<p>DRILLING PROCESSES (Continued)</p>	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Properly sharpen a twist drill by hand ❖ Properly sharpen a twist drill by machine ❖ Identify and explain the correct uses for several work-holding and locating devices ❖ Determine the correct drilling speeds for 5 given drill diameters ❖ Determine the correct feed in steel by chip observation 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance 	<p><u>Video</u> <u>Modern Marvels:</u> <u>Machine Tools</u></p>

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<p>DRILLING PROCESSES (Continued)</p>	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Identify tools for countersinking and counter-boring ❖ Select speeds and feeds for countersinking ❖ Countersink and counter-bore holes ❖ Identify commonly used machine reamers ❖ Select the correct feeds and speeds for reaming commonly used materials ❖ Determine appropriate amounts of stock allowance in reaming ❖ Identify probable solutions to reaming problems 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance 	

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THREAD CUTTING	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Identify common thread components ❖ Identify common taps and dies ❖ Select taps for specific applications ❖ Select the correct tap drill for a specific percentage of thread ❖ Select the correct coolant for threading ❖ Tap holes by hand 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> <p>Other References: <u>Fundamentals of Machine Technology</u> <u>Machine Tools and Machining Practices</u> <u>Processes of Manufacturing</u></p>

MANUFACTURING I

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<p>THREAD CUTTING (Continued)</p>	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Identify and correct common tapping problems ❖ Identify dies used for hand threading ❖ Cut threads with a die 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance 	

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SOLDERING	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Safely set up a soldering torch (propane) ❖ Safely light and adjust torch ❖ Properly clean the metal to be soldered ❖ Flux the base metals ❖ Determine when to use acid or rosin flux ❖ Preheat the base metals to the correct temperature by color ❖ Bond two pieces of metal by soldering 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> <p>Other References: <u>Processes of Manufacturing</u> <u>Technical Metals</u></p>

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BRAZING	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Safely set up the brazing station with instructor's assistance ❖ Properly clean metal to be brazed ❖ Select correct tip, pressure and rod ❖ Flux the brazing rod ❖ Preheat base metal to a dull cherry red ❖ Bond two pieces of metal by brazing 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments ❖ Teacher demonstration ❖ Guided practice in laboratory 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams ❖ Laboratory performance 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> <p>Other References: <u>Processes of Manufacturing</u> <u>Technical Metals</u></p>

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CHIPLESS MACHINING	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ List and describe 4 chipless machining processes ❖ Describe the 4 major components of an Electrical Discharge Machine (EDM) ❖ Describe at least 4 applications for the E.D.M. ❖ Describe the process of explosive forming ❖ Describe the major advantages of explosive forming over conventional fabrication ❖ Describe the 6 basic steps in chem-milling 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams 	<ul style="list-style-type: none"> ❖ Laboratory equipment ❖ Teacher generated worksheets ❖ Textbook: <u>Modern Metalworking</u> Other References: <u>Fundamentals of Machine Technology</u> <u>Processes of Manufacturing</u>

MANUFACTURING I

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<p>CHIPLESS MACHINING (Continued)</p>	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Describe at least 5 advantages of chem.-milling over convectional milling ❖ Describe the 5 basic steps in the Powder Metallurgy (Sintering) process ❖ List 5 applications for the sintering process 	<ul style="list-style-type: none"> ❖ Teacher directed lecture ❖ Note-taking ❖ Text book assignments 	<ul style="list-style-type: none"> ❖ Teacher generated written quizzes and exams 	

MANUFACTURING I

Content Standard 3: Career Awareness: Students will become aware of the world of work and its function in society, diversity, expectations, trends and requirements.

Performance Standard a: identify career opportunities in the areas of transportation, communications, production and biotechnology

Performance Standard f: identify future labor market trends

<i>Unit</i>	<i>Learning Objectives</i>	<i>Sample Activities</i>	<i>Assessment Strategies</i>	<i>Resources</i>
CAREERS IN MANUFACTURING	<p><i>Students will</i></p> <ul style="list-style-type: none"> ❖ Identify careers in manufacturing in CT, US and globally ❖ Identify present and future opportunities in manufacturing ❖ Identify trends in manufacturing 	<ul style="list-style-type: none"> ❖ Visitation to WHS Career Center ❖ Internet research ❖ Viewing DVD from CBIA 	<ul style="list-style-type: none"> ❖ Independent report grades using School-wide Rubric 	<ul style="list-style-type: none"> ❖ State of CT DOL website ❖ DOL Occupational Handbook in Wolcott High School Career Center ❖ DVD CBIA

MANUFACTURING I

Bibliography of Teaching Resources

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