



## COURSE OUTLINE: MTF141 - MATERIALS/PROC QUAL

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	MTF141: MATERIALS AND PROCESS QUALITY
<b>Program Number: Name</b>	4051: METAL FABRICATION 4053: WELDING TECHNIQUES
<b>Department:</b>	IRONWKR APPR./WELDING RELATED
<b>Semesters/Terms:</b>	20W
<b>Course Description:</b>	This course deals mainly with how metals are affected by welding. To be a competent welder, a good understanding of the materials being welded is needed as well as the processes and procedures required to produce sound, reliable welds. A thorough study of the mechanical and physical properties of metals is then followed by presentations that explain how metals are affected by forming and the application of welding heat. Safety precautions will be discussed, along with welding codes and standards. Topics range from Welding Metallurgy and Weldability of Metals to Testing and Inspection of Welds and Welder Certification.
<b>Total Credits:</b>	3
<b>Hours/Week:</b>	3
<b>Total Hours:</b>	0
<b>Prerequisites:</b>	There are no pre-requisites for this course.
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>Vocational Learning Outcomes (VLO's) addressed in this course:</b>  Please refer to program web page for a complete listing of program outcomes where applicable.	<b>4051 - METAL FABRICATION</b> VLO 5 Understand and use a variety of destructive and non-destructive methods to test welds.  <b>4053 - WELDING TECHNIQUES</b> VLO 3 Recognize and understand use of welding symbols. VLO 9 Identify defect in welds, demonstrate how to prevent them and define procedures for correction of defective weld quality.
<b>Course Evaluation:</b>	Passing Grade: 50%, D
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	The final course grade will be determined by the following:  Three Term Tests: 70% Quizzes: 30% Attendance: -1% (per unexcused hour) (late = 1 hour)  TOTAL = 100%  If shop work is included, the final course grade will be determined by the following:  Three Term Tests: 70% Shop Project(s): 10%



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Quizzes: 20%  
Attendance: -1% (per unexcused hour)  
(late = 1 hour)  
TOTAL = 100%

**Course Outcomes and Learning Objectives:**

Course Outcome 1	Learning Objectives for Course Outcome 1
Define metals, their properties, and how they are made.	<p>Define the properties of metals and how they affect weldability:</p> <ul style="list-style-type: none"> <li>o Tensile strength</li> <li>o Impact strength</li> <li>o Hardness</li> <li>o Ductility</li> <li>o Chemical properties</li> <li>o Corrosion resistance</li> <li>o Alloys</li> </ul> <p>Review the iron-making and steel-making processes:</p> <ul style="list-style-type: none"> <li>o Blast furnace: pig iron and cast iron</li> <li>o Steel refining furnaces: basic oxygen furnace and electric arc furnace</li> <li>o Material forming methods: wrought and cast metals</li> <li>o Casting and continuous casting methods</li> <li>o Structural shapes: HSS, plate, hot rolled and cold rolled</li> </ul> <p>Discuss the significance of mechanical and physical properties of common metals:</p> <ul style="list-style-type: none"> <li>o Understand the crystalline structures of carbon steels</li> <li>o Carbon steel microstructures: <ul style="list-style-type: none"> <li>? Ferrite</li> <li>? Pearlite</li> <li>? Martensite</li> <li>? Austenite</li> </ul> </li> </ul> <p>Stainless steels:</p> <ul style="list-style-type: none"> <li>? Austenitic</li> <li>? Martensitic</li> <li>? Ferritic</li> </ul> <p>Aluminum (alloys):</p> <ul style="list-style-type: none"> <li>? Designation system</li> </ul> <p>Explain the purpose and effects of heat-treatments on steel:</p> <ul style="list-style-type: none"> <li>o Annealing</li> <li>o Normalizing</li> <li>o Quenching</li> <li>o Hardening</li> <li>o Tempering</li> <li>o Stress relieving</li> </ul> <p>Describe properties of metals and their effect on material selection, fabrication and welding considerations.</p> <p>Physical properties:</p> <ul style="list-style-type: none"> <li>? Mass</li> <li>? Melting point</li> </ul>



	<p>? Thermal conductivity          ? Coefficient of expansion          ? Electrical conductivity</p> <p>Mechanical properties:          ? Tensile strength          ? Yield strength          ? Ductility          ? Impact strength</p> <p>Identify steel types and classification systems:</p> <p>Characteristics of:          ? Low carbon steel          ? Medium carbon steel          ? High carbon steel          ? Stainless steel</p> <p>Classification numbering systems of plain carbon steels          ? SAE          ? AISI          ? ASTM          ? CSA</p> <p>Metal (steel) identification methods:          ? Appearance          ? Hardness test          ? Magnetic test          ? Chisel test          ? Fracture test          ? Flame test          ? Spark test          ? Weight test</p> <p>Identify factors affecting the formability and weldability of the following metals:          o Carbon and low alloy steels          o Stainless steels          o Aluminum and aluminum alloys          o Cast iron and non-ferrous metals</p>
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
Describe methods of distortion control.	<ul style="list-style-type: none"> <li>• Selection of preventative method</li> <li>• Preheating</li> <li>• Pre-setting joints</li> <li>• Jigs and fixtures</li> <li>• Effects of joint configuration, weld size, travel speed and multiple pass verses single pass               <ul style="list-style-type: none"> <li>• Perform correction of weld distortion</li> </ul> </li> </ul>
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
Explain the function and application of destructive and non-destructive testing	<p>Explain the function and application of mechanical test methods:          o Tensile testing</p>



	methods for welds.	<ul style="list-style-type: none"> <li>o Impact testing</li> <li>o Bend testing</li> </ul> <p>Explain the function and application of non-destructive test methods:</p> <ul style="list-style-type: none"> <li>o Visual inspection</li> <li>o Penetrant testing</li> <li>o Magnetic particle testing</li> <li>o Radiography</li> <li>o Ultrasonic testing</li> </ul> <p>Describe inspection and testing methods:</p> <ul style="list-style-type: none"> <li>o Non-destructive testing</li> <li>o Destructive testing</li> <li>o Hydrostatic testing</li> <li>o Leak testing</li> <li>o Vacuum testing</li> </ul>
	<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
	Describe the requirements of welding codes and standards.	<p>Codes and standards related to structural steel construction:</p> <ul style="list-style-type: none"> <li>o CSA W47.1</li> <li>o CSA W59</li> </ul> <p>Codes and standards related to boilers and pressure vessels:</p> <ul style="list-style-type: none"> <li>o ASME Boiler and Pressure Vessel Code</li> <li>o CSA B51 Boiler, Pressure Vessel and Pressure Piping Code</li> </ul> <p>Codes and standards related to piping systems:</p> <ul style="list-style-type: none"> <li>o ASME B31 Code for Pressure Piping</li> <li>o CSA Standard Z662 Oil and Gas Pipeline Systems</li> </ul> <p>Codes and standards related to storage tanks:</p> <ul style="list-style-type: none"> <li>o API 650</li> </ul> <ul style="list-style-type: none"> <li>• CSA W48 Filler Metal Requirements</li> <li>• Explain the requirements for welding performance qualification testing</li> <li>• Explain the requirements for welding procedure qualification testing</li> </ul>
	<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
	Describe the features of weld quality, welding discontinuity and welding procedures.	<ul style="list-style-type: none"> <li>• Define welding discontinuities and their effect on weld quality</li> <li>• Describe the need for other functions to assure weld quality</li> <li>• Define procedures for correction of defective weld quality</li> </ul>
<b>Date:</b>	July 25, 2019	
<b>Addendum:</b>	Please refer to the course outline addendum on the Learning Management System for further information.	

