

**ANNEX B OF CMO NO. 20, SERIES OF 2015
BACHELOR OF SCIENCE IN MARINE ENGINEERING
COURSE SPECIFICATIONS**

Course Code	:	Machine Shop 3
Course Descriptive Title	:	Gas and Electric Welding
Course Credits	:	2 units
Lecture Contact Hours per Week	:	1 hour
Laboratory Contact Hours per Week	:	4 hours
Prerequisite	:	None
Reference/s	:	<ol style="list-style-type: none"> 1. Table A-III/1 of the 1978 STCW Code as amended 2. IMO Model Course 7.04 (OIC Nav) 3. Annex A of CMO No. 20, Series of 2015 (Curriculum Mapping for BSMarE) 4. STCW'78 as amended

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	PERFORMANCE	APPROX HOURS
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board	Use of hand tools, machine tools and measuring instruments	<p><i>Welding and Soldering</i></p> <p><u>Principles of electric arc welding</u></p> <ul style="list-style-type: none"> - Explains the suitability of low-, medium-and high-carbon steels for welding - Sketches the relative positions of the electrode and the base metal when metallic arc welding manually - States that A.C. welding is more common than D.C. welding - Sketches the components and circuit necessary in arc welding - Describes how welding electrodes are classified - Describes the purpose of the electrode covering - Explains how electrodes should be stored - Explains how damp electrodes can be detected - States how damp electrodes can be dried - Identifies the tools commonly used when welding - Describes the principle of metal arc gas-shielded welding - Describes the principle of tungsten inert-gas welding 	5 Hours
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<p><u>Principles of gas welding</u></p> <ul style="list-style-type: none"> - Explains the basic principles of gas welding - Describes the principle features of a low-pressure system - Explains what is meant by a high-pressure system - Lists the fuel-oxygen/air mixtures - Describes the flame produced when using oxygen and acetylene - Explains the effect on the flame of mixing different proportions of oxygen and acetylene - Describes the dangers of handling acetylene gas and the methods used for its storage in cylinders - Explains why the maximum discharge rate should not be exceeded - Identifies the safety fittings for an acetylene gas cylinder - Compares the need for control of gas pressure for: <ul style="list-style-type: none"> - Welding - Cutting - States that a two-stage gas pressure regulator gives a more precise control than a single-stage regulator - Identifies the safety features of gas pressure gauges 	5 Hours

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	PERFORMANCE	APPROX HOURS
		<ul style="list-style-type: none"> - States that high-pressure blowpipes are unsuitable for use in a low-pressure system - Identifies the principle parts of a high-pressure blowpipe - Explains the care necessary for: <ul style="list-style-type: none"> - Blowpipe - Hoses - Explains the purpose of hose check valves and flashback arresters - Describes the sequence to be followed if a flashback arrester is triggered - Explains the basic purpose of a cylinder manifold system - Names the gas, states its approximate pressure and describes the cylinder outlet thread, given the colours of cylinders likely to be encountered - Sketches the relative positions of the base metal, the filler wire and the welding nozzle when using: <ul style="list-style-type: none"> - The leftward technique - The rightward technique - Demonstrates the welding procedure for both techniques in the above objective - Explains the limitations of leftward welding - Explains the advantage of the rightward technique 	
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<u>Welded joints in low-carbon steel</u> <ul style="list-style-type: none"> - Describes a butt weld - Explains why plate edges are prepared - Sketches cross-sections: <ul style="list-style-type: none"> - Of typical plate-edge preparations - Indicating the features of a good weld - Of a typical multi-run weld - Describe a fillet weld - Sketches cross-sections of fillet joints, showing: <ul style="list-style-type: none"> - Throat length with concave and convex reinforcement - Tee joint plate-edge preparations - Corner joints - Lap joint 	20 Hours
		<u>Supervised Student Activity</u> <ul style="list-style-type: none"> - Makes welded butt and fillet joints, using manual electric arc and gas welding techniques 	7 Hours
		<u>Common faults in welded joints</u> <ul style="list-style-type: none"> - Identifies the errors which can occur when lining up joints prior to welding - Explains the cause of distortion 	1 Hour

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Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<ul style="list-style-type: none"> - Sketches a butt-welded and a fillet-welded joint, showing the effect of distortion 	
		<u>Thermal cutting</u> <ul style="list-style-type: none"> - States the applications of flame and plasma-arc cutting - Explains the principle upon which oxygen is used to cut iron - Describes the conditions necessary in order to cut when using an oxygen-fuel gas mixture - Identifies the common engineering metals which can and cannot be cut using an oxygen-fuel gas mixture - Lists the gases commonly used as fuels - Identifies the controls on a gas cutting blowpipe and demonstrates their purpose - Explains the factors which affect the quality of cutting - <u>States the basic principles of plasma-arc cutting</u> 	10 Hours
		<u>Supervised Student Activity</u> <ul style="list-style-type: none"> - Uses an oxygen-fuel gas cutting torch to cut straight lines and curves in mild steel plate up to 10 mm thick to crop mild steel sections 	7 Hours
		<u>Inspection</u> <ul style="list-style-type: none"> - Constructs a checklist for visual inspection during: <ul style="list-style-type: none"> - Electric welding - Gas welding - Constructs a list of the points to check visually after welding is completed - Explains the limitations of visual inspection - Carries out the following destructive tests on welded joints: <ul style="list-style-type: none"> - Bend - Macroscopic - Nick-break - Carries out penetrant tests on welded joints - Describes the principle of: <ul style="list-style-type: none"> - Ultrasonic inspection - Microscopic inspection - Lists common weld defects and their causes 	5 Hours
		<u>Soldering</u> <ul style="list-style-type: none"> - Explains why brazing is used - Describes the basic principles of soldering 	10 Hours
		<u>Soft soldering</u> <ul style="list-style-type: none"> - Explains the limitations of soft-soldered joints and the reasons 	

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Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<ul style="list-style-type: none"> - Explains how soft-soldered joints might be strengthened - With the aid of a simple sketch, describe the uses of a soldering iron - States the main hazards and precautions necessary when soldering - Tin is a soldering iron and makes soft-soldered joints - Describes the process of sweating joints - Explains the need for a flux, its application and its removal - Explains the differences between and the uses of the following fluxes: <ul style="list-style-type: none"> - Passive - Active - Explains the characteristics and uses of plumber's solder 	
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<u>Hard soldering</u> <ul style="list-style-type: none"> - State the reason for hard soldering - Identifies the metals which can be joined by: <ul style="list-style-type: none"> - Silver solder - Brazing - Bronze welding - States the processes to be followed, stating the approximate melting point when: <ul style="list-style-type: none"> - Silver solder - Brazing - Bronze welding 	
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<u>Supervised Student Activity</u> <ul style="list-style-type: none"> - Makes soft-and hard-soldering joints 	4 Hours
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<u>Heat Treatment of Carbon Steel</u> <ul style="list-style-type: none"> - Carries out the heat treatments for different application conditions and typical tool applications - Tests a hardened and tempered cutting edge, taking the necessary safety precautions 	3 Hours

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Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (cont)	Use of hand tools, machine tools and measuring instruments (cont)	<u>Safety and health when welding</u> <ul style="list-style-type: none"> - States the protective clothing to be worn when welding on a bench - States the additional protection necessary when welding in more difficult situations - States the measures necessary to protect other personnel when welding - States the precautions related specifically to gas welding - Explains the effect of radiation from welding on the eyes and skin - Describes the dangers of fumes from welding and how this should be dealt with - Explains the principles of the precautions to be taken when welding or when a similar heating process is to be performed in tanks which have contained combustibles - States the precautions to be taken when working in confined spaces - States the care and precautions necessary when handling and storing compressed gas cylinders, with particular reference to acetylene and oxygen 	3 Hours
		Total No. of Hours	80 Hours

* discrepancy between course specifications and course map total hours is intended for assessment