

COURSE PACKAGE

Part A: Course Specifications

Course Code	:	Mach 1						
Course Descriptive Title	:	Machine Shop Theory						
Prerequisite	:	None			Co requisite	:	None	
Year Level	:	First Year			Semester Offered	:	First Semester	
Course Credits	:	3 units	Theoretical Contact Hours Per Week	:	3 hours	Demonstration/ Practical Work Contact Hours Per Week	:	0 hour
Course Description	:	This Course provides the students with fundamental knowledge and understanding in safe use of measuring instruments, hand tools, portable power tools, machining tools, sealants and packings, and welding equipment to carry out fabrications, maintenance and repair works on board ships.						
STCW Reference	:	STCW Table	Function	Competence	Knowledge, Understanding, and Proficiency			
		A-III/1	Maintenance and repair at the operational level	Appropriate use of hand tools, machine tools, and measuring instruments for fabrication and repair on board	Characteristics and limitations of materials used in construction and repair of ships and equipment Characteristics and limitations of process used for fabrication and repair Properties and parameters considered in the fabrication and repair of systems and components Methods for carrying out safe emergency/temporary repairs Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools, and measuring instruments			



					Use of hand tools, machine tools, and measuring instruments Use of various types of sealants and packings.
Course Outcome	:	PO-E.8 PO-E.9	<p><i>At the end of the course, the student must be able to:</i></p> <p>CO1. Explain the safety measures in the use of hand tools, portable power tools, measuring instruments, machining tools, welding equipment, and sealants and packings based on manufacturer's specifications and industry best practices.</p> <p>CO2. Identify the appropriate use of hand tools, portable power tools, measuring instruments, machining tools, sealants and packings, and gas and electric welding equipment in accordance with manuals and/or industry best practices</p>		
Course Intake Limitations	:	The number of students that can be accommodated shall not exceed 40 for lectures and 20 for laboratory.			
Faculty Requirement	:	<p>Instructor The faculty that will be assigned to handle the Course must possess the following qualifications:</p> <ul style="list-style-type: none"> ● Graduate of Bachelor of Science in Marine Engineering; ● Officer-in-charge of an Engineering Watch on seagoing ships powered by propulsion machinery of 750 kW propulsion power or more; ● completed Training Course for Instructors (IMO Model Course 6.09); ● completed Training Course on Assessment, Examination and Certification of Seafarers (IMO Model Course 3.12); <p>OR</p> <ul style="list-style-type: none"> ● Registered professional holding a bachelor's degree in Mechanical Engineering or holder of bachelor's degree in Industrial Technology with major in machine shop technology and/or welding and fabrication technology with Master's Degree in the same discipline; ● with at least one (1) year industrial and/or teaching experience; ● completed Approved Training Course for Instructors (IMO Model Course 6.09); ● completed Approved Training Course on Assessment, Examination and Certification of Seafarers (IMO Model Course 3.12); 			



	<p>Assessor The assessor assigned shall have the same qualifications above. <i>Note:</i></p> <ol style="list-style-type: none"> 1. <i>The instructor shall conduct the formative assessment.</i> 2. <i>Summative assessment shall be conducted by an Assessor not teaching the students (assessee).</i> 																																
<p>Teaching Facilities and Equipment</p>	<p>CLASSROOM The standard classroom size shall be a minimum of 48 square meters; no side shall be less than 6 meters for a class of 40 students. The classroom must be illuminated at 50.76 Lux and well-ventilated. It should contain the following:</p> <ul style="list-style-type: none"> • Tables and chairs or armed chairs • Whiteboards or chalkboards • Multimedia equipment <p style="text-align: center;">EQUIPMENT FOR CLASS DELIVERY / DISCUSSION</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Facilities and Equipment</th> <th style="text-align: center;">Equipment to Student Ratio</th> </tr> </thead> <tbody> <tr> <td colspan="2" style="text-align: center;"><i>Measuring Instruments (Shall be provided by the MHEI)</i></td> </tr> <tr> <td>1. Dial micrometer with magnetic base</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>2. Gauge, depth</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>3. Gauge, feeler (metric/inches)</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>4. Gauge, screw pitch (metric/inches)</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>5. Gauge, surface</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>8. Micrometer (inside and outside)</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>9. Steel tape</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>10. Steel ruler</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>11. L-square (steel)</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>12. Vernier caliper (steel)</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>13. Divider</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>14. Scriber</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td>15. Level bar</td> <td style="text-align: center;">1:4</td> </tr> <tr> <td colspan="2" style="text-align: center;"><i>Basic Hand Tools (Shall be provided by the MHEI)</i></td> </tr> </tbody> </table>	Facilities and Equipment	Equipment to Student Ratio	<i>Measuring Instruments (Shall be provided by the MHEI)</i>		1. Dial micrometer with magnetic base	1:4	2. Gauge, depth	1:4	3. Gauge, feeler (metric/inches)	1:4	4. Gauge, screw pitch (metric/inches)	1:4	5. Gauge, surface	1:4	8. Micrometer (inside and outside)	1:4	9. Steel tape	1:4	10. Steel ruler	1:4	11. L-square (steel)	1:4	12. Vernier caliper (steel)	1:4	13. Divider	1:4	14. Scriber	1:4	15. Level bar	1:4	<i>Basic Hand Tools (Shall be provided by the MHEI)</i>	
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		<ol style="list-style-type: none"> 1. Screwdriver, philips (various sizes) 2. Screwdriver, flat (various sizes) 3. Pliers, mechanical (lineman's pliers) 4. Vise grips 5. Ball peen hammer 6. Straight peen hammer 7. Sledge hammer 8. Torque wrench 9. Hacksaw 10. Drift punch 11. Center punch 60mm 12. Center punch 90mm 13. Drive pin punch 14. Gasket hole punch set 15. Flaring tools 16. Copper Tube cutters 17. Double-cut rough files 18. Second-cut smooth files 19. Single-cut smooth files 20. Second-cut files 21. Hand wire brush 22. Wheel type brush 23. Cup-type brush 24. Screw/bolt extractor 25. Bearing puller 26. Chain Block (min 0.5-ton capacity) 27. Metal cutting shear (snip) 28. Flat chisel 29. Cross-cut chisel 30. Diamond cut chisel 31. Grease gun 32. Oil applicator 33. Reamer handset (assorted) 34. Wrench, socket type, 10mm – 24mm 35. Wrench, open type (metric), 10mm – 24mm 36. Tap and dies
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Teaching Aids	:	<p>TA1 Machine Shop Safety TA2 Measuring Instruments TA3 Hand Tools TA4 Power and Pneumatic Hand Tools TA5 Drilling Machine & Grinding Machine TA6 Lathe Machine TA7 Welding Equipment TA8 Sealants and Packings</p> <p><i>Note: The MHEIs can use alternative and/or additional teaching aids as deemed necessary to meet the learning outcomes of this course.</i></p>																	
References/ Bibliographies	:	<p>References: R1 Maritime and Coastguard Agency (2011). <i>Code of Safe Working Practices for Merchant Seamen</i>. London: The Stationery Office R2 Flood, C.R. (1981) <i>Fabrication, Welding and Metal Joining Processes</i>. London: Butterworth R3 Kibbe, R. (2010) <i>Machine Tool Practices</i>. Pearson Education</p>																	



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| | <p>R4 Miller, R. (2004) Machine shop tools and operations. Wiley Publishing
R5 Pritchard, R.T. (1979) Technician Workshop Processes and Materials. London: Hodder and Stoughton
R6 Manufacturer's manual</p> <p><i>Note: The MHEIs can use alternative and/or additional references/bibliographies as deemed necessary to meet the learning outcomes of this course.</i></p> |
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Part B: Course Outline and Timetable

Term	Week	Topic	Time Allotment (in hours)	
			Theoretical	Demonstration / Practical Work
<i>Note: MHEIs shall determine the number of periods for terms the semester is divided based on their school calendar activities</i>	1-2	1. Machine Shop Safety 1.1. Safety Principles 1.2. Risk Assessment and its elements 1.3. Personal Protective Equipment 1.4. Safety Signs 1.5. Fire Precautions 1.6. Safety systems of work 1.7. Permit to Work Systems 1.8. Use of Work Equipment	6	-
	3-4	2. Measuring Instruments 2.1. Reading Measuring Scales 2.2. Measuring and Layout Tools	6	-
	5-8	3. Hand Tools 3.1. Fastening and Prying Tools 3.2. Sawing and Cutting Tools 3.3. Boring and Clamping Tools 3.4. Smoothing Tools 3.5. Brushes 3.6. Tap, Dies, and Extractors 3.7. Benders 3.8. Pullers and chain blocks 3.9. Rigging Tools	9	-



Term	Week	Topic	Time Allotment (in hours)	
			Theoretical	Demonstration / Practical Work
	7-9	4. Power and Pneumatic Hand Tools 4.1. Portable Electric Drills 4.2. Portable Electric Saw 4.3. Grinder	6	-
	10-13	5. Machining Tools 5.1 Drilling Machine 5.2 Grinding Machine 5.3 Lathe Machine	12	-
	14-16	6. Welding Equipment 6.1 Electric Welding Machines 6.2 Gas Electric Welding	9	-
	17	7. Sealants and Packings	3	-
Sub-total (Contact Hours)			51	-
Total Contact Hours			51	
Examination and Assessment				

Note:

1. The MHEIs are to develop their respective timetable according to their resources but meets with the minimum time allocation for the contact hours. OR
2. The MHEIs shall determine the time allotment for the conduct of summative assessments.



Part C: Course Syllabus

CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
CO1	<p>1. Machine Shop Safety</p> <ol style="list-style-type: none"> 1.1. Explain safety practices in the use of hand tools, portable power tools, measuring instruments, machining tools, welding equipment, and sealants and packings following manufacturers recommendation or industry best practices. 1.2. Explain the importance of risk assessment before any job on board. 1.3. Explain the procedure in wearing personal protective equipment in accordance to shipboard safety practices 1.4. Explain the importance of personal hygiene and first aid required when working at ship's workshops. 1.5. Identify the different safety signs/posters used onboard ships and its importance. 1.6. Explain the safety before, during and after work. 1.7. Explain the importance of work permits 1.8. Fill up a work permit correctly before starting work. 	R1, R3, R4	TA1
CO2	<p>2. Measuring Instruments</p> <ol style="list-style-type: none"> 2.1. Read scales, dials and gauges typically used on board ships 2.2. Use dividers to measure, transfer, or mark off distances in a workpiece. 2.3. Use an inside and outside steel Vernier caliper to determine the thickness or diameter of a workpiece. 2.4. Use an inside and outside micrometer to measure the thickness or diameter of a component. 2.5. Use a dial micrometer to measure the difference compared to a reference or correcting parallelism. 2.6. Use rules and steels tapes to measure length on of a workpiece 2.7. Use a level bar to prove a plane of workpiece its true vertical or horizontal 2.8. Use a scribe to mark or score on workpiece 2.9. Use steel L-squares to prove a workpiece perpendicular or squared. 2.10. Use a depth gauge to measure the depth on a workpiece 2.11. Use a feeler gauge to measure the clearance of a component. 2.12. Use a screw pitch gauge to determine the pitch of a thread. 2.13. Use a surface gauge to transfer a dimension either to or from a work piece. 	R1, R4, R6	TA2

CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
CO2	<p>3. Hand Tools Fastening and Prying Tools</p> <p>3.1. Identify and explain the usage of the following types of pliers:</p> <ol style="list-style-type: none"> a. Slip joint pliers b. Diagonal cutting pliers c. Longnose pliers d. Flat nose pliers e. End cutting pliers f. Vise grips g. Tongue and groove pliers <p>3.2. Identify and explain the usage of the following types of hammers:</p> <ol style="list-style-type: none"> a. Claw hammers b. Ball peen hammer c. Sledgehammer d. Soft face hammer e. Lead or copper hammer f. Inserted face hammer g. Welders hammer h. Mallets <p>3.3. Identify and explain the usage of the following types of screwdrivers:</p> <ol style="list-style-type: none"> a. Flathead screwdrivers b. Philips head screwdrivers c. Offset screwdrivers d. Ratchet Screw Driver e. Allen Screwdrivers <p>3.4. Identify and explain the usage of the following types of wrenches:</p>	R3, R4, R6	TA3



CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
	<ul style="list-style-type: none"> a. Open-end wrenches b. Box end wrench c. Split box end wrench d. Combination wrench e. Allen wrench f. Pipe wrenches g. Strap pipe wrench h. Adjustable wrench i. Socket wrenches and adapters j. T handle wrench k. Torque wrenches l. F type Valve Wrench / Valve Spanner <p>Sawing and Cutting Tools</p> <ul style="list-style-type: none"> 3.5. Identify and explain the usage of the following type of saw: <ul style="list-style-type: none"> a. Hand saw b. Hacksaw 3.6. Identify and explain the usage of the following types of chisels: <ul style="list-style-type: none"> a. Flat chisel b. Cross-cut chisel c. Diamond point chisel d. Round nose chisel 3.7. Identify and explain the usage of the following types of punches: <ul style="list-style-type: none"> a. Center punches b. Drift punch c. Drive pin punch 3.8. Identify and explain the usage of the following types gasket cutter: <ul style="list-style-type: none"> a. Circle gasket cutter b. Gasket hole punch set 		



CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
	<p>3.9. Identify and explain the usage of the following types of pipes cutting and threading tools:</p> <ul style="list-style-type: none"> a. Pipe cutters b. Pipe threading set <p>3.10. Identify and explain the usage of the following types tube cutters and flaring tools:</p> <ul style="list-style-type: none"> 1. Tube cutters 2. Flaring tools <p>3.11. Identify and explain the usage of the following types of shears and nippers.</p> <p>Boring and Clamping Tools</p> <p>3.12. Identify and explain the usage of the following types of reamers:</p> <ul style="list-style-type: none"> a. Solid straight hole reamer b. Solid taper pin reamer <p>3.13. Identify and explain the usage of the following types of vises:</p> <ul style="list-style-type: none"> a. Machinist bench vise b. Round pipe vise <p>3.14. Identify and explain the usage of the following types clamps:</p> <ul style="list-style-type: none"> a. C – clamps b. Beam block clamp <p>Smoothing Tools</p> <p>3.15. Identify and explain the usage of the following types of files according to shape and according to cut:</p> <ul style="list-style-type: none"> a. Flat file b. Triangular file c. Round file 		



CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
	<p>d. Half-round file e. Square file</p> <p>Brushes</p> <p>3.16. Identify and explain the usage of the following types of brushes:</p> <p>a. Paintbrush b. Wire brush c. Wheel type brush d. Cup type wire brush e. File card brush f. Flap brush</p> <p>Tap, Dies, and Extractors</p> <p>3.17. Identify and explain the usage of the following types taps, dies, and extractors:</p> <p>a. Taper, plug, and bottoming hand taps b. Rethreading die c. Screw/bolt extractors d. Tap extractors</p> <p>3.18. Demonstrate the use of rethreading die and screw/bolt extractors in a given activity in accordance with manufacturer's manual/recommendation or industry best practices. (<i>Laboratory activity</i>)</p> <p>Benders</p> <p>3.19. Identify and explain the usage of the following types of benders:</p> <p>a. Hand tube bender b. Hydraulic pipe bender</p> <p>3.20. Identify the minimum bend radius with regard to pipe diameter, thickness, material and process to be used.</p> <p>Pullers and chain blocks</p>		



CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
	<p>3.21. Identify and explain the usage of the following types of pullers:</p> <ol style="list-style-type: none"> a. Universal gear puller b. Gear and bearing puller <p>Rigging Tools</p> <p>3.22. Identify and explain the usage of the following types of rigging tools:</p> <ol style="list-style-type: none"> a. Chain blocks b. Hooks, eye bolt and shackles c. Wire rope and polyester slings <p>4. Power Drills and Pneumatic Hand Tools</p> <p>Portable Power Drills</p> <ol style="list-style-type: none"> 4.1. Identify the different types of portable power drills. 4.2. Explain the safety precautions that apply to portable electric and pneumatic power drills. 4.3. Explain briefly how drills are held in a machine, emphasizing dangerous practices and the problem when drilling thin plate 4.4. Explain the procedures for inserting and removing drills with parallel and with tapered shanks <p>Portable Electric Saw</p> <ol style="list-style-type: none"> 4.5. Identify the different types of portable electrical saws. 4.6. Explain the proper use of portable electrical saws and its corresponding safety precautions. <p>Portable Electric Grinder</p> <ol style="list-style-type: none"> 4.7. Explain the purpose of a grinding machine 4.8. Identify the different types of grinders 4.9. Explain the proper use of portable electric grinder and its corresponding safety precautions. 		



CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
CO2	<p>5. Machining Tools</p> <p>Drilling Machine</p> <p>5.1 Lists the uses of a drilling machine</p> <p>5.2 Explain briefly how drills are held in a machine</p> <p>5.3 Explain how a work piece is held in place, emphasizing dangerous practice and the particular problem when drilling thin plate</p> <p>5.4 Explain the procedure for inserting and removing drill bit with parallel and with tapered shanks</p> <p>5.5 Explain the necessary care to avoid accidents when using a drilling machine and choosing the appropriate speed for drilling</p> <p>5.6 Explain safe and proper operation of the drill press and portable electric drill</p> <p>Grinding Machine</p> <p>5.7 Explain the purpose of a grinding machine</p> <p>5.8 Explain how to use a grinding machine such as pedestal grinder and portable electric grinder</p> <p>5.9 Explain the procedure to ensure safety when using a grinding machine with emphasis on:</p> <ol style="list-style-type: none"> a. Correct distance between the grinding disc and tool rest b. Use safety glass shield or eye shield <p>5.10 Explain the procedure for inserting and removing grinding stone and grinding disc</p> <p>5.10 Explain the importance of selecting the correct type of grinding stone and grinding disc</p> <p>Lathe Machine</p> <p>5.11 Explain the primary purpose of a lathe machine, its construction and functions</p> <p>5.12 Explain the function of chucks, live centres, face plates, dogs, material removal, thread cutting and taper turning</p> <p>5.13 On a given diagram or machine, identify the main features of a modern lathe</p> <p>5.14 Identify the hazards when using lathe machine</p> <p>5.15 Explain the importance of choosing the right speed during operation</p> <p>5.16 Explain how to operate the center lathe machine</p> <p>5.17 Explain the proper care and basic maintenance done on a lathe machine</p> <p>5.18 Explain various cutting tools in terms of materials, figures and functions</p>	R3, R4, R5, R6	TA5, TA6



CO	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
CO2	<p>4. Welding Equipment Electric Welding 6.1 Explain the basic construction and operating principle of electric welding machine 6.2 Explain the different types of electric welding equipment 6.3 Explain the procedures in using electric welding equipment in accordance with manual and/or best industry practices</p> <p>Gas Welding 6.4 Explain the basic construction and operating principle of gas welding and cutting equipment 6.5 Explain the different types of gas welding equipment 6.6 Explain the procedures in using gas welding equipment in accordance with manual and/or best industry practices</p>	R2, R6	TA7
CO2	<p>5. Sealants and Packings 7.1 Explain the purpose and different uses of sealants and packings 7.2 Explain the safety precautions in handling sealants 7.3 Explain the types and characteristics of sealants and packings 7.4 Explain the procedures in applying sealant during repair in accordance with manufacturer's recommendation and/or best industry practices 7.5 Explain the consequences of not installing new packing properly 7.6 Explain the procedures in installing packing on pumps, valves and other rotating equipment with manufacturer's manual and/or best industry practices</p>	R6	TA8

Note: The MHEIs are to develop Part D: Detailed Teaching Syllabus and Instructional Materials (IMs), and Part E: Course Assessment and Assessment Tools (ATs) which satisfactorily meets with the requirements of the course as prescribed in the course outcomes and learning outcomes.

