






- Semester Learning Plan (RPS)

		<p align="center"><b>SURABAYA MERCHANT MARINE POLYTECHNIC DIPLOMA - TECHNICAL III</b></p>					
<p align="center"><b>SEMESTER LESSON PLAN</b></p>							
<b>COURSE (MK)</b>		<b>CODE</b>	<b>MK Family</b>	<b>WEIGHT (SKS)</b>		<b>SEMESTER</b>	<b>Date of Preparation</b>
Marine engineering Marine engineering Maintenance and repair on shipboard II		T202230	MKDK	T=1	P=2	III	8 Agustus 2022
<b>AUTHORIZATION</b>		<b>RPS Developer</b>		<b>RMK Coordinator</b>		<b>Head of Study Program</b>	
		 <b>RAMA SYAHPUTRA S., S.ST. Pel</b>		 <b>DIRHAMSYAH, S.E., M.Pd.</b>		 <b>MONIKA RETNO GUNARTI, S.Si.T., M.Pd.</b>	
<b>Learning Outcomes (CP)</b>	<b>CPL-PRODI charged to MK</b>						
	CPL1	Able to regulate and apply appropriately the use of hand tool equipment, machine tools and measuring instruments for fabrication and repair on board.					
	CPL2	Able to evaluate the implementation of maintenance and repair of ship machinery and equipment.					
	CPL3	Mastering the theoretical concepts of engineering technology needed in the field of specialization of ship machinery maintenance and repair systems including supporting equipment .					

	CPL4	Mastering practical knowledge of engineering technology in identifying the cause of damage and repairing damage to ship machinery.				
	Course Learning Outcomes (CPMK)					
	CPMK1	Able to demonstrates a knowledge and understanding of maintenance and repair such as dismantling, adjustment and reass embling of machinery and equipment				
	CPMK2	Able to demonstrates a knowledge and understanding of design characteristics and selection of materials in cons truction of equipment.				
	Final ability of each learning stage (Sub-CPMK)					
	Sub-CPMK1	Able To Apply Diesel engine				
	Sub-CPMK2	Able To Apply Turbocharger				
	Sub-CPMK3	Able To Apply Boiler				
	Sub-CPMK4	Able To Apply Shafting system				
	Sub-CPMK5	Able To Apply Refrigerator				
	Sub-CPMK6	Able To Apply Oils, fuels and lubricating system				
	Sub-CPMK7	Able to apply Deck machinery				
	Sub-CPMK8	Able to apply Selection of materials in construction of equipment				
	Sub-CPMK9	Able to apply Design characteristics				
	Sub-CPMK10	Able to apply Design characteristics of bearings				
	CPL Map – CPMK					
		CPL1	CPL2	CPL3	CPL4	
	CPMK1	✓	✓	✓		
	CPMK2	✓	✓		✓	
Brief Description MK	The cadets are able to understand how to Operate Main and Auxiliary Machinery and Associated Control System sthem in carrying out maintenance and repair of ship machinery and equipment).					
Study Material:	Maintenance and repair such as dismantling, adjustment and Reass embling of machinery and equipment 1. Diesel engine					

<b>Learning Material</b>	2. Turbocharger 3. Boiler 4. Shafting system 5. Refrigerator 6. Oils, fuels and lubricating system 7. Deck machinery 8. Selection of materials in construction of equipment 9. Design characteristics 1. Design characteristics of bearings	
<b>Pustaka</b>	<b>Main :</b>	
	1. R1: International convention on standards of training, certification and watchkeeping for seafarers (STCW), 1978, as amended (2011 Edition) (ISBN 978-92-801-15284) 2. T2: Jackson, L. and Morton, T.D., General Engineering Knowledge for Marine Engineers. 5th ed. London, Thomas Reed Publications Ltd, 1990 (ISBN 09-47-63776-1) 3. T5: Taylor, D.A., Introduction to Marine Engineering. 2nd ed. London, Butterworth, 1990 (ISBN 07-50-6253-9) 4. T9: Jackson, L. and Morton, T.D., General Engineering Knowledge for Marine Engineers. 5th ed. London, Thomas Reed Publications Ltd, 1990 (ISBN 09-47-63776-1) 5. T12: Hannah-Hillier, J., Applied Mechanics. Harlow, Longman, 1995 (ISBN 05-82-25632-1) 6. T13: Joel, R., Basic Engineering Thermodynamics in S.I. Units. 5th ed. Harlow, Longman, 1996 (ISBN 05-82-25629-1) 7. A1: Instructor Manual (Part D of this course) 8. A2: Manufacturers' Manuals, Manufacturers' instruction manuals and handbooks are the main source of information in instructing the correct procedures in dismantling, inspection and assembly of the Specific items of machinery listed. 9. A3: Video player/DVD player, personal computer 10. V14: Handling and treatment of heavy fuels (Code No. 143) 11. V15: Fuel oil burner theory and diagnostics (Code No. 604) 12. V16: Internal care of marine boilers (Code No. 150)	
	<b>Supporter :</b>	
	<i>Materials from lecturers and the Internet</i>	
<b>Lecturer</b>	Eko Prayitno	

Subject requirements		Marine engineering Maintenance and repair on shipboard II					
week -	The final ability of each learning stage (Sub-CPMK)	Valuation		Help Learning, Learning Methods, Student Assignments, [ Time Estimate]		Learning Materials [ Pustaka ]	Assess ment Weight (%)
		Indicator	Criteria & Forms	Learning Experience (Luring (offline))	Learning Media / Online (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1,2,3	Able to understand maintenance and repair Diesel engine	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Dismantles and inspects all parts for wear and deterioration, including: <ul style="list-style-type: none"> <li>- Pistons</li> <li>- Rings</li> <li>- Liners</li> <li>- Bearings</li> <li>- Valves</li> <li>- Cooling passages</li> <li>- Crankshaft alignment</li> <li>- Lubrication system</li> </ul> </li> <li>- Refurbishes diesel engine components: <ul style="list-style-type: none"> <li>- Cylinder heads</li> <li>- Exhaust valves</li> <li>- Air-start valves</li> <li>- Fuel injector</li> </ul> </li> </ul>	Demonstrates a knowledge and understanding of ISM Code, SMS & Safety measures to be taken	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus [P (2 X 170)]</li> </ul>	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Dismantles and inspects all parts for wear and deterioration, including: <ul style="list-style-type: none"> <li>- Pistons</li> <li>- Rings</li> <li>- Liners</li> <li>- Bearings</li> <li>- Valves</li> <li>- Cooling passages</li> <li>- Crankshaft alignment</li> <li>- Lubrication system</li> </ul> </li> <li>- Diesel engine components:</li> </ul>	Presenc e & Involve ment : 1,2% Task assignm ent : 1 %

		<ul style="list-style-type: none"> <li>- Relief valve</li> <li>- Fuel injection pump</li> <li>- Reassembles</li> <li>- Checks timing and ascertains freedom of movement</li> <li>- Checks condition of lubrication oil</li> <li>- Purges air from fuel system</li> <li>- Test runs</li> </ul>				<ul style="list-style-type: none"> <li>- Cylinder heads</li> <li>- Exhaust valves</li> <li>- Air-start valves</li> <li>- Fuel injector</li> <li>- Relief valve</li> <li>- Fuel injection pump</li> <li>- Reassembles</li> <li>- Timing and ascertains freedom of movement</li> <li>- Condition of lubrication oil</li> <li>- Purges air from fuel system</li> <li>- Test runs</li> </ul>	
<b>4 &amp; 5</b>	Able to understand maintenance and repair Turbocharger	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Dismantles: <ul style="list-style-type: none"> <li>- Air filter</li> <li>- Air casing</li> <li>- Inducer (if fitted)</li> <li>- Impeller</li> <li>- Volute</li> <li>- Diffuser</li> <li>- Gas inlet grid</li> <li>- Nozzle ring</li> <li>- Rotor</li> </ul> </li> </ul>	Demonstrates a knowledge and understanding of fastening bolt, threaded & nut	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus [P (2 X 170)]</li> </ul>	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Dismantles: <ul style="list-style-type: none"> <li>- Air filter</li> <li>- Air casing</li> <li>- Inducer (if fitted)</li> <li>- Impeller</li> <li>- Volute</li> <li>- Diffuser</li> <li>- Gas inlet grid</li> <li>- Nozzle ring</li> <li>- Rotor</li> </ul> </li> </ul>	Presenc e & Involve ment : 1,2% Task assignm ent : 1 %

		<ul style="list-style-type: none"> <li>- Bearings</li> <li>- Examines all parts for wear and deterioration, paying particular attention to: <ul style="list-style-type: none"> <li>- Erosion in the air side</li> <li>- Erosion in the turbine nozzles and in the blades</li> <li>- Corrosion of the gas casing</li> <li>- Hard deposits</li> <li>- Condition of bearings</li> <li>- Condition of labyrinths</li> <li>- Lubrication system</li> </ul> </li> <li>- Reassembles and checks clearances</li> </ul>				<ul style="list-style-type: none"> <li>- Bearings</li> <li>- all parts for wear and deterioration, paying particular attention to: <ul style="list-style-type: none"> <li>- Erosion in the air side</li> <li>- Erosion in the turbine nozzles and in the blades</li> <li>- Corrosion of the gas casing</li> <li>- Hard deposits</li> <li>- Condition of bearings</li> <li>- Condition of labyrinths</li> <li>- Lubrication system</li> </ul> </li> <li>- Reassembles and checks clearances</li> </ul>	
<b>6</b>	Able to understand maintenance and repair Boiler	<ul style="list-style-type: none"> <li>- Explains the need for cleaning the fire side of a boiler and how to do it</li> <li>- Describes how to inspect the fire side of a boiler and repair/maintenance</li> </ul>	Demonstrates a knowledge and understanding safe emergency / temporary repairs	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus</li> <li>• [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>- The need for cleaning the fire side of a boiler and how to do it</li> <li>- How to inspect the fire side of a boiler and repair/maintenance</li> </ul>	Presence & Involvement : 1,2%

		<ul style="list-style-type: none"> <li>- Explains the need of cleaning up the water side of a boiler and how to do it</li> <li>- Describes how to inspect the water side of a boiler and the repair/maintenance</li> <li>- Describes how to restore the boiler after cleaning up the fire/water side</li> <li>- Describes how to repair the firebrick wall of a furnace</li> </ul>		<ul style="list-style-type: none"> <li>• [P (2 X 170)]</li> </ul>		<ul style="list-style-type: none"> <li>- The need of cleaning up the water side of a boiler and how to do it</li> <li>- How to inspect the water side of a boiler and the repair/maintenance</li> <li>- How to restore the boiler after cleaning up the fire/water side</li> <li>- How to repair the firebrick wall of a furnace</li> </ul>	Task assignment : 1 %
--	--	--	--	---	--	---	-----------------------

7	Able to understand maintenance and repair Shafting	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Thrust block</li> <li>- Stern tube</li> <li>- Shaft bearings</li> <li>- Shaft sealing equipment</li> </ul>	Demonstrates a knowledge and understanding of bolt, threaded & nut	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus</li> <li>• [P (2 X 170)]</li> </ul>	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Thrust block</li> <li>- Stern tube</li> <li>- Shaft bearings</li> <li>- Shaft sealing equipment</li> </ul>	Presenc e & Involve ment : 1,2% Task assignm ent : 1 %
8	<b>Midterm Evaluation / Midterm Exam</b>						30%
9 & 10	Able to understand maintenance and repair Refrigerator	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Compressors</li> <li>- Evaporator</li> <li>- Condenser</li> <li>- Expansion valve</li> <li>- Oil separator</li> </ul>	Demonstrates a knowledge and understanding of Centrifugal pumps	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus</li> <li>• [P (2 X 170)]</li> </ul>	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Compressors</li> <li>- Evaporator</li> <li>- Condenser</li> <li>- Expansion valve</li> <li>- Oil separator</li> </ul>	Presenc e & Involve ment : 1,2% Task assignm ent : 1 %



11	Able to understand maintenance and repair Oils, fuels and lubricating system	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Filters</li> <li>- Purifiers</li> <li>- Bearings</li> <li>- Settling-tanks</li> <li>- Tank contents gauges</li> </ul>	Knowledge and understanding of Reciprocating pumps	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus</li> <li>• [P (2 X 170)]</li> </ul>	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Filters</li> <li>- Purifiers</li> <li>- Bearings</li> <li>- Settling-tanks</li> <li>- Tank contents gauges</li> </ul>	Presence & Involvement : 1,2% Task assignment : 1 %
----	--	---	--	--	---	---	---

12	Able to understand maintenance and repair Deck machinery	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Lifeboat davits and gear</li> <li>- Mooring winch</li> <li>- Windlass</li> <li>- Winch</li> <li>- Crane</li> </ul>	Knowledge and understanding of Screw and gear pumps	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus [P (2 X 170)]</li> </ul>	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Lifeboat davits and gear</li> <li>- Mooring winch</li> <li>- Windlass</li> <li>- Winch</li> <li>- Crane</li> </ul>	Presenc e & Involve ment : 1,2% Task assignm ent : 1 %
13	Able to understand of selection of materials in construction of equipment	<ul style="list-style-type: none"> <li>- Explains what materials are used for constructing major parts of the following equipment:</li> <li>- Diesel engines: crank shaft, cylinder liner and head, piston, exhaust valve, bearing</li> <li>- Steam turbines: turbine casing, rotor, blade, nozzle, reduction gear</li> </ul>	materials in construction of equipment	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>- The materials are used for constructing major parts of the following equipment:</li> <li>- Diesel engines: crank shaft, cylinder liner and head, piston, exhaust valve, bearing</li> <li>- Steam turbines: turbine casing, rotor, blade, nozzle, reduction gear</li> </ul>	Presenc e & Involve ment : 1,2% Task assignm ent : 1 %

		<ul style="list-style-type: none"> <li>- Gas turbine: turbine casing, rotor, compressor, gas generator</li> <li>- Boilers: water tube, furnace, steam, water drum, super-heater</li> <li>- Shafting: propeller shaft, stern tube bearing, propeller</li> <li>- Pumps: impeller, casing, shaft, casing ring, sleeve, gear, screw, piston/ bucket ring</li> <li>- Heat exchangers: heating tube, cooling tube, shell</li> <li>- Compressors: piston ring, valve, cylinder block, cylinder liner</li> <li>- Purifiers: spindle, gravity disc/ring dam, bowl body</li> <li>- High pressure/temperature</li> </ul>				<ul style="list-style-type: none"> <li>- Gas turbine: turbine casing, rotor, compressor, gas generator</li> <li>- Boilers: water tube, furnace, steam, water drum, super-heater</li> <li>- Shafting: propeller shaft, stern tube bearing, propeller</li> <li>- Pumps: impeller, casing, shaft, casing ring, sleeve, gear, screw, piston/ bucket ring</li> <li>- Heat exchangers: heating tube, cooling tube, shell</li> <li>- Compressors: piston ring, valve, cylinder block, cylinder liner</li> <li>- Purifiers: spindle, gravity disc/ring dam, bowl body</li> <li>- High pressure/temperature</li> </ul>	
--	--	---	--	--	--	---	--

		valve: body, valve, valve seat				valve: body, valve, valve seat	
<b>14</b>	Able to understand of design characteristics	<ul style="list-style-type: none"> <li>- Explains design characteristics developed to improve performance in:</li> <li>- Highly skewed propeller</li> <li>- Construction of diesel engines</li> <li>- Construction of steam turbine</li> <li>- Construction of gas turbine</li> <li>- Construction of boiler</li> </ul>	Characteristics of bearings	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus</li> <li>• [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>- Explains design characteristics developed to improve performance in:</li> <li>- Highly skewed propeller</li> <li>- Construction of diesel engines</li> <li>- Construction of steam turbine</li> <li>- Construction of gas turbine</li> <li>- Construction of boiler</li> </ul>	Presenc e & Involve ment : 1,2% Task assignm ent : 1 %

15	<p>Able to understand of design characteristics of bearings</p>	<p><b>(Plain bearings)</b></p> <ul style="list-style-type: none"> <li>- Explains the limitations of direct-lined bearings</li> <li>- Describes solid and lined inserts</li> <li>- Describes briefly: <ul style="list-style-type: none"> <li>- Thick-walled liners</li> <li>- Medium-walled liners</li> <li>- Thin-walled liners</li> <li>- Wrapped bushes</li> </ul> </li> <li>- Lists the ideal properties of a lubrication oil for plain bearings</li> <li>- Describes the reasons for using white metal, copper-lead alloys, lead bronzes, tin bronzes, gun metals and aluminum-based alloys for plain bearings</li> </ul> <p><b>(Ball and roller bearings)</b></p>	<p>Demonstrates a knowledge and understanding of Heat exchangers</p>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Pelaksanaan Praktek [P (2 X 170)]</li> </ul>	<ul style="list-style-type: none"> <li>• Presentasi Dosen [T (1 X 50)]</li> <li>• Studi Kasus [P (2 X 170)]</li> </ul>	<p><b>(Plain bearings)</b></p> <ul style="list-style-type: none"> <li>- The limitations of direct-lined bearings</li> <li>- The solid and lined inserts</li> <li>- The briefly: <ul style="list-style-type: none"> <li>- Thick-walled liners</li> <li>- Medium-walled liners</li> <li>- Thin-walled liners</li> <li>- Wrapped bushes</li> </ul> </li> <li>- Lists the ideal properties of a lubrication oil for plain bearings</li> <li>- The reasons for using white metal, copper-lead alloys, lead bronzes, tin bronzes, gun metals and aluminum-based alloys for plain bearings</li> </ul> <p><b>(Ball and roller bearings)</b></p>	<p>Presenc e &amp; Involve ment : 1,2% Task assignm ent : 1 %</p>
----	---	--	--	--	--	---	---

		<ul style="list-style-type: none"> <li>- Compares the load-carrying abilities of ball and roller bearings</li> <li>- Compares the ability of ball and roller bearings to carry radial and axial loads</li> <li>- States the type of bearing suitable for shafts subject to angular misalignment</li> <li>- Describes how ball and roller bearings are lubricated</li> <li>- States the proportion of available volume to be filled when using grease</li> <li>- States the maximum height of lubricant in a stationary bearing when using oil</li> </ul>				<ul style="list-style-type: none"> <li>- The load-carrying abilities of ball and roller bearings</li> <li>- The ability of ball and roller bearings to carry radial and axial loads</li> <li>- The type of bearing suitable for shafts subject to angular misalignment</li> <li>- How ball and roller bearings are lubricated</li> <li>- The proportion of available volume to be filled when using grease</li> <li>- The maximum height of lubricant in a stationary bearing when using oil</li> </ul>	
<b>16</b>	<b>End of Semester Evaluation / End of Semester Exam</b>						<b>40%</b>

**Note :**

1. **1.Learning Outcomes of Study Program Graduates (CPL-Prodi)** is the ability possessed by every PRODI graduate which is an internalization of attitudes, mastery of knowledge and skills in accordance with the level of study program obtained through the learning process.
2. **CPL charged to the course** is some of the learning outcomes of study program graduates (CPL-PRODI) which are used for the formation / development of a course consisting of aspects of attitudes, general skills, special skills and knowledge.
3. **CP Course (CPMK)** is an ability that is described specifically from the CPL charged to the course, and is specific to the study material or learning material of the course.
4. **Sub-CP Course (Sub-CPMK)** is a specific described ability of CPMK that can be measured or observed and is the final ability planned at each stage of learning, and is specific to the learning material of the course.
5. **Indicators** of ability assessment in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** is a benchmark used as a measure or benchmark of learning achievement in assessment based on predetermined indicators. Assessment criteria is a guideline for appraisers so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Learning forms:** Lectures, Responses, Tutorials, Seminars or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yg setara.
10. **Learning Material** is a detail or description of study material that can be presented in the form of several points and sub-subjects.
11. **The assessment weight** is the percentage of assessment of each sub-CPMK achievement which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.  
**TM=Face-to-face, PT=Structured assignment, BM=Self-study.**



**SURABAYA MERCHANT MARINE POLYTECHNIC  
TECHNICAL DIPLOMA-III**

**SILABUS**


COURSES	Name	MARINE ENGINEERING MAINTENANCE AND REPAIR ON SHIPBOARD II
	Code	T202230
	Kredit	3 sks
	Semester	4
Brief Description COURSES		
The cadets are able to understand how to Operate Main and Auxiliary Machinery and Associated Control System sthem in carrying out maintenance and repair of ship machinery and equipment).		
CPL-PRODI charged to MK		
CPL 1	Able to regulate and apply appropriately the use of hand tool equipment, machine tools and measuring instruments for fabrication and repair on board.	
CPL 2	Able to evaluate the implementation of maintenance and repair of ship machinery and equipment.	
CPL 3	Mastering the theoretical concepts of engineering technology needed in the field of specialization of ship machinery maintenance and repair systems including supporting equipment .	
CPL 4	Mastering practical knowledge of engineering technology in identifying the cause of damage and repairing damage to ship machinery.	
No	CPL-MK	
CPMK 1	Able to demonstrates a knowledge and understanding of maintenance and repair such as dismantling, adjustment and reass embling of machinery and equipment	
CPMK 2	Able to demonstrates a knowledge and understanding of design characteristics and selection of materials in	
Final ability of each learning stage (Sub-CPMK)		
No	Sub-CP-MK	



Sub-CPMK1	Able To Apply Diesel engine
Sub-CPMK2	Able To Apply Turbocharger
Sub-CPMK3	Able To Apply Boiler
Sub-CPMK4	Able To Apply Shafting system
Sub-CPMK5	Able To Apply Refrigerator
Sub-CPMK6	Able To Apply Oils, fuels and lubricating system
Sub-CPMK7	Able to apply Deck machinery
Sub-CPMK8	Able to apply Selection of materials in construction of equipment
Sub-CPMK9	Able to apply Design characteristics
Sub-CPMK10	Able to apply Design characteristics of bearings
Sub-CPMK3	Able to apply Steering gear
<b>LANGUAGE TREE</b>	
<ol style="list-style-type: none"> <li>1. Diesel engine</li> <li>2. Turbocharger</li> <li>3. Boiler</li> <li>4. Shafting system</li> <li>5. Refrigerator</li> <li>6. Oils, fuels and lubricating system</li> <li>7. Deck machinery</li> <li>8. Selection of materials in construction of equipment</li> <li>9. Design characteristics</li> <li>10. Design characteristics of bearings</li> </ol>	

<b>PUSTAKA</b>	
No	Main
1	<ol style="list-style-type: none"> <li>1. Maritime and Coastguard Agency (MCA), Code of Safe Working Practices for Merchant Seamen, London. The Stationery Office Publications Centre, Consolidated Edition, 2009 (ISBN 9780115530784</li> <li>2. Flood, C.R., Fabrication, Welding and Metal Joining Processes. London, Butterworth, 981 (ISBN 04-08-00448-7) OUT OF PRINT 1999</li> <li>3. Pritchard, R.T., Technician Workshop Processes and Materials. London, Hodder and Stoughton, 1979 (ISBN 0-34022-100-3) OUT OF PRINT 1999</li> <li>4. Personal safety in the engine room (Code No. 556)</li> <li>5. Who needs it? Personal protective equipment (Code No. 597)</li> </ol>
2	<b>SUPPORTING LIBRARY</b>
	<ol style="list-style-type: none"> <li>1. Jackson, L. and Morton, T.D., General Engineering Knowledge for Marine Engineers. 5th ed. London, Thomas Reed Publications Ltd, 1990 (ISBN 09-47-63776-1)</li> <li>2. Joel, R., Basic Engineering Thermodynamics in S.I. Units. 5th ed. Harlow, Longman, 1996 (ISBN 05-82-25629-1)</li> <li>3. Morton, T.D., Motor Engineering Knowledge for Marine Engineers. London, Thomas Reed Publications Ltd, 1994 (ISBN 09-01-2856-5)</li> <li>4. Taylor, D.A., Introduction to Marine Engineering. 2nd ed. London, Butterworth, 1990 (ISBN 07-50-6253-9)</li> <li>5. Handling and treatment of heavy fuels (Code No. 143)</li> <li>6. Fuel oil burner theory and diagnostics (Code No. 604)</li> <li>7. Internal care of marine boilers (Code No. 150)</li> <li>8. Centrifugal pumps – theory and operation (Code No. 9)</li> <li>9. Marine steam turbine plant</li> </ol> <p>Available from: The Maritime Human Resource Institute Kaiji center building, 4-5 Kojimachi Chiyoda-ku, Tokyo, Japan</p>
<b>PREREQUISITES (If applicable)</b>	
-	

- **Student Assignment Plan**

		<p align="center"><b>POLITEKNIK PELAYARAN SURABAYA</b> <b>DIPLOMA-III TEKNIKA</b></p>			
<p align="center"><b>STUDENT ASSIGNMENT PLAN</b></p>					
<b>COURSES</b>	Marine engineering Maintenance and repair on shipboard II				
<b>CODE</b>		<b>SKS</b>	1T & 2P	<b>SEMESTER</b>	4
<b>LECTURER</b>	Eko Prayitno				
<b>TASK FORM</b>					
Presentation in the form of a video clip at least 5 minutes / in front of the class using a whiteboard					
<b>TITLE</b>					
Diesel engines CPMK 1					
<b>SUB LEARNING OUTCOMES OF COURSES</b>					
Able to understand maintenance and repair such as dismantling, adjustment and reassembling of Diesel engines					
<b>ASSIGNMENT DESCRIPTION</b>					
Make a video presentation of at least 5 minutes / use a whiteboard to understand how to lift and install pistons, piston rings to diesel engine body based on SOP					
<b>TASK EXECUTION METHOD</b>					
Make a video recording of at least 5 minutes / explanation with whiteboard related to assignment description					
<b>EXTERNAL SHAPES AND FORMATS</b>					

Recordings are sent via E-learning / explaining the material on the board (off line) / directly practice in the work-shop

#### **INDICATORS, CRETERIA AND ASSESSMENT WEIGHTS**

1. Video duration and material usage: 35% ; 65%
2. Attitude and mastery of the material: 35 % ; 65%

#### **EXTERNAL SHAPES AND FORMATS**

Week 2/3

#### **OTHER**

Done independently / in groups presented in front of the workshop class

#### **REFERENCE LIST**

1. T9: Jackson, L. and Morton, T.D., General Engineering Knowledge for Marine Engineers. 5th ed. London, Thomas Reed Publications Ltd, 1990 (ISBN 09-47-63776-1)
2. T13: Joel, R., Basic Engineering Thermodynamics in S.I. Units. 5th ed. Harlow, Longman, 1996 (ISBN 05-82-25629-1)
3. A1: Instructor Manual (Part D of this course)
4. A2: Manufacturers' Manuals, Manufacturers' instruction manuals and handbooks are the main source of information in instructing the correct procedures in dismantling, inspection and assembly of the Specific items of machinery listed.
5. A3: Video player/DVD player, personal computer
6. V14: Handling and treatment of heavy fuels (Code No. 143)
7. V15: Fuel oil burner theory and diagnostics (Code No. 604)
8. V16: Internal care of marine boilers (Code No. 150)




**SURABAYA MERCHANT MARINE POLYTECHNIC  
DIPLOMA - TECHNICAL III**

**DIPLOMA-III TEKNIKA**

STUDENT ASSIGNMENT PLAN					
COURSES	Marine engineering Maintenance and repair on shipboard II				
CODE		SKS	1T & 2P	SEMESTER	4
LECTURER	Eko Prayitno				
TASK FORM 2					
Presentation in the form of a video clip at least 5 minutes / in front of the class using a whiteboard					
TITLE					
Positive displacement pump CPMK 1					
SUB LEARNING OUTCOMES OF COURSES					
1. Able to understand Fungtion, prinsiples and Type of pumps Sub CPMK 5					
ASSIGNMENT DESCRIPTION					
Make a video presentation of at least 5 minutes / use a whiteboard to understand the composition & explain the basic action of the displacement pump (its fluid journey)					
TASK EXECUTION METHOD					
Make a video recording of at least 5 minutes / explanation with whiteboard related to assignment description					
EXTERNAL SHAPES AND FORMATS					
Recordings are sent via E-learning / explaining the material with a whiteboard (off line)					
INDICATORS, CRETERIA AND ASSESSMENT WEIGHTS					
1. Video duration and material usage: 35% ; 65%					
2. Attitude and mastery of the material: 35 % ; 65%					
SCHEDULE					
Week ke-3					
OTHER					
Done independently and presented in front of the class					
REFERENCE LIST					

9. V7: Centrifugal pumps – theory and operation (Code No. 9)  
T2: Jackson, L. and Morton, T.D., General Engineering Knowledge for Marine Engineers. 5th ed.  
London, Thomas Reed Publications Ltd, 1990 (ISBN 09-47-63776-1)

		<p align="center"><b>SURABAYA MERCHANT MARINE POLYTECHNIC DIPLOMA - TECHNICAL III</b></p>			
<p align="center"><b>STUDENT ASSIGNMENT PLAN</b></p>					
<b>COURSES</b>	Marine engineering Maintenance and repair on shipboard II				
<b>CODE</b>		<b>SKS</b>	1T & 2P	<b>SEMESTER</b>	4
<b>LECTURER</b>	Eko Prayitno				
<b>TASK FORM 3</b>					
Presentation in the form of a video clip at least 5 minutes / in front of the class using a whiteboard					
<b>TITLE</b>					
Positive displacement pump					
<b>ASSIGNMENT DESCRIPTION</b>					
1. Able to understand Fungsi, prinsiples and Type of pumps CPMK 2					
<b>TASK EXECUTION METHOD</b>					
Make a video presentation of at least 5 minutes / use a whiteboard to understand the composition &; explain the basic action of the displacement pump (its fluid journey)					
<b>EXTERNAL SHAPES AND FORMATS</b>					

Make a video recording of at least 5 minutes / explanation with whiteboard related to assignment description
Recordings sent via E-learning / explaining material with a whiteboard (off line)
<b>INDICATORS, CRITERIA AND ASSESSMENT WEIGHTS</b>
1. Durasi video dan penguasaan materi : 35 % ; 65%
1. Sikap dan penguasaan materi: 35 % ; 65%
<b>SCHEDULE</b>
Week ke-3
<b>OTHER</b>
Dikerjakan secara mandiri dan di presentasikan didepan kelas
<b>REFERENCE LIST</b>
10. V7: Centrifugal pumps – theory and operation (Code No. 9) T2: Jackson, L. and Morton, T.D., General Engineering Knowledge for Marine Engineers. 5th ed. London, Thomas Reed Publications Ltd, 1990 (ISBN 09-47-63776-1)

## Sample Description Test

<b>Subject</b>	: Marine Engineering Maintenance And Repair On Shipboard Ii	<b>Semester</b>	: IV
<b>Kode</b>	: T202230	<b>Lecturer</b>	:
<b>Dept.</b>	: D-III Teknika	<b>Sks</b>	: T=1+ P=2

Sub-CPMK :

Sub-CPMK1 Able To Apply Diesel engine  
Sub-CPMK2 Able To Apply Turbocharger  
Sub-CPMK3 Able To Apply Boiler  
Sub-CPMK4 Able To Apply Shafting system  
Sub-CPMK5 Able To Apply Refrigerator  
Sub-CPMK6 Able To Apply Oils, fuels and lubricating system  
Sub-CPMK7 Able to apply Deck machinery  
Sub-CPMK8 Able to apply Selection of materials in construction of equipment  
Sub-CPMK9 Able to apply Design characteristics  
Sub-CPMK10 Able to apply Design characteristics of bearings

### Task 1 :

1. When the steam boiler is working, and in the context of maintenance and repair you are asked to determine the presence or absence of seawater entering the steam boiler through a leaking condenser pipe. After knowing the presence of water entering the boiler, you are asked to determine the leaking condenser pipes so that they can be closed using a plug ".because the condenser pipe that is plugged is 30% then you are asked to explain how you replace the leaking condenser. Sub-CPMK3

Answer:

How to determine a leaking condenser pipe as:

- Close main v/v steam
- Turn off the seawater cooling pump

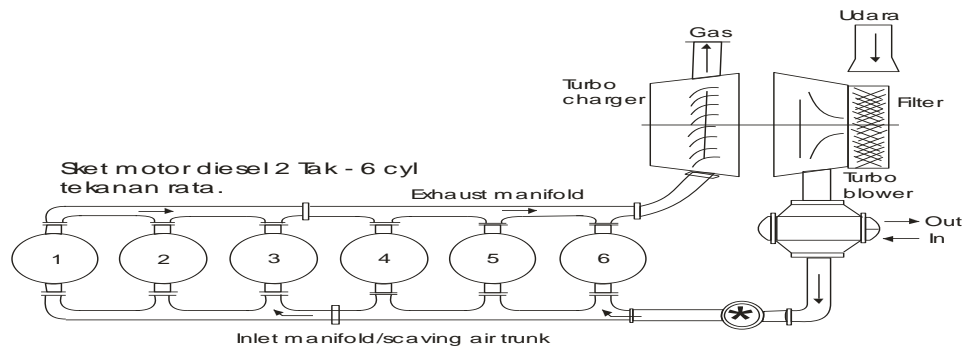


- Open the condenser cover on the side of the sea water cooler
- Open main v/v steam enters the condenser gradually until it is known that steam comes out of the cooling hole of the seawater pipe
- Immediately closed using plugs on two sides of the leaking seawater cooling pipe. (The plug is made of wood or brass).
- How to replace the condenser pipe that is plugged is 30% as follows:
- Turn off the steam boiler
- Turn off the seawater cooling pump.
- Open the condenser covers on the two front rear sides.
- Unplug the condenser pipe one by one that has a plug (pipe that will dig anti).
- Flatten the end of the pipe that will be dug anti with grind to facilitate pipe removal.
- Press the pipe to exit or unplug.
- Position the pipe until it is clean.
- Install new pipes according to their size
- Use the expander tool to press the pipe on two sides front and back until it is impermeable.
- Test until it is impermeable by applying pressure.
- After testing with good results, install it back as before.

The condenser is ready for normal use.

2. 2-stroke low rev 6-cylinder main motor and equipped with a turbocharge unit using a flat-pressure system ( constant Pressure system). In shipping on the high seas you experience heavy damage to the turbocharge unit, so it can no longer be used, and there are no spare parts available on board, you are instructed by the head office to continue the cruise without using turbocharge until the destination port. In an emergency, explain in detail with sketches as necessary what you prepare or repair wherever possible to continue the voyage with good results and safety. Sub-CPMK1

Answer:



The actions taken are:

1. Remove the turbine blades and side blowers along with the shafts.
  2. The turbo charge part associated with the side turbine is closed/blanked.
  3. Use auxiliary blower.
  4. The engine is running at low revs.
  5. The condition of the machine must always be maintained or always checked.
  6. Upon arrival at the port, it was immediately repaired again.
3. .gear type oil pump coupled with a motor ( Attached LO pump) for two-way rotation. After disassembling it in pristine condition, explain in detail what is inspected, measured and what is usually repaired and how to repair it. Then explain how to reassemble it as it was until it is ready to try. Sub-CPMK7

Answer:

What needs to be done in checking the parts of the pump :

- Line bearings are checking the condition of the bearing and measuring the inner diameter by following the proseedur according to the instructions of the manual book if damaged is replaced.
- Ball bearings are checking the bearings on the ball bearings if the rotation of the ball bearing is hard, a replacement is made.
- Gland packing by checking the condition of the gland packing.
- Mechanical seal, check the condition of this tool.

- The shaft measures its straightness condition with a motor.
- O-ring check the condition of this o-ring.
- The safety valve checks the working condition of this tool.
- Gear is a measurement of the diameter of the gear and its wear.
- Shaft coupling bolt dan rubber ring.
- Foundation bolts Check.

What to replace:

- Ball bearings if damaged
- Paking – paking
- Mechanical seal
- Coupling bolt dan rubber ring.

How to install it :

- Remove dust and stains from each metal by washing it, using kerosene/kerosene, repairing it if there is damage.
- Adjust the locking device appropriately on each rotating part if necessary.

## Assessment in the form of a Rubric or Portfolio

### A. Assessment Instrument in the form of a Rubric

The Assessment Instrument uses the Perception Scale Rubric by having a level of assessment criteria that are not described but are still given a rating scale or assessment score which can be seen in the table as follows:

DIMENSI	Sangat Baik	Baik	Cukup	Kurang	Sangat Kurang
	Skor $\geq 81$	(61-80)	(41-60)	(21-40)	<20
<b>Pemahaman kasus</b>	Dapat memahami kasus sangat baik, dengan mendemonstrasikan/ memaparkan : 1. Apa yang diketahui 2. Apa yang Ditanyakan 3. Pemahaman terhadap konsep-konsep 4. Membuat pengembangan perumusan (9-10)	Dapat memahami kasus dengan, dengan mendemonstrasikan/ memaparkan : 1. Apa yang diketahui 2. Apa yang ditanyakan 3. Pemahaman terhadap konsep-konsep (6-8)	Dapat memahami kasus dengan cukup, dengan mendemonstrasikan/ memaparkan : 1. Apa yang diketahui 2. Apa yang Ditanyakan (4-5)	Dapat memahami kasus dengan kurang, mendemonstrasikan/ memaparkan: 1. Apa yang diketahui (2-3)	Tidak ada yang dilaporkan, dikerjakan dan dipraktekkan (0-1)
<b>Penyelesaian kasus</b>	Dapat merencanakan penyelesaian dengan sangat detail, menyelesaikan kasus sesuai rencana, mengecek kembali (14-15)	Dapat merencanakan penyelesaian dengan detail, menyelesaikan kasus sesuai rencana (10-13)	Dapat merencanakan penyelesaian cukup detail (6-9)	Dapat merencanakan penyelesaian kurang detail (3-5)	Tidak dapat merencanakan penyelesaian kasus (0-2)
<b>Kualitas Kerjasama/ Presentasi</b>	Kejelasan presentasi/Kerjasama : - sistematika berurutan  Pengetahuan : - Sangat menguasai materi presentasi - Dapat menjawab pertanyaan yang berhubungan dengan materi	Kejelasan presentasi/Kerjasama: - sistematika kurang berurutan Pengetahuan : - Penguasaan materi presentasi baik - Dapat menjawab pertanyaan yang berhubungan dengan materi	Kejelasan presentasi/Kerjasama: - sistematika cukup  Pengetahuan : - Penguasaan materi presentasi cukup - Kurang dapat menjawab pertanyaan yang berhubungan dengan materi	Kejelasan presentasi/Kerjasama: - sistematika kurang  Pengetahuan : - Penguasaan materi presentasi kurang - Tidak dapat menjawab pertanyaan yang berhubungan dengan	Kejelasan presentasi/Kerjasama: - tidak sistematika  Pengetahuan : - Tidak menguasai materi presentasi - Tidak dapat menjawab pertanyaan yang berhubungan

### B. Assessment Instruments in the form of Portfolios

Assessment Instruments using a Comprehensive Portfolio, which contains the results of student work as a whole during the learning process with learning assessment techniques consisting of:

a) Observation

- b) Participation
- c) Performance
- d) Written Test
- e) Oral Test
- f) Questionnaire

No	Predicate	Value (in letters)	Value (in numbers)	Quality Score (AM)
1	Special	A	87,5 - 100	4,0
2	Very Good	OFF	82,50 – 87,49	3,3
3	Good	B	78,00 – 82,49	3,12
4	Good enough	BC	73,50 – 77,99	2,94
5	Enough	C	70,00 – 73,49	2,76
6	Less	D	34,50 – 69,99	1,38
7	Less Once/Failed	And	0 – 34,49	0

The assessment results of the cadet exam are considered from attendance, assignments, Midterm Exams and Final Semester Exams as follows:

- 1) Attendance (K) 10%.
- 2) Assignment (T) 20%
- 3) Midterm Exam (UTS) 30%.
- 4) Final Semester Exam (UAS) 40%.

Cadet final grade =  $\frac{(K \times 2T \times 3UTS \times 4UAS)}{10}$

10

**Courses** : MARINE ENGINEERING MAINTENANCE AND REPAIR ON SHIPBOARD II      **Code** : T202230  
**Semester** : III      **Credits** : 3 SKS  
**Department** : D- III Technic      **Lecturer** :

**CPL-PRODI charged to MK**

CPL-PRODI charged to MK

CPL1 Able to regulate and apply appropriately the use of hand tool equipment, machine tools and measuring instruments for fabrication and repair on board.

CPL2 Able to evaluate the implementation of maintenance and repair of ship machinery and equipment.

CPL3 Able to the theoretical concepts of engineering technology needed in the field of specialization of ship machinery maintenance and repair systems including supporting equipment ..

CPL4 Able to practical knowledge of engineering technology in identifying the cause of damage and repairing damage to ship machinery.

**Course Learning Outcomes (CPMK)**

CPMK1 Able to demonstrates a knowledge and understanding of maintenance and repair such as dismantling, adjustment and reassembling of machinery and equipment.

CPMK2 Able to demonstrates a knowledge and understanding of design characteristics and selection of materials in construction of equipment.

### Final ability of each learning stage (Sub-CPMK)

- Sub-CPMK1 Able To Apply Diesel engine
- Sub-CPMK2 Able To Apply Turbocharger
- Sub-CPMK3 Able To Apply Boiler
- Sub-CPMK4 Able To Apply Shafting system
- Sub-CPMK5 Able To Apply Refrigerator
- Sub-CPMK6 Able To Apply Oils, fuels and lubricating system
- Sub-CPMK7 Able to apply Deck machinery
- Sub-CPMK8 Able to apply Selection of materials in construction of equipment
- Sub-CPMK9 Able to apply Design characteristics
- Sub-CPMK10 Able to apply Design characteristics of bearings

week	CPL	CPMK (CLO)	Sub-CPMK (LLO)	Indicator	Problem Form - Weight(%) *)	Weight (%) Sub-CPMK		Mhs value (0-100)	$\square((\text{Mhs value}) \times (\text{weight \%})^*)$	Ketercapaian CPL pd MK (%)
1,2,3	1,2	1	1,2	(Supervised student activity) - Dismantles and inspects all parts for wear and deterioration, including: - Pistons - Rings - Liners - Bearings	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>		1	92	0.92	0.92

				<ul style="list-style-type: none"> <li>- Valves</li> <li>- Cooling passages</li> <li>- Crankshaft alignment</li> <li>- Lubrication system</li> </ul> Refurbishes diesel engine components: <ul style="list-style-type: none"> <li>- Cylinder heads</li> <li>- Exhaust valves</li> <li>- Air-start valves</li> <li>- Fuel injector</li> <li>- Relief valve</li> <li>- Fuel injection pump</li> </ul> Reassembles Checks timing and ascertains freedom of movement Checks condition of lubrication oil Purges air from fuel system Test runs						
4-5	1,2	1	1,2	<b>(Supervised student activity)</b> <ul style="list-style-type: none"> <li>- Dismantles:               <ul style="list-style-type: none"> <li>- Air filter</li> <li>- Air casing</li> <li>- Inducer (if fitted)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> </ul>		1	80	0.8	0.8



				<ul style="list-style-type: none"> <li>- Impeller</li> <li>- Volute</li> <li>- Diffuser</li> <li>- Gas inlet grid</li> <li>- Nozzle ring</li> <li>- Rotor</li> <li>- Bearings</li> </ul> <p>Examines all parts for wear and deterioration, paying particular attention to:</p> <ul style="list-style-type: none"> <li>- Erosion in the air side</li> <li>- Erosion in the turbine nozzles and in the blades</li> <li>- Corrosion of the gas casing</li> <li>- Hard deposits</li> <li>- Condition of bearings</li> <li>- Condition of labyrinths</li> <li>- Lubrication system</li> </ul> <p>Reassembles and checks clearances</p>	<ul style="list-style-type: none"> <li>• Integrative:</li> </ul>						
--	--	--	--	---	--	--	--	--	--	--	--

6.	1,2	1	3	<p>Explains the need for cleaning the fire side of a boiler and how to do it</p> <p>Describes how to inspect the fire side of a boiler and repair/maintenance</p> <p>Explains the need of cleaning up the water side of a boiler and how to do it</p> <p>Describes how to inspect the water side of a boiler and the repair/maintenance</p> <p>Describes how to restore the boiler after cleaning up the fire/water side</p> <p>Describes how to repair the firebrick wall of a furnace</p>	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>	1	85	0.85	0.85
7	3	1	4	<p><b>(Supervised student activity)</b></p> <p>Thrust block</p> <p>Stern tube</p> <p>Shaft bearings</p> <ul style="list-style-type: none"> <li>• Shaft sealing equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>	2	86	1.72	1.72

8	<b>Midterm Evaluation (ETS) – 30%</b>							90	27	27
9-10	3,4	2	5	<b>(Supervised student activity)</b> - Compressors - Evaporator - Condenser - Expansion valve Oil separator	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>		1	85	0.85	0.85
11	3,4	2	6	<b>(Supervised student activity)</b> - Filters - Purifiers - Bearings - Settling-tanks contents gauges	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>		1	88	0.88	0.88
12	3,4	1	7	<b>(Supervised student activity)</b> - Lifeboat davits and gear - Mooring winch - Windlass - Winch Crane	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> </ul>		1	90	0.9	0.9

					• Integrative:					
13	3,4	1,2	8	<ul style="list-style-type: none"> <li>- Explains what materials are used for constructing major parts of the following equipment:</li> <li>- Diesel engines: crank shaft, cylinder liner and head, piston, exhaust valve, bearing</li> <li>- Steam turbines: turbine casing, rotor, blade, nozzle, reduction gear</li> <li>- Gas turbine: turbine casing, rotor, compressor, gas generator</li> <li>- Boilers: water tube, furnace, steam, water drum, super-heater</li> <li>- Shafting: propeller shaft, stern tube bearing, propeller</li> <li>- Pumps: impeller, casing, shaft, casing</li> </ul>	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>		1	95	0.95	0.95

				ring, sleeve, gear, screw, piston/ bucket ring - Heat exchangers: heating tube, cooling tube, shell - Compressors: piston ring, valve, cylinder block, cylinder liner - Purifiers: spindle, gravity disc/ring dam, bowl body High pressure/temperature valve: body, valve, valve seat						
--	--	--	--	--	--	--	--	--	--	--

14	3,4	1,2	9	<ul style="list-style-type: none"> <li>- Explains design characteristics developed to improve performance in:</li> <li>- Highly skewed propeller</li> <li>- Construction of diesel engines</li> <li>- Construction of steam turbine</li> <li>- Construction of gas turbine</li> <li>- Construction of boiler</li> </ul>	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>	Description	2	88	1.76	1.76
15	3,4	1,2	10	<b>(Plain bearings)</b> <ul style="list-style-type: none"> <li>- Explains the limitations of direct-lined bearings</li> <li>- Describes solid and lined inserts</li> <li>- Describes briefly:</li> <li>- Thick-walled liners</li> <li>- Medium-walled liners</li> <li>- Thin-walled liners</li> <li>- Wrapped bushes</li> <li>- Lists the ideal properties of a</li> </ul>	<ul style="list-style-type: none"> <li>• Lecturer presentation</li> <li>• Case Studies</li> <li>• FAQs</li> <li>• Evaluation</li> <li>• Refleksi</li> <li>• Integrative:</li> </ul>		2	90	1.8	1.8

				lubrication oil for plain bearings - Describes the reasons for using white metal, copper-lead alloys, lead bronzes, tin bronzes, gun metals and aluminum-based alloys for plain bearings <b>(Ball and roller bearings)</b> - Compares the load-carrying abilities of ball and roller bearings - Compares the ability of ball and roller bearings to carry radial and axial loads - States the type of bearing suitable for shafts subject to angular misalignment - Describes how ball and roller bearings are lubricated						
--	--	--	--	---	--	--	--	--	--	--

				- States the proportion of available volume to be filled when using grease  States the maximum height of lubricant in a stationary bearing when using oil						
	16	<b>End of Semester Evaluation (EAS) – 40%</b>						91	36.4	36.4
		<b>Attendance – 10%</b>						100	10	10
		<b>Student's final grade (<math>\square</math>(Mhs Grade) X (Weight%))</b>							90.73	90.73