Bachelor of Science in Marine Engineering

DETAILED TEACHING SYLLABUS

Course Title	Basic Control Engineering				
Course Code	Auto 1		Prerequisite	Electro 1	Rev.0
Course Credits	3 units	Lecture contact hours per week	3		
		Laboratory contact hours per week	3		
Competence/s	A-III/1.F1.C1: Operate main and auxiliary machinery and associated control systems A-III/1.F2.C1: Operate electrical, electronic and control systems				
KUPs	**A-III/1; F1: C2: KUP.8** Basic construction and operation principles of machinery systems including: .8 automatic control systems **A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a Various automatic control methodologies and characteristics 3b Proportional -Integral-Derivative (PID) control characteristics and associated system device for process control **A-III/1; F2: C2: KUP 2** Basic configuration and operation principles of the following electrical, electronic and control equipment; 2 electronic equipment 2a. characteristics of basic electronic circuits 2b. flowchart for automatic and control systems 2c functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls				
Course Outcome/s	CO1: Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships. CO2: Interpret process and instrument diagrams of automation system based on the industry standards CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices				
Reference/s	Annex C of CMO no. 67, s2017 STCW ‘78 with 2010 Manila Amendments 2017 edition IMO Model Course 7.04 “Officer in Charge of an Engineering Watch” 2014 ed. IMO Model Course 7.02 “Chief Engineer Officer and Second Engineer Officer”				
Effective Date	xx xx xxxx		Revision No. 0		

Prepared by:	Checked by:	Approved by:
Eng’r Wenceslao M. Cawagas III MEP-MEM	Eng’r Romano A. Gabrillo Adviser, Practicum Research Writing Eng’r Nancy M. Santiago Critic, Practicum Research Writing	

PROGRAM OUTCOMES ADDRESSED		INTRODUCTORY	ENABLING	DEMONSTRATIVE
PO1	A graduate of BSMarE shall be able to demonstrate the ability to perform the competence, at the operational level under Table A-III/1 and some elements of Table A-III/2 of the STCW Code.			X
PO2	Apply knowledge in mathematics, science and technology in solving problem related to the profession and the workplace		X	
PO3	Evaluate the impact and implications of various contemporary issues in the global and social context of the profession		X	X
PO4	Engage in lifelong learning and keep abreast with the developments in the field of specialization and/or profession		X	
PO5	Use appropriate techniques, skills and modern tools in the practice of the profession in order to remain globally competitive			X
PO6	Conduct research using appropriate research methodologies	X		

Note: For the weekly Quiz please refer to the TOS and Question bank. The Q bank has 10item Test/week. The instructor will decide which question will he use as weekly quiz or else he will tailor his own quiz.

FUNCTION: ELECTRICAL, ELECTRONIC & CONTROL ENGINEERING IN THE OPERATIONAL LEVEL

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	Indicated Hours	
								Lec	Lab
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F1: C2: KUP.8** Basic construction and operation principles of machinery systems including: .8 automatic control systems	**1.Fundamentals of Automatic Control**	Week 1-day 1 CO1: Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships	1.1 define an automatic control and state its purpose 1.2 describe what devices/equipment construct control systems and their role/function 1.3relate sensing unit, controller, controlled variable, manipulating variable and controlled object to each of them in the control system 1.4describe what sort of devices are included in the sensing unit 1.5 describe variety of controllers such as electronic (PID, PLC, computer) controller and pneumatic controller	**The instructor shall** ▪ introduce about the subject matter and motivate the student about the essence of automation on board ships; how it improves safety, economy and efficiency and above all ease of hard labor. ▪ define automatic control, and enumerate its components. ▪ show a video #1 about automation. ▪ Interaction about the video **The student shall** ▪ listen about the lecture, ▪ view the video attentively ▪ express their reactions about the video.	Multi media PPT 1 Video 1: Automation 6:20 SR1: Control Fundamentals pp 9-18 T1: pp1- 10	**The student shall:** ▪define automation ▪describe the components involved in automation ▪relate sensing unit, controller, controlled variable and the manipulator ▪describe variety of controllers such as PID, PLC, pneumatic and electronic controller	1.5	
			Week 1 day 2 CO1: Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships	1.6 define setting value, input value, deviation and output value/controlled variable in the controller 1.7describe what sort of devices are included as	**The instructor shall:** ▪ define set value, input value, deviation and output value in the controller. ▪ Describe what are manipulator devices ▪ Described various controllable objects	Multi media PPT 2 Video 2: Basics of Automation 2:09 SR2:Control 101 pp 12-13	**The student shall:** ▪ define set value, input value, deviation and output value in the controller. ▪ Describe what are manipulator devices	1.5	

				manipulators 1.8describe variety of controlled objects 1.9describe how automatic controls are utilized in the ship's propulsion machinery taking examples of temperature and level control systems, including control parameters such as time lag, time constant, dead time, first/second order lag element, disturbance and offset	▪ Describe how automatic control are utilized in the ship's propulsion machinery taking example as temperature, kevel, flow,etc. ▪ Play video #2 about basics in automation ▪ Discuss about the video **The student shall:** ▪ Listen and participate to the discussion ▪ Watch the video ▪ Show their appreciation about automation		▪ Described various controllable objects ▪ Describe how automatic control are utilized in the ship's propulsion machinery taking example as temperature, kevel, flow, etc. ▪ answer weekly quiz #1		
			Week 1 day 3	Interpret process and instrument diagrams of automation system based on the industry standards.	**The instructor shall:** ▪ divide students into group, ▪ brief the students about the activity, ▪ remind the students about safety measures while on the workshop ▪ debrief the students after the activity was performed. ▪ supervise activity proceedings **The student shall** ▪ read the manual procedure ▪ perform the activity. ▪ Do housekeeping upon conclusion of activity	WSA 01: Block Diagram of an Automatic Control System Laboratory manual	The student shall ▪ read and interpret a block diagram of an automatic control system		3.0

STCW	KUP	Course	Course Outcomes	Learning Outcomes	TLA	Equipment/	Assessment method	**Indicated**

Competence		Content				Material/ References		Hours	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F1: C2: KUP.8** Basic construction and operation principles of machinery systems including: .8 automatic control systems	**2 Various Automatic Controls**	Week 2-day 1 CO1: Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships	2.1 classify systematically automatic control in terms of control methodologies 2.2 state what an optimal control means 2.3 explain briefly feedback control and feedforward control	**The instructor shall:** ▪ classify systematically automatic control in terms control methodologies ▪ state what optimal control means ▪ explain briefly feedback control and feedforward control ▪ play video about feedback control system ▪ play video#3 ▪ discuss about the video **The students shall**: ▪ listen and interact about the discussion ▪ view the video attentively.	Multi media PPT 3 Video 3: Feedback Control System 5:56 SR2: Control 101pp14-23, p47	**The student shall:** ▪ classify systematically automatic control in terms of control methodologies ▪ state what optimal control means ▪ explain briefly feedback control and feedforward control ▪ play video about feedback control system	1.5	
			Week 2-day 2 CO1: Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships	2.4 describe briefly on off control, sequential control, PID control and program control 2.5 explain how these automatic controls are applied to the control systems 2.6 explain briefly program control and how the control is realized 2.7 describe the applications of program control in the ship's propulsion machinery	**The instructor shall:** ▪ describe briefly on off control, sequential control, PID control and program control ▪ explain how these automatic controls are applied to the control systems ▪ explain briefly program control and how the ▪ describe the applications of program control in the ship's propulsion machinery ▪ play video#4 ▪ discuss about the video **The students shall:**	Multi media PPT 4 Video 4: Feedback and Feedforward control 27:36 SR2: Control 101 pp19-31	**The student shall:** ▪ describe briefly on off control, sequential control, PID control and program control ▪ explain how these automatic controls are applied to the control systems ▪ explain briefly program control and how the control is realized ▪ describe the applications of program control in the ship's propulsion machinery	1.5	

					▪ Listen and participate to the discussion ▪ Ask some questions		▪ answer weekly quiz #2		
			Week 2-day 3	Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships.	**The instructor shall:** ▪ brief the students about the activity, what is expected outcome ▪ debrief the students after the activity ▪ observe safety of the students during the proceedings **The student shall:** ▪ read the procedure ▪ gather required materials/equipment ▪ perform the activity ▪ observe safety at all times	WSA 02:Feedback Control System Laboratory manual SR1 p3	**The student shall:** ▪ understand the concept of feedback control systems ▪ Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships. ▪ appreciate feedback control and relate the theory on shipboard automation		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/ Material/ References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F1: C2: KUP.8** Basic construction and operation principles of machinery systems including: .8 automatic control systems	**3.ON-OFF controls**	Week 3-day 1 CO1: Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships	3.1 explain what ON-OFF control means 3.2 explain the characteristics of ON-OFF control	**The instructor shall:** ▪ explain what on off control means ▪ explain the characteristics of on off control ▪ play video #5 ▪ discuss about the video **The student shall:**	Multi media PPT 5 Video 5: Pressure Switch 3:49 R1: Control Fundamentals p32	**The student shall** ▪ explain what ON-OFF control means ▪ explain the characteristics of ON-OFF control	1.5	

					▪ listen to discussion ▪ interact with the instructor ▪ view the video and draw out ideas about it	SR2Control 101 pp 17-25			
			Week 3-day 2 CO1: Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships	3.3 explain how ON-OFF control is utilized 3.4 list components comprising ON-OFF control system 3.5 describe ON-OFF control taking some applications as examples	**The instructor shall:** ▪ explain how ON-OFF control is utilized ▪ list components comprising ON-OFF control system ▪ describe ON-OFF control taking some applications as examples ▪ play video#6 discuss about the video ▪ Play video #8 ▪ Discuss about the video **The student shall:** ▪ interact with the discussion ▪ view the video and draw out idea and understanding about on off control	Multi media PPT 6 Video 6: How to Adjust a Pressure Switch 7:57 Video 7: Hydrophore Unit 1:22 SR2: Control 101 p18	**The student shall:** ▪ explain how ON-OFF control is utilized in shipboard automation ▪ list components comprising ON-OFF control system ▪ describe ON-OFF control taking some applications as examples ▪ answer weekly quiz #3	1.5	
			Week 3-day 3	Demonstrate performance test in accordance with the manufacturer's standards for the automatic control devices.	**The instructor shall:** ▪ brief the students on the objective of the activity ▪ remind safety measures while performing the task ▪ supervise activity proceedings **The student shall:** ▪ read and comprehend the manual ▪ prepare all required equipment ▪ perform activity	WSA 03: On-Off Control Laboratory manual for WSA 03 *Note: all needed equipment is listed on the equipment in the manual*	**The student shall:** ▪ demonstrate performance test in accordance with the manufacturer's standards for the automatic control devices. ▪ Develop deep understanding about hydrophore tank principles ofautomation		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/ Material/ References	Assessment method	Indicated Hours	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a Various automatic control methodologies and characteristics	**4. Sequential Control**	Week 4-day 1 CO2: Interpret process and instrument diagrams of automation system based on the industry standards	4.1explain what a sequential control means 4.2explain the characteristic of sequential control 4.3explain how a sequential control is utilized 4.4list components comprising a sequential control system 4.5 describe sequential controls taking some applications as example	**The instructor shall:** ▪ explain what a sequential control means ▪ explain the characteristic of sequential control ▪ explain how a sequential control is utilized ▪ list components comprising a sequential control system ▪ describe sequential controls taking some applications as example ▪ show a video about sequential control of 3 motors ▪ discuss about the video **The student shall:** ▪ listen and interact with discussion ▪ Draw out idea from the video	Multi media PPT 7 Video 8: Sequential Control of 3 motors 1:59 M1: Machinery Operating Manual “HFS” pp10-21	**The student shall:** ▪ explain what a sequential control means ▪ explain the characteristic of sequential control ▪ explain how a sequential control is utilized ▪ list components comprising a sequential control system ▪ describe sequential controls taking some applications as example	1.5	
			Week 4-day 2	provide feedback to instructor for the students’ learning progress of the course.	The instructor shall: ▪ prepare examination venue ▪ facilitate the conduct of the term exam	Prelim Exam Questionnaire	The student shall: ▪ answer Prelim Exam	1.5	
			Week 4-day 3	Interpret process and	**The instructor shall:**	WSA	**The student shall:**		3.0

				instrument diagrams of automation system based on the industry standards	▪ brief about safety precautions and discuss about the objectives of the activity **The student shall:** ▪ read the instructions on the manual ▪ perform the activity ▪ do housekeeping when the activity is concluded	04:Sequential Control Laboratory manual	▪ Interpret process and instrument diagrams of automation system based on the industry standards ▪ Develop safety habits when working with electricity and automation system ▪ Gain confidence in performing task in electrical and automation systems		

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3b Proportional - Integral-Derivative (PID) control characteristics and associated system device for process	**5.Proportional Integral Derivative Control**	Week 5-day 1 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	5.1 explain the principles/theory of PID Control 5.2 explain how P I and D actions can be electrically/pneumatically available showing simple electronic circuits and pneumatic diagram 5.3 state that PID control is classical control methodology but even now it is still	**The instructor shall:** ▪ explain the principles/theory of PID Control ▪ explain how P I and D actions can be electrically/pneumatically available showing simple electronic circuits and pneumatic diagram ▪ state that PID control is classical control methodology but even	Multi media PPT 8 Video 9: What is a PID Controller 5:38 SR2: pp26-35	**The student shall:** ▪ explain the principles/theory of PID Control ▪ explain how P I and D actions can be electrically/pneumatically available showing simple electronic circuits and pneumatic diagram ▪ state that PID	1.5	

	control			firm basis for controlling any physical/process value	now it is still firm basis for controlling any physical/process value ▪ show video#9 about PID controller ▪ discuss about the video **The student shall:** ▪ interact with the discussion ▪ view the video and draw ideas about PID controller		control is classical control methodology but even now it is still firm basis for controlling any physical/process value		
			Week 5-day 2 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	5.4state that PLC and computer controller produces the same actions as analogue PID controller when controlling any physical/process value 5.5 explain P, I, D, PI, PD & PID actions respectively using step or ramp input	**The instructor shall:** ▪ state that PLC and computer controller produces the same actions as analogue PID controller when controlling any physical/process value ▪ explain P, I, D, PI, PD & PID actions respectively using step or ramp input ▪ play video #10 ▪ discuss about the video **The student shall:** ▪ involve himself in the discussion ▪ watch the video ▪ show appreciation about PID controller	Multi media PPT 9 Video 10: Proportional Gain 3:55 R2: pp26-35	**The student shall:** ▪ state that PLC and computer controller produces the same actions as analogue PID controller when controlling any physical/process value ▪ explain P, I, D, PI, PD & PID actions respectively using step or ramp input ▪ answer weekly Quiz #5	1.5	
			Week 5-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall:** ▪ brief the students about the expected outcome of the activity ▪ remind safety matters ▪ answer questions about the activity **The student shall:** ▪ read the procedure in the manual ▪ perform the activity	WSA 05: Performance Check of a PID Controller PID Simulator	**The student shall:** ▪ Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices ▪ Check the		3.0

							performance of a PID controller		

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/ Material/ References	Assessment method	Indicated Hours	
								Lec	Lab
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3b Proportional -Integral-Derivative (PID) control characteristics and associated system device for process control	**5. Proportional Integral Derivative Control contd.**	Week 6-day 1 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	5.6 explain the characteristic of P action as well as the proportional band (PB) 5.7explain the characteristics of I and D actions 5.8 explain how P,I and D actions contribute to control systems, stating that P value contributes to strength of control, I value contributes to accuracy of control and D value contributes to speed of control	**The instructor shall:** ▪ explain the characteristic of P action as well as the proportional band (PB) ▪ explain the characteristics of I and D actions ▪ explain how P, I and D actions contribute to control systems, stating that P value contributes to strength of control, I value contributes to accuracy of control and D value contributes to speed of control ▪ play a video#11 about PID ▪ discuss about the video **The student shall:** ▪ listen and interact to discussions ▪ view the video ▪ develop critical thinking about PID Control	Multi media PPT 10 Video 11: PIDs Simplified 13:06 SR2: pp 29-32	**The student shall:** ▪ explain the characteristic of P action as well as the proportional band (PB) ▪ explain the characteristics of I and D actions ▪ explain how P, I and D actions contribute to control systems, stating that P value contributes to strength of control, I value contributes to accuracy of control and D value contributes to speed of control	1.5	
			Week 6-day 2 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	5.9 describe the step response test to PID action and what can be understood by its results 5.10 explain how P,I and D parameters for optimal control can be determined 5.11 describe the	**The instructor shall:** ▪ describe the step response test to PID action and what can be understood by its results ▪ explain how P, I and D parameters for optimal control can be determined ▪ describe the	Multi media PPT 11 Video 12: Understanding PID in 4 Minutes 3:59	**The student shall:** ▪ describe the step response test to PID action and what can be understood by its results ▪ explain how P, I and D parameters for optimal control can be determined	1.5	

				components comprising PID control systems including sensing unit, transducer, manipulator and controller	components comprising PID control systems including sensing unit, transducer, manipulator and controller ▪ play a video#12 about PID ▪ discuss about the video **The student shall:** ▪ listen and ask questions about the topic ▪ view the video and interact with the instructor and co students after the film showing		▪ describe the components comprising PID control systems including sensing unit, transducer, manipulator and controller ▪ answer weekly quiz #6		
			Week 6-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall:** ▪ Brief the students about what is expected in the activity ▪ Familiarize them with the use of the PID simulator ▪ Demonstrate operation of the simulator **The students shall:** ▪ Read the manual procedure ▪ perform the activity ▪ draw out realization on the PID tuning	WSA 06: Controller Tuning PID Simulator	**The student shall;** ▪ Demonstrate performance test in accordance with the manufacturers standards for the: monitoring systems; automatic control devices; and protective devices ▪ Perform controller tuning adjustment		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation	**6 Process Measurement** 6.1Mechanical Thermometers	Week 7-day 1 CO3: Demonstrate performance test in accordance with the manufacturers	6.1 Mechanical Thermometers 6.1.1 state that it is common practice to call the measuring	**The instructor shall:** ▪ enumerate Mechanical Thermometers ▪ state that it is common practice to call the	Multi media PPT 12 Video 13: How Bi-	**The student shall:** ▪ enumerate Mechanical Thermometers ▪ state that it is	1.5	

	principles of the following electrical, electronic and control equipment .3 Control systems: .3a various automatic control methodologies and characteristics		standards for the: Monitoring systems; Automatic control devices; and Protective devices	instrument for temperatures: -above 500OC a pyrometer -below 500OC a thermometer 6.1.2 state the temperature range for which mercury is used	measuring instrument for temperatures: -above 500OC a pyrometer -below 500OC a thermometer ▪ state the temperature range for which mercury is used ▪ play video#13 about bimetallic thermometer ▪ discuss about the video **The student shall:** ▪ interact with the discussion ▪ view the video intently ▪ develop an understanding about mechanical thermometers	metallic Thermometer Work 6:20 T1: pp11-12	common practice to call the measuring instrument for temperatures: -above 500OC a pyrometer -below 500OC a thermometer state the temperature range for which mercury is used		
		Mechanical Thermometers Contd....	Week 7-day 2 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	6.1.3 name the fluids which can be used for the measurement of lower temperatures 6.1.4 describe the principal features of thermometers based on the filled system, including -mercury in steel -vapour pressure -gas-filled 6.1.5 describe the principal features of bi metallic thermometer	**The instructor shall:** ▪ name the fluids which can be used for the measurement of lower temperatures ▪ describe the principal features of thermometers based on the filled system, including -mercury in steel -vapor pressure -gas-filled ▪ describe the principal features of bi metallic thermometer ▪ play video#14 ▪ discuss about the video **The student shall:** ▪ Participate in the discussion ▪ Answer some questions ▪ Ask some questions	Multi media PPT 13 Video 14: How a Bulb Thermometer Works 4:05	**The student shall:** ▪ name the fluids which can be used for the measurement of lower temperatures ▪ describe the principal features of thermometers based on the filled system, including -mercury in steel -vapor pressure -gas-filled ▪ describe the principal features of bi metallic thermometer ▪ answer weekly Quiz #7	1.5	

					▪ Watch the video				
			Week 7-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall:** ▪ brief the students about the expected outcome of the activity ▪ remind safety measures ▪ debrief the students about their results ▪ reconcile different issues about the result **The students shall:** ▪ read the manual procedure ▪ perform the activity ▪ observe safety practice at all times ▪ do the housekeeping after the activity is concluded	WSA 07: Performance Test of a Pt100 Sensor WSA 8:Calibration of a Pt100 Transmitter Laboratory manual M3: Pt100 resistance table	**The student shall:** ▪ Demonstrate performance test in accordance with the manufacturers standards for the: monitoring systems; automatic control devices; and protective devices ▪ Check the integrity of the Pt100 sensor		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: .3a various automatic control methodologies and characteristics	6.2 Electrical Thermometers	Week 8-day 1 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	6.2.1 state that the range and accuracy varies according to the material used in the detecting element 6.2.2 sketch and describe a resistance-type measuring instrument based on the Wheatstone bridge 6.2.3 describe the characteristics of a thermistor and the conditions for which it is suitable 6.2.4 sketch a circuit used in a thermocouple and describes its operation	**The instructor shall:** ▪ state that the range and accuracy vary according to the material used in the detecting element ▪ sketch and describe a resistance-type measuring instrument based on the Wheatstone bridge ▪ describe the characteristics of a thermistor and the conditions for which it is suitable ▪ sketch a circuit used in a thermocouple and describes its operation ▪ describe the principle of	Multi media PPT 14 Video 15: Types of temperature Sensors 4:27 T1: pp13-21	**The student shall:** ▪ state that the range and accuracy vary according to the material used in the detecting element ▪ sketch and describe a resistance-type measuring instrument based on the Wheatstone bridge ▪ describe the characteristics of a thermistor and the conditions for which it is suitable ▪ sketch a circuit used in a	1.5	

				6.2.5 describe the principle of optical pyrometer	optical pyrometer ▪ play video #15 ▪ discuss about the video **The student shall:** ▪ Listen to the lecture ▪ Ask feedback questions for unclear issues ▪ View the video ▪ Express their learning about the video		thermocouple and describes its operation ▪ describe the principle of optical pyrometer		
			Week 8 day 2	Provide feedback to instructor for the learning progress of the course.	The instructor shall: ▪ prepare examination venue ▪ facilitate the conduct of the term exam	Midterm Exam Questionnaire	The student shall: ▪ answer Midterm Exam	1.5	
			Week 8-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall:** ▪ Brief the student about the activity ▪ Remind the students about safety practice ▪ Reconcile any arguments about the result of the activity ▪ Appreciate those students who are outstanding in their result **The student shall:** ▪ Read the manual procedure ▪ Perform Activity ▪ Do housekeeping upon conclusion of the activity	PA 01: Midterm Practical Assessment	**The student shall:** ▪ Demonstrate performance test in accordance with the manufacturers standards for the: monitoring systems; automatic control devices; and protective devices ▪ Check the integrity of the thermocouple sensor		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical,	**A-III/1; F2: C2: KUP 3** Basic	**6.3 Pressure Measurement**	Week 9-day 1 CO3: Demonstrate performance test in	6.3.1 describe the principal features of, and compares, the	**The instructor shall:** ▪ describe the principal features of, and	Multi media PPT 15	**The student shall:** ▪ describe the principal features of,	1.5	

electronic and control systems	configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a various automatic control methodologies and characteristics		accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	following: -manometers: -simple water -wide cistern or well -inclined tube -mercury -pressure gauges: -bourdon -diaphragm-sealed gauge -twin bellows differentialpressure cell -strain gauge 6.3.2 describe how pressure gauges can be tested on board ship	compares, the following: -manometers: -simple water -wide cistern or well -inclined tube -mercury -pressure gauges: -bourdon -diaphragm-sealed gauge -twin bellows differential pressure cell -strain gauge ▪ describe how pressure gauges can be tested on board ship ▪ play video #16 ▪ discuss about the video **The student shall:** ▪ participate in the classroom discussion ▪ watch the video ▪ express idea about the video	Video 16: How Fluid Pressure is measured 11:10 T1: pp23-32	and compares, the following: -manometers: -simple water -wide cistern or well -inclined tube -mercury -pressure gauges: -bourdon -diaphragm-sealed gauge -twin bellows differential pressure cell -strain gauge ▪ describe how pressure gauges can be tested on board ship		
			Week 9-day 2 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	6.3.3 test a pressure pump 6.3.4 sketch calibration curves for a bourdon pressure gauge, showing the effect of -zero adjustment -multiplication adjustment -angularity adjustment 6.3.5 state the calibration and testing are normally performed by specialists	**The instructor shall:** ▪ test a pressure pump ▪ sketch calibration curves for a bourdon pressure gauge, showing the effect of -zero adjustment -multiplication adjustment -angularity adjustment ▪ state the calibration and testing are normally performed by specialists ▪ play video#17 ▪ discuss about the video **The student shall:** ▪ Participate in the discussion ▪ Share their ideas about	Multi media PPT 16 Video 17: How a Bourdon Pressure Gauge Work 7:33	**The students shall:** ▪ test a pressure pump ▪ sketch calibration curves for a bourdon pressure gauge, showing the effect of -zero adjustment -multiplication adjustment -angularity adjustment ▪ state the calibration and testing are normally performed by specialists ▪ answer weekly	1.5	

					the discussion ▪ Watch video ▪ Express his appreciation about the video		Quiz #9		
			Week 9-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall:** ▪ Brief the students about the intended outcome of the activity ▪ Remind safety measures ▪ Debrief by explaining about the outcome of the activity ▪ Appreciate those group who are outstanding in performance **The student shall:** ▪ Read the instruction manual ▪ Ask clarificatory questions ▪ perform the activity ▪ do housekeeping after the conclusion of the activity	WSA 09: Performance Test of a TC "K" sensor WSA 10: Calibration of a TC" K" Transmitter M4: Type K thermocouple reference table WSA 11 Performance Test of a Pressure Switch M5: Nomogram of RT116 Pressure switch	**The student shall:** ▪ Demonstrate performance test in accordance with the manufacturers standards for the: monitoring systems; automatic control devices; and protective devices ▪ Adjust cut in cut out of a pressure switch		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment	6.4 Level measurement-Direct Method	Week 10-day 1 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	**6.4 Level measurement (Direct Method)** 6.4.1 describe the principle of a float-operated level measuring device 6.4.2 describe the principle of a probe element 6.4.3 describe a	**The instructor shall:** ▪ describe the principle of a float-operated level measuring device ▪ describe the principle of a probe element ▪ describe a displacement gauge ▪ Play a video#18 about ball float switch **The student shall:**	Multi media PPT 17 Video 18: Ball Float Liquid Level Sensor 4:20 T1: pp. 33-34	**The student shall:** ▪ describe the principle of a float-operated level measuring device ▪ describe the principle of a probe element ▪ describe a displacement gauge	1.5	

	.3 Control systems: 3a various automatic control methodologies and characteristics			displacement gauge	▪ Listen to the discussion ▪ Interact with the instructor ▪ View the video ▪ Develop critical thinking about float switch				
		6.5 Level measurement - Inferential Method	Week 10-day 2 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	**6.5 Inferential Method** 6.5.1 explain the principle of inferential method 6.5.2 describe a level sensor based on immersed resistors 6.5.3 describe a level indicator based on a bubbler system 6.5.4 describe a pneumercator gauge	**The instructor shall:** ▪ explain the principle of inferential method ▪ describe a level sensor based on immersed resistors ▪ describe a level indicator based on a bubbler system ▪ describe a pneumercator gauge ▪ Play video #19 ▪ Discuss about the video ▪ **Thestudents shall:** ▪ Listen intently to the discussion proper ▪ Interact whenever they have an idea on the topic ▪ Watch video ▪ Develop a critical thinking about level measurement	Multi media PPT 18 Video 19: Level measurement using DP Transmitter 6:14 T1: pp 35-39	**The student shall:** ▪ explain the principle of inferential method ▪ describe a level sensor based on immersed resistors ▪ describe a level indicator based on a bubbler system ▪ describe a pneumercator gauge ▪ answer weekly Quiz #10	1.5	
			Week 10-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall:** ▪ Brief the student about the activity ▪ Remind safety practice ▪ Process the results of the activity **The student shall:** ▪ Read the manual procedure ▪ Clarify unclear instructions ▪ perform activity	WSA12: Performance test of a Float Switch	**The student shall:** ▪ Demonstrate performance test in accordance with the manufacturers standards for the: monitoring systems; automatic control devices; and protective devices ▪ Perform cut in and		3.0

					▪ do housekeeping at the end of activity		cut out of a float switch		
STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a various automatic control methodologies and characteristics	6.6.Flow Measurement	Week 11-day 1 CO3: Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	6.6.1 explain the difference between a quantity meter and a rate of flow metre 6.6.2 explain that quantity metre is basically a rate of flow metre combined with an integrator 6.6.3 describe the function of the two elements of a flow metre 6.6.4 sketches a graph to show the relationship between velocity of a fluid and its pressure difference 6.6.5 from the above objective, show the velocity is proportional to the square root of pressure 6.6.6 explain the situations in which extractions of a square roots are necessary	**The instructor shall:** ▪ explain the difference between a quantity meter and a rate of flow meter ▪ explain that quantity meter is basically a rate of flow meter combined with an integrator ▪ describe the function of the two elements of a flow meter ▪ sketches a graph to show the relationship between velocity of a fluid and its pressure difference ▪ from the above objective, show the velocity is proportional to the square root of pressure ▪ explain the situations in which extractions of a square roots are necessary ▪ Play video# 20 ▪ Discuss about the video ▪ play a video #21 ▪ discuss about the video **The students shall;** ▪ interact with the discussion ▪ watch the video ▪ appreciate the essential of DP transmitter	Multi media PPT 19 Video 20: Differential Pressure Flow Measurement (Venturi) 4:49 Video 21: DP Flow measurement (Pitot) 4:36 T1: pp41-47	**The student shall:** ▪ explain the difference between a quantity meter and a rate of flow meter ▪ explain that quantity meter is basically a rate of flow meter combined with an integrator ▪ describe the function of the two elements of a flow meter ▪ sketches a graph to show the relationship between velocity of a fluid and its pressure difference ▪ from the above objective, show the velocity is proportional to the square root of pressure ▪ explain the situations in which extractions of a square roots are necessary	1.5	
		6.6.Flow Measurement	Week 11-day 2 CO3: Demonstrate	6.6.7 describe the principal features of:	**The instructor shall:** ▪ describe the principal	Multi media	**The student shall:** ▪ describe the	1.5	

		Contd....	performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	- a rotormeter - an electrical flowmeter - a rotameter 6.6.8 sketch an orifice and a venturi, showing the direction of flow and the pressure=measuring point 6.6.9 explain how a manometer can be used as a square-root extractor 6.6.10 state that extractions of square root can be accomplished pneumatically and electrically	features of: - a rotor meter - an electrical flowmeter - a rotameter ▪ sketch an orifice and a venturi, showing the direction of flow and the pressure=measuring point ▪ explain how a manometer can be used as a square-root extractor ▪ state that extractions of square root can be accomplished pneumatically and electrically ▪ play video #22 ▪ discuss about the video **The student shall:** ▪ Interact with the discussion ▪ Express their ideas about the topic ▪ Watch the video and develop appreciation about rotameter	PPT 20 Video 22: Rotameter Working Principle 3:24 T1: p47-54	principal features of: - a rotor meter - an electrical flowmeter - a rotameter ▪ sketch an orifice and a venturi, showing the direction of flow and the pressure=measuring point ▪ explain how a manometer can be used as a square-root extractor ▪ state that extractions of square root can be accomplished pneumatically and electrically ▪ answer weekly Quiz #11		
			Week 11-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall:** ▪ brief the students about the activity and its expected outcome ▪ remind safety precautions to themselves and to the equipment ▪ debrief the students after the conduction of activity and clarify the results **The student shall:** ▪ Read the manual procedure	WSA 13: Performance Test of a DP Transmitter M7: 1151 Rosemount Pressure Transmitter	**The student shall:** ▪ Demonstrate performance test in accordance with the manufacturers standards for the: monitoring systems; automatic control devices; and protective devices ▪ Perform calibration of a DP transmitter		3.0

					▪ perform the activity ▪ observe safety at all times				

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a various automatic control methodologies and characteristics	6.7 General Measurement of Process	Week 12-day 1 CO1:Differentiate basic construction and principles in automation regarding various measuring Instruments and automation devices used onboard ships.	6.7.1 explain the principle of a tachometer 6.7.2 explain the principles of AC and DC electric tachometer 6.7.3 explain the principles of a torque metre based on the effect of stress in a magnetic field 6.7.4 explain how the above objective can be developed to measure power 6.7.5 explain the principal features of a viscometer 6.7.6 describe the application of a photocell to: -an oil in- water -a smoke- density detector -an oil mist detector -a flame detector	**The instructor shall:** ▪ explain the principle of a tachometer ▪ explain the principles of AC and DC electric tachometer ▪ explain the principles of a torque meter based on the effect of stress in a magnetic field ▪ explain how the above objective can be developed to measure power ▪ explain the principal features of a viscometer ▪ describe the application of a photocell to: -an oil in- water -a smoke- density detector -an oil mist detector -a flame detector ▪ Play video #23 ▪ Discuss about the video **The student shall:** ▪ Listen to the discussion ▪ Interact with the instructor and the classmates	Multi media PPT 21 Video 23: Inductive Type RPM sensor T1: pp 55-59	**The student shall:** ▪ explain the principle of a tachometer ▪ explain the principles of AC and DC electric tachometer ▪ explain the principles of a torque meter based on the effect of stress in a magnetic field ▪ explain how the above objective can be developed to measure power ▪ explain the principal features of a viscometer ▪ describe the application of a photocell to: -an oil in- water -a smoke- density detector -an oil mist detector -a flame detector	1.5	

					▪ Watch the video				
			Week 12 day 2	provide feedback to instructor for the learning progress of the course.	The instructor shall: ▪ prepare examination venue ▪ facilitate the conduct of the term exam	Semi Final Exam Questionnaire	The student shall: ▪ answer Semi-final Exam	1.5	
			Week 12-day 3	Demonstrate performance test in accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The instructor shall**: ▪ Brief the students about the activity ▪ Remind safety precaution ▪ Debrief the students after the activity **The student shall** ▪ Read the manual procedure ▪ perform the activity ▪ do housekeeping upon conclusion of the activity	WSA 14: Boiler Flame Scanner (Photocell)	**The student shall:** ▪ Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships.		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a various automatic control	**6.7 General Measurement of Process contd.**	Week 13-day 1 CO1:Differentiate basic construction and principles in automation regarding various measuring Instruments and automation devices used onboard ships.	6.7.7 describe the common type of fire detectors 6.7.8 describe the principal features of: -an explosive gas detector -a vibration monitor -an oxygen analyzer -a CO2 analyser -a relative humidity meter -salinity measurement -a dissolved oxygen meter -a pH metre	**The instructor shall:** ▪ describe the common type of fire detectors ▪ describe the principal features of: -an explosive gas detector -a vibration monitor -an oxygen analyzer -a CO2 analyzer -a relative humidity meter -salinity measurement -a dissolved oxygen meter -a pH meter ▪ describe or perform	Multi media PPT 22 Video 24: Vibration Monitor 16:27 T1: pp 60-74	The student shall: ▪ describe the common type of fire detectors ▪ describe the principal features of: -an explosive gas detector -a vibration monitor -an oxygen analyzer -a CO2 Analyzer -a relative humidity meter -salinity measurement -a dissolved oxygen meter -a pH meter	1.5	

	methodologies and characteristics			6.7.9 describe or perform routine setting up, testing and maintenance of the measuring devices included in the above objectives	routine setting up, testing and maintenance of the measuring devices included in the above objectives ▪ play video #24 ▪ discuss about the video **The student shall:** ▪ Listen and interact to the discussion ▪ Share ideas about the topic ▪ Watch video and develop critical thinking about Vibration monitoring		▪ describe or perform routine setting up, testing and maintenance of the measuring devices included in the above objectives		
		7Transmission of Signals **A. Transmitters**	Week 13-day 2 CO1:Differentiate basic construction and principles in automation regarding various measuring Instruments and automation devices used onboard ships.	7.1 Describe the function of a transducer/transmitter	**The instructor shall:** ▪ Describe the function of a transducer/transmitter ▪ Play video #25 ▪ Discuss about the video ▪ Play video #26 ▪ Discuss about the video ▪ Emphasize the uses of different types of transmitters **The student shall:** ▪ Listen and interact about the topic ▪ Watch video ▪ Discuss what they learn about the video	Multi media PPT 23 Video 25: Open tank Level Measurement Video 26: Why 4 to 20 mA SR2:Control101pp 4-7	**The student shall:** ▪ Describe the function of a transducer/ transmitter ▪ Answer weekly Quiz #13	1.5	
			Week 13-day 3	Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships Demonstrate performance test in	**The instructor shall:** ▪ Brief the students about the activity ▪ Emphasize care for the pneumatic transmitter's delicate components ▪ Remind safety protocols while at the laboratory ▪ Summarize the entire activity based from their gathered data	WSA 15: Performance test of a Pneumatic transmitter Nomogram of Foxboro 11GM	**The student shall:** ▪ Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships. ▪ Perform adjustment of transmitter		3.0

				accordance with the manufacturers standards for the monitoring systems and automatic control devices	**The student shall:** ▪ Read manual procedure ▪ Prepare for equipment needed ▪ perform the activity ▪ do housekeeping upon conclusion of the activity				

STCW Competence	**KUP**	**Course Content**	**Course Outcomes**	**Learning Outcomes**	**TLA**	**Equipment/Material References**	**Assessment method**	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a various automatic control methodologies and characteristics	7Transmission of Signals contd. **B.Controlling Elements**	Week 14-day 1 CO1:Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships.	**B1: Pneumatic** 7.1 describe the flapper nozzle arrangement 7.2 explain what is meant by negative feedback and by positive feedback 7.3 sketch a flapper and nozzle arrangement with negative feedback 7.4 explain the function of a force balance transducer 7.5 describe the principal features of an electro-pneumatic transducer **B2: Electrical** 7.6 use a Wheatstone bridge used as a transducer 7.7 describe the principles of a variable inductance 7.8 describe the principles of a variable capacitance transducer	**The instructor shall:** B1: Pneumatic ▪ describe the flapper nozzle arrangement ▪ explain what is meant by negative feedback and by positive feedback ▪ sketch a flapper and nozzle arrangement with negative feedback ▪ explain the function of a force balance transducer ▪ describe the principal features of an electro-pneumatic transducer B2: Electrical ▪ use a Wheatstone bridge used as a transducer ▪ describe the principles of a variable inductance ▪ describe the principles of a variable capacitance transducer ▪ describe the principles of an electronic force balance transducer ▪ describe the principles	Multi media PPT 24 Video 27: 3 Basic Mechanism for Pneumatic T1: pp 76-78 T1: pp79-84	**The students shall:** B1: Pneumatic ▪ describe the flapper nozzle arrangement ▪ explain what is meant by negative feedback and by positive feedback ▪ sketch a flapper and nozzle arrangement with negative feedback ▪ explain the function of a force balance transducer ▪ describe the principal features of an electro-pneumatic transducer B2: Electrical ▪ use a Wheatstone bridge used as a transducer ▪ describe the principles of a variable inductance ▪ describe the principles of a variable capacitance transducer ▪ describe the principles of an electronic force	1.5	

				7.9 describe the principles of an electronic force balance transducer 7.10 describe the principles of a voltage current transducer	of a voltage current transducer ▪ play video #27 ▪ discuss about thevideo **The student shall:** ▪ Participate in the discussion ▪ Watch video ▪ Draw out ideas about the video		balance transducer ▪ describe the principles of a voltage current transducer		
			Week 14-day 2 CO3: CO1:Differentiate basic construction and principles in automation regarding various measuring Instruments and automation devices used onboard ships.	**B3: Receivers** 7.11 describe the principal features of: - a pneumatic receiver integrator - a potentiometric pen recorder 7.12 explain the function of an XY recorder 7.13 describe the basic principles of AC and DC servomotors	**The instructor shall:** B3: Receivers ▪ describe the principal features of: - a pneumatic receiver integrator - a potentiometric pen recorder ▪ explain the function of an XY recorder ▪ describe the basic principles of AC and DC servomotors ▪ play video #28 ▪ discuss about the video **The students shall:** ▪ Participate in the discussion ▪ Watch video ▪ Draw out ideas about receivers/servomotor	Multi media PPT 25 Video 28:How Servomotors work 2:27 T1: pp 84-88	**The students shall:** B3: Receivers ▪ describe the principal features of: - a pneumatic receiver integrator - a potentiometric pen recorder ▪ explain the function of an XY recorder ▪ describe the basic principles of AC and DC servomotors ▪ answer weekly Quiz #14	1.5	
			Week 14-day 3	Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships	**The instructor shall:** ▪ Brief the students about the expected outcome of the activity ▪ Debrief the students after the activity **The student shall:** ▪ Read the manual procedure ▪ perform activity ▪ do housekeeping upon conclusion of the	WSA 16:AC and DC Servomotors	**The students shall:** ▪ Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships.		3.0

					activity				

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a various automatic control methodologies and characteristics	**8.Manipulator Elements** **A: Pneumatic**	Week 15-day 1 CO1:Differentiate basic construction and principles in automation regarding various measuring Instruments and automation devices used onboard ships.	8.1 State that the final controller might be operated pneumatically, hydraulically or electrically 8.2 Sketch a diaphragm operated control valve 8.3 Describe the characteristics of a motor element and the correcting element in the above objective 8.4 describe or, preferably, determines by experiment the flow characteristics and applications of: –mitre valves –vee-ported valves 8.5 explain what is meant by “turn-down ratio”	**The instructor shall:** ▪ State that the final controller might be operated pneumatically, hydraulically or electrically ▪ Sketch a diaphragm operated control valve ▪ Describe the characteristics of a motor element and the correcting element in the above objective ▪ describe or, preferably, determines by experiment the flow characteristics and applications of: –miter valves –vee-ported valves ▪ explain what is meant by “turn-down ratio” ▪ play video #30 **The students shall:** ▪ Participate in the discussion ▪ Watch video ▪ Draw out their understanding of manipulating elements	Multi media PPT 26 Video 29:Control Valves 1:41 Video 30: How Diapraghm Control valve works 5:28 T1: pp 115-118	**The students shall:** ▪ State that the final controller might be operated pneumatically, hydraulically or electrically ▪ Sketch a diaphragm operated control valve ▪ Describe the characteristics of a motor element and the correcting element in the above objective ▪ describe or, preferably, determines by experiment the flow characteristics and applications of: –miter valves –vee-ported valves ▪ explain what is meant by “turn-down ratio”	1.5	
			Week 15-day 2 CO1:Differentiate basic construction and principles in automation regarding various measuring	8.6 describe the conditions which may dictate the need for a positioner 8.7 describe the principal features of a positioner	**The instructor shall:** ▪ describe the conditions which may dictate the need for a positioner ▪ describe the principal features of a positioner ▪ explains the	Multi media PPT 27 Video 31: What are valve positioner 3:41	The students shall: ▪ describe the conditions which may dictate the need for a positioner ▪ describe the principal features of a positioner ▪ explains the	1.5	

			Instruments and automation devices used onboard ships.	8.8 explains the circumstances when piston actuators might be used 8.9 describe the conditions where butterfly valves might be used 8.10 describe the wax-element temperature-control valve and states its normal temperature range	circumstances when piston actuators might be used ▪ describe the conditions where butterfly valves might be used ▪ describe the wax-element temperature-control valve and states its normal temperature range ▪ play video#31 ▪ discuss about video ▪ play video #32 ▪ discuss about video **The student shall:** ▪ Interact with the discussion ▪ Watch the video ▪ Appreciate the importance of calibration	Video 32: Calibration of a Positioner T1: pp 117-120	circumstances when piston actuators might be used ▪ describe the conditions where butterfly valves might be used ▪ describe the wax-element temperature-control valve and states its normal temperature range ▪ answer weekly Quiz #15		
			Week 15-day 3	Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships.	**The instructor shall:** ▪ Brief the students about the expected outcome of the activity ▪ Debrief the students after the activity **The student shall:** ▪ Read the manual procedure ▪ perform activity ▪ do housekeeping upon conclusion of the activity	WSA 17: Diaphragm Operated Control Valve	**The Students shall:** ▪ Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships.		3.0

STCW Competence	KUP	Course Content	Course Outcomes	Learning Outcomes	TLA	Equipment/Material References	Assessment method	**Indicated Hours**	
								Lec	**Lab**
A-III/1; F2: C1: Operate electrical, electronic and control systems	**A-III/1; F2: C2: KUP 3** Basic configuration and operation principles of the following electrical, electronic and control equipment .3 Control systems: 3a various automatic control methodologies and characteristics	8.Manipulator Elements **B: Electrical servomotors** **C: Hydraulic servomotor**	Week 16-day 1 CO1:Differentiate basic construction and principles in automation regarding various measuring Instruments and automation devices used onboard ships.	8.11 describes a D.C. servomotor and explains how it varies from the common motor 8.12 explains the problems of using a three-phase 8.13 describe the principles of a swash plate pump 8.14 explain the advantage of using high pressures 8.15 explain the applications of a hydraulic ram servomotor	**The instructor shall:** ▪ describes a D.C. servomotor and explains how it varies from the common motor ▪ explains the problems of using a three-phase ▪ describe the principles of a swash plate pump ▪ explain the advantage of using high pressures ▪ explain the applications of a hydraulic ram servomotor ▪ play video #33 ▪ discuss about video **The student shall:** ▪ Interact with the discussions ▪ Watch video ▪ Draw out appreciation from the video	Muliti media PPT 28 Video 33: Swash Plate Pump T1: pp121-126	**The students shall:** ▪ describe a D.C. servomotor and explains how it varies from the common motor ▪ explain the problems of using a three-phase ▪ describe the principles of a swash plate pump ▪ explain the advantage of using high pressures ▪ explain the applications of a hydraulic ram servomotor	1.5	
			. week 16 day2	▪ Provide feedback to instructor for the learning progress of the course.	The instructor shall: ▪ prepare the room for final examination ▪ facilitate the conduct of the Final Examination	Final Exam Questionnaire	The student shall: ▪ answer the Written Final Examination	1.5	
			Week 16-day 3	▪ Differentiate basic construction and principles in	**The instructor shall:** ▪ Collect compilation of activities	▪ WSA 18 Compilation Of WSA	**The students shall:** ▪ Compile all the activities		3.0

				automation regarding various measuring instruments and automation devices used onboard ships. ▪ Interpret process and instrument diagrams of automation system based on the industry Standards ▪ Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices	▪ Summarize the entire subject of automation what did they learn and the essence of automation in their future work ▪ Prepare for Final Practical Assessment ▪ Brief the students about the rules of the assessment ▪ Conduct Individual Final Practical Assessment	▪ PA 02: Final Practical Assessment Set#1 ▪ PA 03: Final Practical Assessment set#2 ▪ *Note depends on the instructor which set is to be given or both so that the venue will be divided to save time*	▪ Make up for the unfinished activities ▪ Submit the compilation report to the instructor For final practical assessment: ▪ Demonstrate all course intended learning outcomes for automation as below; ▪ Differentiate basic construction and principles in automation regarding various measuring instruments and automation devices used onboard ships. ▪ Interpret process and instrument diagrams of automation system based on the industry standards ▪ Demonstrate performance test in accordance with the manufacturers standards for the: Monitoring systems; Automatic control devices; and Protective devices		