	SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF CIVIL, PLANNING AND EARTH ENGINEERING** **DEPARTMENT OF GEOMATICS ENGINEERING** **UNDERGRADUATE STUDY PROGRAM**	**Document Code**

SEMESTER LEARNING PLAN (SLP)

COURSE NAME	**CODE**	**COURSE GROUP**	**CREDITS (SKS)**		**SEMESTER**	**Date of Preparation**
Seabed Imaging and Mapping	CM235030	Geomarine	**T=2**	**P=1**	6	-

AUTHORIZATION	**SLP Developer**	**Course Group Coordinator**	**Head of Study Program**
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Learning Outcomes (CP)		
	Expected Learning Outcomes (ELO) that Imposed in the Course	
	ELO-4	Able to apply mathematics, science, and engineering in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral to gain a thorough understanding of the principles of engineering.
	ELO-5	Able to design survey and mapping activities using the latest technology in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral.
	ELO-9	Able to plan, perform and evaluate the process of surveying and mapping activities using the latest technology in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral.
	Course Learning Outcomes (CLO)	
	CLO-1	Students are able to explain the concepts and scope of hydrographic surveying.
	CLO-2	Students are able to review singlebeam echosounders and their operational procedures.
	CLO-3	Students are able to understand angular resolution and range resolution in multibeam echosounders.
	CLO-4	Students are able to identify various types of vessel movements on the sea surface.
	CLO-5	Students are able to explain the definition, working principles, and analysis of multibeam echosounders.
	CLO-6	Students are able to describe the basic concepts of horizontal and vertical data acquisition.
	CLO-7	Students are able to explain the working principles of bathymetric LiDAR.

	CLO-8	Students are able to design hydrographic surveys for various applications.

ELO-CPMK matrix

CLO	ELO-4	ELO-5	ELO-9
CLO-1	V		
CLO-2	V		
CLO -3	V		
CLO -4		V	
CLO-5		V	
CLO-6		V	
CLO-7	V		
CLO-8			V

Course Description	Seabed Sensing is a compulsory course in hydrography that aims to provide a continuation of hydrographic surveys that have been taken in the previous semester. In this course, students will learn about underwater mapping which includes hydrographic surveys and instruments used in conducting hydrographic surveys. the implementation of hydrographic surveys in question using various methods, both sonar, Lidar and satellite altimetry and making good survey designs. The various positions both horizontally and vertically in hydrographic surveys will also be explained in this course. In this lecture will be explained the resolution produced from one of the hydrographic survey instruments, namely multibeam echosonder, the resulting resolution consists of two, namely angular resolution and distance resolution (range resolution). From this course will also be explained about the movement of ships that occur over the sea, such as pitch, roll and yaw.
Course Materials	1. The concept and scope of hydrographic surveys 2. Reviews of singlebeam echosounders and the procedure for using them 3. Angle resolution and distance resolution on multibeam echosounders 4. Various cams of ship movement above sea level 5. Definition, working principle and analysis on multibeam echosounders 6. Basic concepts of horizontal and vertical data acquisition 7. The working principle of bathy lidar and its working principle 8. Creation of hydrographic survey design
References	**Main:**
	1. Lurton, Xavier. An Introduction to Underwater Acoustic: Principles and Applications. France. Praxis Publ. 2002. 2. Hughes-Clarke, J. Toward remote seafloor classification using the angular response of accoustic backscattering: A Case Study for Multiple Overlapping GLORIA Data, IEEE Joural of Oceanic Engineering, 19, 112-127, 1994.

	3. Rennard, V. and Allenou, J.P. Sea beam multibeam echosounding on Jean Charcot: Description, evaluation and first results, Int. Hydr. 1979. **Additional :** 1. Wilson, O.B. An introduction to the theory and design of sonar transducer. Washington, DC: Naval Post Graduate School. US Government Printing Office. 1985 2. Lasky, M. Review of underwater acoustic to 1950, Journal of the acoustical society of America. 1977 3. Nielsen, R. O. Sonar Signal Processing. Boston: Artech House, 1991.
Lecturer	1. Danar Guruh Pratomo, S.T., M.T., Ph.D. 2. Khomsin, S.T., M.T. 3. Dr. Aldila Syariz, S.T., M.S., Ph.D. 4. Irena Hana Hariyanto, S.T., M.T.
Prerequisite	Hydrographic Survey

Class/ Week	Lesson Learning Outcome (Sub-CLO)	Valuation		Learning Forms, Learning Methods, Student Assignments/Task, [Estimated Time]		Learning Materials [References]	Weight (%)
		Indicators	Criteria	Offline	Online		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Have knowledge of the definition of hydrographic surveys in general and their application	Accuracy in explaining the definition of hydrographic surveys in general and their application	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise and Task Response 1 [1 x 50']		1. Syllabus Explanation, tatib 2. Introduction to hydrographic surveying 3. Methodology of conducting hydrographic surveys 4. Hydrographic survey application	5
2 - 3	Able to explain hydrographic surveyed data collection instruments using a singlebeam echosounder and the procedure for its use	Accuracy in explaining hydrographic surveyed data collection instruments	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Response Exercise and Task 2 [2 x 50']		1. Understanding Singlebeam echosounders 2. Procedure for using singlebeam echosounders	10

		using a singlebeam echosounder and the procedure for its use	3. Attitude accuracy			3. Difference between singlebeam echosounder and multibeam echosounder	
4 - 5	Able to distinguish between angular resolution and range resolution in a multibeam echosounder	Accuracy in distinguishing between angular resolution and range resolution in a multibeam echosounder	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Exercise [2 x 50']		1. Angular resolution 2. Range resolution	15
6	Able to describe errors or errors and their causes that can occur during hydrographic surveys	Accuracy in describing errors or errors and their causes that can occur during hydrographic surveys	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. Translational errors 2. Rotation Error	5
7	Able to explain tolerances and types of corrections applied to hydrographic surveys	Accuracy in explaining tolerances and types of corrections applied to hydrographic surveys	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. IHO S-44 Standard 2. Patch Test 3. Correction process support equipment	5
8	**Midterm Evaluation / Midterm Exam**						**40**
9 - 10	Able to understand the analysis on hydrographic	Accuracy in to understanding	1. Completeness of the material	1. Lecture [2 x 50'] 2. Discussion [2 x 50']		1. Multibeam Geometry	10

	survey instruments, namely multibeam echosounders	the analysis on hydrographic survey instruments, namely multibeam echosounders	2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	3. Exercise [2 x 50']		2. Multibeam bottom detection 3. Multibeam active compensation	
11	Have the ability to explain data acquisition in vertical and horizontal positioning in hydrographic surveys	Accuracy in explaining data acquisition in vertical and horizontal positioning in hydrographic surveys	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Exercise [2 x 50']		1. Horizontal positioning on board 2. Vertical positioning in hydrographic surveys	10
12	Able to carry out horizontal positioning practicum using optical and semi-electro methods	Accuracy in carrying out horizontal positioning practicum using optical and semi-electro methods	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Practicum and Task Response 3 [1 x 50']		1. Resection method in horizontal positioning in the sea 2. Intersection method in horizontal positioning in the sea 3. Use of Total Station and GNSS in horizontal positioning at sea	10
13	Able to explain data acquisition in vertical positioning in hydrographic surveys	Accuracy in explaining data acquisition in vertical positioning in hydrographic surveys	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. Orientation and Heave 2. Ship reference frame	10

14	Able to understand the basic concepts of data acquisition using Bathy Lidar in hydrographic surveys	Accuracy in understanding the basic concepts of data acquisition using Bathy Lidar in hydrographic surveys	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. Understanding bathy lidar 2. Working principle of bathy lidar	10
15	Able to design hydrographic surveys in an area	Accuracy in designing hydrographic surveys in an area	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Response Exercises and Tasks 4 [1 x 50']		1. Creation of hydrographic survey design	10
16	**Final Semester Evaluation / Final Semester Examination**						**100**