Semester Lesson Plan (SLP)

	THE STATE UNIVERSITY OF SURABAYA FACULTY OF MATHEMATICS AND NATURAL SCIENCES PHYSICS STUDY PROGRAM	Document Code

SEMESTER LESSON PLAN

NAME OF COURSE	COURSE CODE	DISCIPLINE	COURSE UNIT		SEMESTER	DATE CREATED
PHYSICAL OCEANOGRAPHY		PHYSICS	T= 2 units	P=?	7 (seven)	8 December 2020

AUTHORISATION	AUTHOR	COURSE COORDINATOR	HEAD OF PHYSICS STUDY PROGRAM
PHYSICS DEPARTMENT	Tjipto Prastowo, Ph.D	Tjipto Prastowo, Ph.D	Prof. Dr. Munasir, M.Si

Learning Achievement		
	Program Learning Outcome (PLO)	
	PLO-3	Able to solve problems in physical systems comprehensively by using mathematics and computational tools.
	PLO-4	Able to analyze a physical system by applying mathematics and computational tools/ICT.
	PLO-6	Able to improve their knowledge and be able to continue their study in a higher education.
	PLO-7	Able to communicate their ideas and/or research results in academic writing and speaking effectively.
	PLO-9	Able to work as an individual as well as a team effectively, have entrepreneurship skill and awareness of environmental issues.
	PLO-10	Able to demonstrate good scientist's manners, critical thinking and innovation skills in research and professional fields; and willing to do lifelong learning.
	Course Learning Outcome (CLO)	
	CLO-1	Understanding the systematic study of ocean dynamics as a physical system and its roles in human life and living organisms.
	CLO-2	Understanding interdependence of human and the ocean.
	CLO-3	Understanding ocean's structure and its corresponding characteristics in the context of exploration of ocean resources.
	CLO-4	Understanding potential threats from hydro-meteorological hazards associated with ocean hydrological cycle influenced by conditions on local, regional and global climates.
	Final competence in each step of learning (Sub-CLO)	
	Sub-CLO1	Being able to understand that Indonesia is a marine country based on geographical, historical, social-economical and social-cultural considerations.
	Sub-CLO2	Being able to understand important roles of the ocean as a physical system in human life in the context of ocean resources, ocean circulation and hydrological cycle.
	Sub-CLO3	Being able to understand effects of sun's radiation exposure on sea surface temperature and at depth through air-sea interaction.
	Sub-CLO4	Being able to understand constant composition of salt around the world, and vertical and horizontal variations of salinity that cause density variations of ocean waters.
	Sub-CLO5	Being able to understand density distribution of ocean waters as a function of temperature and salinity, vertical and horizontal

		variations of density as the driving force for the Indonesian Throughflow, physical processes (ocean mixing and diffusion) that drive ocean waters into ocean stratification.
	Sub-CLO6	Being able to understand issues related to characteristics of propagation of light and sound waves under the sea surface, principles of sensors for light and sound detection under the sea surface, marine acoustics for bathymetry and topography mapping at the sea floor.
	Sub-CLO7	Being able to understand effects of air-sea interaction with respect to wind-forcing pattern that affects ocean currents and surface waves in the ocean, characteristics of divergent and convergent currents, characteristics of wave group velocity in shallow and deep seas.
	Sub-CLO8	Being able to understand dynamics of ocean tides as the source of ocean power generation, effectiveness of ocean power generation in shallow and deep waters.
	Sub-CLO9	Being able to understand potential threats from hydro-meteorological hazards associated with ocean hydrological cycle influenced by conditions on local, regional and global climates, hazard mitigation study and disaster risk management.
	Sub-CLO10	Being able to understand posters relevant to physical oceanography with emphasis upon the exploration of ocean resources and efforts for hazard mitigation with respect to ocean hydrological cycle.
Course Description	Indonesia is a marine country with area coverage of seas wider than lands. This calls for a specific course discussing issues related to knowledge and use of ocean resources in the country territory. During class discussions, a phenomological approach is utilised with discussions are focussed on aspects of physical oceanography. Class discussions include the properties of ocean water, ocean wave and energy, ocean tides and currents, ocean circulation on regional and global scales, the Indonesian Throughflow, hydro-meteorological hazards associated with ocean hydrological cycle, and characteristic of a tsunami wave.	
Topic Discussions: Learning Materials	1. Indonesia as a marine country: geographical, historical, social-economical, and social-cultural considerations 2. Ocean as a physical system, ocean structure, ocean characteristics, ocean hydrological cycle 3. Sun's radiation, air-sea interaction, sea surface temperature, temperature distribution, temperature as a function of depth 4. Ocean salinity, salt composition, salinity as a function of depth, salt distribution around the world 5. Density distribution, pressure distribution, density as a function of temperature and salinity, physical processes affecting density distribution 6. Propagation of light and sound waves at seas, visibility under the sea surface, sensor technology under the sea surface, marine acoustics 7. Air-sea interaction, wind-forcing pattern, ocean currents, surface waves in the ocean in shallow and deep oceans, ocean wave energy 8. Ocean tides, tide dynamics, spatial variation of tides in shallow and deep ocean waters, ocean power generation 9. Hydro-meteorological hazards, floods, droughts, forest fires, hazard mitigation, disaster risk reduction and management 10. Video clips for poster sessions on Physical Oceanography	
References	**Primary:**	
	1. Prastowo, T. 2012. *Sains Kebumian.* Unpublished work, pp.1-31. 2. Burhanudin, S. dkk. 2003. *Sejarah Maritim Indonesia*. Jakarta: BRKP Kementerian Perikanan dan Kelautan, pp.1-185. 3. Supangat dan Susanna. 2005. *Pengantar Oseanografi*. Jakarta: BRKP Kementerian Perikanan dan Kelautan, pp.2-286. 4. Pinet, P. R. 1998. *Invitation to Oceanography.* London, UK: Jones and Bartlett Publishers, pp.1-620.	

	5. Stewart, R. H. 2004. *Introduction to Physical Oceanography*. Texas, US: Texas A & M Uni Press, pp.1-352.
	Secondary:
	Some power point files and/or course materials relevant to Physical Oceanography from the internet
Lecturer	Tjipto Prastowo, Ph.D
Pre-requisites	Thermodynamics, Waves

Week	**Final competence in each learning step (Sub-CLO)**	**Assessment**		**Learning Format, Methods, Instruction, (Time Allocation)**		**Learning Materials**	**Proportion (%)**
		Indicator	**Criteria & Format**	**Luring (*offline*)**	**Daring (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Being able to understand that Indonesia is a marine country based on geographical, historical, social-economical and social-cultural considerations	Students can explain that Indonesia is a marine country based on geographical, historical, social-economical and social-cultural considerations			Contextual Learning Class discussion Q & A	• Indonesia as a marine country • Geographical, historical, social-economical, and social-cultural considerations	
2	Being able to understand important roles of the ocean as a physical system in human life in the context of ocean resources, ocean circulation and hydrological cycle	important roles of the ocean as a physical system in human life in the context of ocean resources, ocean circulation and hydrological	Description on student assignments: 1. Short article (by a group) about topics in physical oceanography 2. Corresponding poster (by a group) 3. Individual poster presentation		Contextual Learning Class discussion Q & A	• Ocean as a physical system • Ocean structure • Ocean characteristics • Ocean hydrological cycle	

		cycle					
3	Being able to understand effects of sun's radiation exposure on sea surface temperature and at depth through air-sea interaction	Students can explain effects of sun's radiation exposure on sea surface temperature and at depth through air-sea interaction			Contextual Learning Class discussion Q & A	• Sun's radiation, air-sea interaction • Sea surface temperature • Temperature distribution • Temperature as a function of depth	
4	Being able to understand constant composition of salt around the world, and vertical and horizontal variations of salinity that cause density variations of ocean waters	Students can explain constant composition of salt around the world, and vertical and horizontal variations of salinity that cause density variations of ocean waters			Contextual Learning Class discussion Q & A	• Ocean salinity • Salt composition, salinity as a function of depth • Salt distribution around the world	
5	Being able to understand density distribution of ocean waters as a function of temperature and salinity, vertical and horizontal variations of density as the driving force for the Indonesian Throughflow, physical processes (ocean mixing and diffusion) that drive ocean waters into	Students can explain density distribution of ocean waters as a function of temperature and salinity, vertical and horizontal variations of density as the			Contextual Learning Class discussion Q & A	• Density distribution • Pressure distribution • Density as a function of temperature and salinity • Physical processes affecting density distribution	

	ocean stratification	driving force for the Indonesian Throughflow, physical processes (ocean mixing and diffusion) that drive ocean waters into ocean stratification					
6	Being able to understand issues related to characteristics of propagation of light and sound waves under the sea surface, principles of sensors for light and sound detection under the sea surface, marine acoustics for bathymetry and topography mapping at the sea floor	Students can explain issues related to characteristics of propagation of light and sound waves under the sea surface, principles of sensors for light and sound detection under the sea surface, marine acoustics for bathymetry and topography mapping at the sea floor	Student assignment 1 (short article): handed in Criteria for assessment are available		Contextual Learning Class discussion Q & A	• Propagation of light and sound waves at seas • Visibility under the sea surface • Sensor technology under the sea surface • Marine acoustics	**15%**
7	Being able to understand effects of air-sea interaction with respect to wind-forcing	Students can explain effects of air-sea			Contextual Learning Class discussion Q & A	• Air-sea interaction • Wind-forcing pattern	

	pattern that affects ocean currents and surface waves in the ocean, characteristics of divergent and convergent currents, characteristics of wave group velocity in shallow and deep seas	interaction with respect to wind-forcing pattern that affects ocean currents and surface waves in the ocean, characteristics of divergent and convergent currents, characteristics of wave group velocity in shallow and deep seas				• Ocean currents • Surface waves in the ocean in shallow and deep oceans • Ocean wave energy	
8	**Mid Semester Exam**						**30%**
9	Being able to understand effects of air-sea interaction with respect to wind-forcing pattern that affects ocean currents and surface waves in the ocean, characteristics of divergent and convergent currents, characteristics of wave group velocity in shallow and deep seas	Students can explain effects of air-sea interaction with respect to wind-forcing pattern that affects ocean currents and surface waves in the ocean, characteristics of divergent and convergent currents, characteristics			Contextual Learning Class discussion Q & A	• Air-sea interaction • Wind-forcing pattern • Ocean currents • Surface waves in the ocean in shallow and deep oceans • Ocean wave energy	

		of wave group velocity in shallow and deep seas					
10	Being able to understand dynamics of ocean tides as the source of ocean power generation, effectiveness of ocean power generation in shallow and deep waters	Students can explain dynamics of ocean tides as the source of ocean power generation, effectiveness of ocean power generation in shallow and deep waters	Student assignment 2 (relevant posters): handed in Criteria for assessment are available		Contextual Learning Class discussion Q & A	• Ocean tides • Tide dynamics • Spatial variation of tides in shallow and deep ocean waters • Ocean power generation	**15%**
11	Being able to understand dynamics of ocean tides as the source of ocean power generation, effectiveness of ocean power generation in shallow and deep waters	Students can explain dynamics of ocean tides as the source of ocean power generation, effectiveness of ocean power generation in shallow and deep waters			Contextual Learning Class discussion Q & A	• Ocean tides • Tide dynamics • Spatial variation of tides in shallow and deep ocean waters • Ocean power generation	
12	Being able to understand potential threats from hydro-meteorological hazards associated with ocean hydrological cycle influenced by conditions on	Students can explain potential threats from hydro-meteorological			Contextual Learning Class discussion Q & A	• Hydro-meteorological hazards • Floods, droughts, forest fires • Hazard mitigation	

	local, regional and global climates, hazard mitigation study and disaster risk management	hazards associated with ocean hydrological cycle influenced by conditions on local, regional and global climates, hazard mitigation study and disaster risk management				• Disaster risk reduction and management	
13	Being able to understand potential threats from hydro-meteorological hazards associated with ocean hydrological cycle influenced by conditions on local, regional and global climates, hazard mitigation study and disaster risk management	Students can explain potential threats from hydro-meteorological hazards associated with ocean hydrological cycle influenced by conditions on local, regional and global climates, hazard mitigation study and disaster risk management			Contextual Learning Class discussion Q & A	• Hydro-meteorological hazards • Floods, droughts, forest fires • Hazard mitigation • Disaster risk reduction and management	
14	Being able to understand posters relevant to physical oceanography with emphasis upon the	posters relevant to physical oceanography with emphasis	Student assignment 3 (relevant clips): handed in		Contextual Learning Class discussion Q & A	Poster Presentation on Physical Oceanography (with students being	

	exploration of ocean resources and efforts for hazard mitigation with respect to ocean hydrological cycle	upon the exploration of ocean resources and efforts for hazard mitigation with respect to ocean hydrological cycle	Criteria for assessment are available			active for class presentation)	
15	Being able to understand posters relevant to physical oceanography with emphasis upon the exploration of ocean resources and efforts for hazard mitigation with respect to ocean hydrological cycle	Students can explain posters relevant to physical oceanography with emphasis upon the exploration of ocean resources and efforts for hazard mitigation with respect to ocean hydrological cycle	Student assignment 3 (relevant clips): handed in Criteria for assessment are available		Contextual Learning Class discussion Q & A	Poster Presentation on Physical Oceanography (with students being active for class presentation)	
16	**Final Exam**						**40%**