MODUL
HYDROCLAMATOLOGY

MASTER PROGRAM OF ENVIRONMENTAL SCIENCE
SCHOOL OF POSTGRADUATED STUDIES
DIPONEGORO UNIVERSITY

Modul Description :

Modul design	Hydroclimatology
Modul level, if applicable	
Code, if applicable	P-CIL-8-215
Subtitles, if any	
Course, if applicable	
Semester(s) in which the Modul is taught	Semester 2
Modul responsible*	
Teaching Lecturer	1. Dr. Ir. Sutrisno Anggoro, MS 2.Dr. Muhammad Helmi, SSi, MSi 3. Ferry Hermawan, ST., MT., PhD.
Language	*Indonesian and English*
Relationship with curriculum	
Type of teaching, hours of contact	*Studying:1 x 120 minutes x 16 meetings = 32 hours/week* *Q&A:1x 20 minutes 16 meetings = 5.3 hours/week* *Discussion:1x 20 minutes 16 meetings = 5.3 hours/week* *Presentation:1x 20 minutes 16 meetings = 5.3 hours/week* *Individual assignments: 36 minutes/day = 3 hours/week* *Total work for 1 semester = 100 hours = 4 ECTS*
Workload	*(Estimated) workload, divided into contact hours (lectures, exercises, laboratory sessions, etc.) and personal study, including test preparation, specified in hours,[1]and overall.*
credit points	*2 credits / 4 ECTS*
Requirements according to the exam regulations	*Lecture attendance of at least 75%*
Recommended prerequisites	*For example, competence in…*

Modulthe desired learning objectives/outcomes	Students are able to explain the relationship that underlies climate variability and water resources; describe and explain natural hydroclimatological variability at various spatial scales; describes the methods used to reconstruct records of past hydroclimatological changes; explain the basic concepts and methods used in both climate science and hydrology; demonstrate knowledge of state-of-the-art technology and instrumentation including weather radar and satellites for real-time measurement of meteorological and climate parameters; demonstrate an understanding of the causes and effects of atmospheric and oceanic circulation; discusses the interaction between ocean circulation/atmosphere and hydrological processes such as precipitation, evaporation, interception, soil moisture, snow, river flow, etc.; explain climate change and climate variability; demonstrate an understanding of climate indicators, hydroclimatic models and global climate data sources; and discusses 'contemporary' challenges in hydroclimatology due to the increasing human impact on processes in the hydrologic cycle
Fill	This course provides students with a thorough background of the basic processes that govern the climatic and hydrological systems, and the relationships between them. It first examines fundamental atmospheric and hydrological processes, and traces the flow of energy and water between the Earth's surface and the atmosphere. Then the physical processes that control the water cycle are examined, including evapotranspiration, precipitation, runoff and storage of water in natural reservoirs (including soil and groundwater, lakes and wetlands). Finally, students will learn about the role of water in climate in Earth's major biomes.
Study and examexam requirements and forms	• *Open the book and close the book* • *Multiple choice, case studies, interviews, practicals*
Media used	*Powerpoint, youtube, website*
Reference	1. Dahuri, R., Jacub Rais, Sapta Putra Ginting, and MJ Sitepu. 2001. Integrated Management of Coastal and Marine Resources. PT Pradnya Paramita, Jakarta 2. Limantara Lily. 2018. Hydrological Engineering. ANDI Publisher. Yogyakarta 3. Syarifudin. 2017. Applied Hydrology. ANDI Publisher. Yogyakarta 4. Tjasyono Bayong. 2008. Applied Climatology. ITB Press. Bandung

SEMESTER STUDY PLAN

Study program: Master of Environmental Science			**Faculty: School Of Postgraduated Studies**				
Subject:	**Hydroclimatology**	**Code: P-CIL-8-215**		**Credit:2 (4 ECTS)**		**Smt:2**	
Supporting lecturer:	**1. Prof. Dr. Ir. Sutrisno Anggoro, MS** **2. Dr. Muhammad Helmi, SSi, MSi** **3. Ferry Hermawan, ST., MT., PhD.**						
Learning Outcomes Subject:	• Be able to describe the underlying relationship between climate variability and water resources; • Able to describe and explain natural hydroclimatological variability at various spatial scales; • Be able to explain the methods used to reconstruct the record of past hydroclimatological changes; • Able to explain basic concepts and methods used in both climate science and hydrology; • Able to demonstrate knowledge of cutting-edge technology and instrumentation including weather radar and satellites for real-time measurement of meteorological and climate parameters; • Be able to demonstrate an understanding of the causes and effects of atmospheric and oceanic circulation; • Be able to discuss the interaction between ocean circulation/atmosphere and hydrological processes such as precipitation, evaporation, interception, soil moisture, snow, river flow, etc.; • Able to explain climate change and climate variability; • Able to demonstrate an understanding of climate indicators, hydroclimatic models and sources of global climate data; • Be able to discuss 'contemporary' challenges in hydroclimatology due to the increasing human impact on processes in the hydrological cycle						
Short Description of Courses:	This course provides students with a thorough background of the basic processes that govern the climate and hydrological systems, and the relationships between them. It first examines fundamental atmospheric and hydrological processes, and traces the flow of energy and water between the Earth's surface and the atmosphere. Then the physical processes that control the water cycle are examined, including evapotranspiration, precipitation, runoff and water storage in natural reservoirs (including soil and groundwater, lakes and wetlands). Finally, students will learn about the role of water in climate in Earth's major biomes.						

1	2	3	4	5	6	7	
Week	**Final Ability of each learning stage**	**Study Materials/ Subjects**	**Learning methods**	**Workload**	**Student Learning Experience**	**Evaluation**	
						Criteria & Indicators	**Weight (%)**
1	Able to understand local to global hydroclimatic challenges, from current conditions to future challenges	Introduction to hydroclimatology includes its boundaries: 1. Environmental Climatology 2. Environmental Climatology 3. Environmental phenomena related to global and local hydroclimatology	Lectures, questions and answers, and discussions	216minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 Minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
2	Able to understand the hydrological cycle, hydrolimnology, types, zones, character systems, vulnerability cases in each water body	Climatological and Hydrological Cycle Environment: 1. Fresh water 2. brackish water 3. Sea water	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 Minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5

3	Able to understand the interrelationships of the hydrological cycle in ecosystems	1. The linkage of biohydroclimate with aquatic ecosystems, 2. The linkage of various development activities on aquatic ecosystems & hydro-oceanography, 3. Coastal boundaries, coastal hydroclimate land & waters, 4. Components of the hydro-oceanographic environment	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: • *Lecture = 1x 120 minutes* • *Q&A =1 x 20 minutes* • *Discussion = 1 x 20 minutes* • *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
4	Able to describe problems and provide an evaluation of environmental impacts	Hydrosean environmental impact forecast case study and environmental impact evaluation	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: • *Lecture = 1x 120 minutes* • *Q&A =1 x 20 minutes* • *Discussion = 1 x 20 minutes* • *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
5	Able to understand the use of coastlines in a case study	Utilization of shoreline data, estuaries (characteristics,	Lectures, questions and	216 minutes (0.25 ECTS) Consist of:	Students listen to the lecturer's	Presence and Activeness in	5

		ecosystem components, functions, type of formation, capacity, hydraulic system	answers, and discussions	◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	explanation and answer the lecturer's questions, as well as discuss	Understanding Discussion	
6	Able to understand climate change events	Climate change and its impact on the resilience of the terrestrial & coastal water environment: - Problem - Impact	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
7	Able to understand climate change events	Climate change and its impact on the resilience of the terrestrial & coastal water environment: Sustainable development based on the carrying capacity of marine resources	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5

				◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*			
8	**Mid Term Examination**	**Meeting Material 1- 9**	**Written test**	**216 minutes of processing time or the equivalent of 0.25 ECTS**	**Students working on UTS questions**	**Completeness and correctness of explanation and accuracy of understanding**	**5**
9	Able to understand climate change events	Climate change and its impact on the resilience of the terrestrial & coastal water environment: - Green economy (understanding, principles, indicators, legal basis, policies) - Blue economy (understanding, principles, indicators, legal basis, policies)	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
10	Able to describe environmental management strategies	Environmental management strategy for disaster mitigation	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5

				minutes ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*			
11	Able to understand hydroclimatic phenomena	The hydroclimatic phenomenon is Acid rain and its impact on the environment: - Formation of acid in the atmosphere - Explanation of acid rain - Causes and effects of acid rain - Environmental variables that can have a synergistic effect with acid rain	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
12	Able to recognize spatial modeling related to hydroclimatology studies	Spatial modeling for studies related to hydroclimatology	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5

				minutes/day (16 weeks)			
13	Able to recognize spatial modeling related to hydroclimatology studies	Spatial modeling for studies related to hydroclimatology	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
14	Able to recognize spatial modeling related to hydroclimatology studies	Spatial modeling for studies related to hydroclimatology	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes* ◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	Students listen to the lecturer's explanation and answer the lecturer's questions, as well as discuss	Presence and Activeness in Understanding Discussion	5
15	Able to understand urban hydrological planning	Urban hydrological planning	Lectures, questions and answers, and discussions	216 minutes (0.25 ECTS) Consist of: ◦ *Lecture = 1x 120 minutes*	Students listen to the lecturer's explanation and answer	Presence and Activeness in Understanding Discussion	5

				◦ *Q&A =1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*	the lecturer's questions, as well as discuss		
16	**Final Examination**	**Meeting Materials 1-15 (resume material)**	**Written test**	**216 minutes of processing time or the equivalent of 0.25 ECTS**	**Students working on UAS questions**	**Completeness and correctness of explanation and accuracy of understanding**	**15**
8. Reference List:		1. Dahuri, R., Jacub Rais, Sapta Putra Ginting, and MJ Sitepu. 2001. Integrated Management of Coastal and Ocean Resources. PT Pradnya Paramita, Jakarta 2. Limantara Lily.2018. Hydrological Engineering. ANDI Publisher. Yogyakarta 3. Syarifudin.2017. Applied Hydrology. ANDI Publisher. Yogyakarta 4. Tjasyono Bayong. 2008. Applied Climatology. ITB Press. Bandung					