MODUL

TRANSFER AND MASS TRANSFORMATION

MASTER PROGRAM OF ENVIRONMENTAL SCIENCE
SCHOOL OF POSTGRADUATED STUDIES
DIPONEGORO UNIVERSITY

Modul Description :

Modul design	Mass Transfer and Transformation
Modul level, if applicable	
Code, if applicable	
Subtitles, if any	
Course, if applicable	
Semester(s) in which the Modul is taught	Semester 2
Modul responsible*	
Teaching Lecturer	Dr. Jafron Wasiq Hidayat, M.Sc. Prof. Dr. Ir. Hadiyanto, ST.M.Sc.IPU
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 know the basics of the equations of Mass, Heat and Momentu, the process of mass transfer and examples And also able to answer questions related to the process of mass transfer
Fill	This course aims to equip students with knowledge, understanding and application of Mass Transfer and Transformation. Lectures discuss various types of mass transfer and transformation with various aspects. Learning activities include lectures with various approaches and methods that involve students a lot, such as discussions, observation activities in the field to learn to identify problems and their solutions, learn to identify problems and their solutions.
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. Anantharaman. 2011. Mass Transfer: Theory and Practice. India: Prentice Hall India Learning Private Limited. 2. Delgado. JMPQ 2017. Heat and Mass Transfer Processes: New Developments and Applications II. Trans Tech Inc. Publications 3. Dutta, BK 2007. Process Principles of Mass Transfer and Separation. PHI 4. Mauro, A.and Massarotti, N. 2020. Heat and Mass Transfer in Energy Systems. MDPI 5. Ventras, JS, and Vrentas, CM 2013, Diffusion and Mass Transfer First Edition. CRC Press

SEMESTER STUDY PLAN

Study program: Master of Environmental Science				**Faculty: School Of Postgraduated Studies**				
Subject:	Mass Transfer and Transformation	**Code: CIL-8-320**		**Credit:2 (4 ECTS)**		**Smt: 2**		
Supporting lecturer:	**Dr. Jafron Wasiq Hidayat, M.Sc.** **Prof. Dr. Ir. Hadiyanto, ST.M.Sc.IPU**							
Learning Outcomes Subject:	Students know the basics of the equations of Mass, Heat, and Momentum Students know the process of mass transfer and examples Students can answer questions related to the mass transfer process							
Short Description of Courses:	This course aims to equip students with knowledge, understanding and application of Mass Transfer and Transformation. Lectures discuss various types of mass transfer and transformation with various aspects. Learning activities include lectures with various approaches and methods that involve students a lot, such as discussions, observation activities in the field to learn to identify problems and solve them, learn to identify problems and solve them.							

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.	Students know the lecture contract and know the basics of the equations of Mass, Heat, and Momentum	• Lecture contracts • Equations of Mass, Heat and Momentum	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know the basics of the equations of Mass, Heat, and Momentum	Lectures and discussions	5

				minutes/day (16 weeks)			
2.	Students know the mass transfer process and its examples	• Presentation of mass transfer processes and examples	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know the mass transfer process and its examples	Lectures and discussions	5
3.	Students know molecular diffusion in gases	• Exposure and discussion of molecular diffusion in gases	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know the molecular diffusion in gases	Lectures and discussions	5
4.	Students know molecular diffusion in liquids	• Presentation and discussion of molecular diffusion in liquids	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *Lecture = 1x 120 minutes* ◦ *Q&A = 1 x 20 minutes* ◦ *Discussion = 1 x 20*	Students can know molecular diffusion in liquids	Lectures and discussions	5

				minutes ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*			
5.	Students know molecular diffusion in solids	• Presentation and discussion of molecular diffusion in solids	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know molecular diffusion in solids	Lectures and discussions	5
6.	Students know the diffusion in two-dimensional objects	• Exposure and discussion of diffusion in two-dimensional objects	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know diffusion in two-dimensional objects	Lectures and discussions	5
7.	Students are able to answer questions related	• Book Review and discussion of	Lectures and discussions	216 minutes (0.25 ECTS)	Students can answer questions	Lectures and discussions	5

	to the mass transfer process	issues related to the mass transfer process		◦ *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)*	related to the mass transfer process		
8.	**Mid-Semester Examination (UTS)**	**Meeting material 1-7**	**Independent Written Test**	**150 minutes (0.25 ECTS)**	**Students can answer questions related to the mass transfer process**	**Written test**	**15**
9.	Students know the toxicity and dynamic chemical mobility in the environment	• Exposure to toxicity and dynamic chemical mobility in the environment	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know the toxicity and dynamic chemical mobility in the environment	Lectures and discussions	5
10.	Students know persistence, concentration, and dynamic chemical amenability	• Exposure to dynamic chemistry persistence, concentration and amenability	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *Lecture = 1x 120 minutes* ◦ *Q&A = 1 x 20 minutes* ◦ *Discussion = 1 x 20*	Students can know persistence, concentration, and dynamic chemical amenability	Lectures and discussions	5

				minutes ◦ *Presentation = 1 x 20 minutes* *Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)*			
11.	Students know the dynamic chemical transformations in the human body	• Presentation and discussion on Dynamic chemical transformations in the human body	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know the dynamic chemical transformation in the human body	Lectures and discussions	5
12.	Students review scientific papers on biotransformation of heavy metals in the body	• Assignment of scientific papers on biotransformatio n of heavy metals in the body	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can review scientific papers on biotransformation of heavy metals in the body	Lectures and discussions	5

13.	Students know bioaccumulation and biotransformation	• Presentation and discussion on bioaccumulation and biotransformation	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can know bioaccumulation and biotransformation	Lectures and discussions	5
14.	Students know about biodegradation and bioremediation	• Presentation on biodegradation and bioremediation	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *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 can learn about biodegradation and bioremediation	Lectures and discussions	5
15.	Students study20 scientific articles (international journals) related to mass transport and transformation	• Assigned a review of 20 scientific articles (international journals) related to mass transport and transformation	Lectures and discussions	216 minutes (0.25 ECTS) ◦ *Lecture = 1x 120 minutes* ◦ *Q&A = 1 x 20 minutes* ◦ *Discussion = 1 x 20 minutes* ◦ *Presentation = 1 x*	Students can study20 scientific articles (international journals) related to mass transport and transformation	Lectures and discussions	5

				20 minutes Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)			
16.	**Final Semester Exam (UAS)**	**All materials after UTS**	**Independent**	**216 minutes of processing time or the equivalent of 0.25 ECTS**	**Students' ability to answer UAS questions**	**Written test**	**15**
8. Reference List:		1. Hadi, S., Statistics, Student Library, Yogyakarta, 2015. 2. Harinaldi, Statistical Principles for Engineering and Science, Erlangga, Jakarta, 2005 3. Rohmad, and Supriyanto, Introduction to Statistics, Kalimedia, Yogyakarta, 2015 4. Spiegel MR, Statistics, Schaum Outline Series, Mc-Graw-Hill, New York, 1982. 5. Supranto J., Statistical Theory and Application Volume 1, Erlangga, Jakarta, 2009. 6. Supranto J., Statistical Theory and Application Volume 2, Erlangga, Jakarta, 2009. 7. Usman, H., and Akbar, PS, Introduction to Statistics, Earth Literacy, Jakarta, 2015					