



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	<ul style="list-style-type: none"> • 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

				<i>minutes/day (16 weeks)</i>			
2.	Students know the mass transfer process and its examples	<ul style="list-style-type: none"> • Presentation of mass transfer processes and examples 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · 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	<ul style="list-style-type: none"> • Exposure and discussion of molecular diffusion in gases 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · 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	<ul style="list-style-type: none"> • Presentation and discussion of molecular diffusion in liquids 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · 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

				<i>minutes</i> <i>· Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i>			
5.	Students know molecular diffusion in solids	<ul style="list-style-type: none"> • Presentation and discussion of molecular diffusion in solids 	Lectures and discussions	216 minutes (0.25 ECTS) <i>· Lecture = 1x 120 minutes</i> <i>· Q&A = 1 x 20 minutes</i> <i>· Discussion = 1 x 20 minutes</i> <i>· Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i>	Students can know molecular diffusion in solids	Lectures and discussions	5
6.	Students know the diffusion in two-dimensional objects	<ul style="list-style-type: none"> • Exposure and discussion of diffusion in two-dimensional objects 	Lectures and discussions	216 minutes (0.25 ECTS) <i>· Lecture = 1x 120 minutes</i> <i>· Q&A = 1 x 20 minutes</i> <i>· Discussion = 1 x 20 minutes</i> <i>· Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i>	Students can know diffusion in two-dimensional objects	Lectures and discussions	5
7.	Students are able to answer questions related	<ul style="list-style-type: none"> • 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		<ul style="list-style-type: none"> · <i>Lecture = 1x 120 minutes</i> · <i>Q&A = 1 x 20 minutes</i> · <i>Discussion = 1 x 20 minutes</i> · <i>Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i> 	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	<ul style="list-style-type: none"> • Exposure to toxicity and dynamic chemical mobility in the environment 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · <i>Lecture = 1x 120 minutes</i> · <i>Q&A = 1 x 20 minutes</i> · <i>Discussion = 1 x 20 minutes</i> · <i>Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i> 	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	<ul style="list-style-type: none"> • Exposure to dynamic chemistry persistence, concentration and amenability 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · <i>Lecture = 1x 120 minutes</i> · <i>Q&A = 1 x 20 minutes</i> · <i>Discussion = 1 x 20</i> 	Students can know persistence, concentration, and dynamic chemical amenability	Lectures and discussions	5

				<i>minutes</i> <i>· Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i>			
11.	Students know the dynamic chemical transformations in the human body	<ul style="list-style-type: none"> • Presentation and discussion on Dynamic chemical transformations in the human body 	Lectures and discussions	216 minutes (0.25 ECTS) <i>· Lecture = 1x 120 minutes</i> <i>· Q&A = 1 x 20 minutes</i> <i>· Discussion = 1 x 20 minutes</i> <i>· Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i>	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	<ul style="list-style-type: none"> • Assignment of scientific papers on biotransformation of heavy metals in the body 	Lectures and discussions	216 minutes (0.25 ECTS) <i>· Lecture = 1x 120 minutes</i> <i>· Q&A = 1 x 20 minutes</i> <i>· Discussion = 1 x 20 minutes</i> <i>· Presentation = 1 x 20 minutes</i> <i>Individual Tasks (Self Work) = 1 x 36 minutes/day (16 weeks)</i>	Students can review scientific papers on biotransformation of heavy metals in the body	Lectures and discussions	5

13.	Students know bioaccumulation and biotransformation	<ul style="list-style-type: none"> • Presentation and discussion on bioaccumulation and biotransformation 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · 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	<ul style="list-style-type: none"> • Presentation on biodegradation and bioremediation 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · 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 study 20 scientific articles (international journals) related to mass transport and transformation	<ul style="list-style-type: none"> • Assigned a review of 20 scientific articles (international journals) related to mass transport and transformation 	Lectures and discussions	216 minutes (0.25 ECTS) <ul style="list-style-type: none"> · Lecture = 1x 120 minutes · Q&A = 1 x 20 minutes · Discussion = 1 x 20 minutes · Presentation = 1 x 	Students can study 20 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:		<ol style="list-style-type: none"> 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 					

