

Module XXVII: Impact and Application IB (Environment)

1.1. Module Objectives

On completion of this module, the students will:

1.2. Module Data

Person in charge	Ir. V Sri Harjati Suhardi, Ph.D.
Credits	3
Course	BM 3205 Aquatic Microbial Ecology
	BM 4108 Biofilm and corrosion
	BM 4205 Bioremediation
Course Examination	Written Test

▪ Sub-module I: Aquatic Microbial Ecology

Lecturer	Prof. Dr. Gede Suantika, Dr. Magdalena L. Situmorang
Semester	6
Type of submodule / course	Elective Course
Credits	2
Workload	2 hours lectures, 2 hours structured activities, 2 hours individual study, 16 weeks per semester, and total 96 hours a semester
Workload Detail	textbook reading assignment, group discussion, presentation, paper review, Field work
Classification within the curriculum:	General Studies / Compulsory Course/ Elective Course
Type of examination	Written test
Language	Bahasa Indonesia
Course Target / Outcome	Conceptual Knowledge and Competence: <ul style="list-style-type: none">- Understand the microorganism community in the aquatic environment- Understand the interaction of microorganisms with other microorganisms and their environment- Understand the interaction of microorganisms with other microorganisms and their environment- Understand the role of aquatic microorganisms A. Scientific Skill: <ul style="list-style-type: none">- Possess the ability of scientific thinking skill and understand the quantitative and qualitative data related to the ecology of microorganisms in the aquatic environment-
Teaching methods	Interactive Lecture
Contents (SAP)	

1	Introduction: Background of aquatic microbial ecology
2	Interaction among aquatic microb
3	Interaction between aquatic microorganisms and plant
4	
5	Interaction between aquatic microorganisms and animal
6	
7	
8	Mid-Term Test
9	Abiotic factor impact in life of aquatic microorganisms
10	Aquatic microorganims natural habitat
11	Roles of aquatic micoorganims in carbon cycle
12	Roles of aquatic micoorganims in nitrogen, sulphur, phospor, iron, and other element
13	Microbial ecology in environment process
14	
15	Topic Presentation
16	Final Test
Literature / Sources	<ul style="list-style-type: none"> • Sigeo, D.C. 2004. Freshwater Microbiology. John Wiley and Sons. Ltd. • Atlas, R.M & R. Bartha, 1993, Microbial Ecology, The Benjamin/Cummings Publishing Company, INC, San Juan • Madigan, M.T.; J.M. Martinko 2006, Brock Biology of Microorganisms, Prentice Hall International, Inc. New Jersey

1. Sub-module III: Biofilm and corrosion

Lecturer	Dr. Eng. Isty Adhitya Purwasena Dr. Eng. Kamarisima
Semester	7
Type of submodule / course	Elective
Credits	2
Workload	2 hours lectures, 2 hours structured activities, 2 hours individual study, 16 weeks per semester, and total 96 hours a semester
Workload Detail	textbook reading assignment, group discussion, presentation, paper review
Classification within the curriculum:	General Studies / Compulsory Course/ Elective Course
Type of examination	Written test
Language	Bahasa Indonesia
Course Target / Outcome	- Conceptual Knowledge and Competence:

	<ul style="list-style-type: none"> - Understand the role of microorganisms in the formation of biofilms related to corrosion processes. Biocorrosion impacts that occur in industry and the environment - Apply the concept of biofilm and corrosion processes to solve corrosion problems in industry and the environment <p>Scientific Skills: Present the results of literature studies related to biofilm and corrosion in group or individual</p>
Teaching methods	Interactive Lecture
Contents (SAP)	
	1 Introduction to microbial influenced corrosion
	2 Biofilm formation
	3 Biofilm cycle
	4 The types of microbes in MIC
	5
	6
	7 The role of microbes in MIC
	8 Mid-Term Test
	9
	10 MIC monitoring
	11 Study case of MIC in marine environment
	12 Study case of MIC in soil environment
	13 Study case of MIC in fresh water environment
	14 Study case of MIC in oil and gas industry
	15 Future trends of MIC
	16 Final Test
Literature / Sources	<ul style="list-style-type: none"> - Flemming, H.C., Wingender, J. Szewzyk, U. 2011. <i>Biofilm Highlight</i>. Springer Heidelberg Dordrecht, London. - Skovhus, T.L., Enning, D., Lee, J.S. 2017. <i>Microbiologically Influenced Corrosion in the Upstream Oil and Gas Industry</i>. Taylor & Francis, New York. - Little, B.J., Lee, J.S. <i>Microbiologically Influenced Corrosion</i>. 2007. John Willey&Son. Canada

▪ **Sub-module III: Bioremediation**

Lecturer	Ir. V Sri Harjati Suhardi, Ph.D.
Semester	8
Type of submodule / course	Elective
Credits	2

Workload	2 hours lectures, 2 hours structured activities, 2 hours individual study, 16 weeks per semester, and total 96 hours a semester
Workload Detail	textbook reading assignment, group discussion, presentation, paper review
Classification within the curriculum:	General Studies / Compulsory Course/ Elective Course
Type of examination	Written test
Language	Bahasa Indonesia
Course Target / Outcome	<p>At completion of course, student will have the ability to:</p> <p>A. Conceptual Knowledge and Competence:</p> <ul style="list-style-type: none"> - know the principles and application of bioremediation. - know contaminants susceptible to bioremediation and mechanisms of contaminant biodegradation by microbial cells - know environmental factors affecting bioremediation - design and demonstrate work plan for bioremediation project - demonstrate the role of bioremediation in environmental quality and restoration in the environments of marine, coast, surface water, groundwater and soil - demonstrate various bioremediation technologies and their strength and weaknesses - know environmental laws and regulations <p>B. Scientific Skills:</p> <ul style="list-style-type: none"> - review, write and represent scientific articles in the field of bioremediation
Teaching methods	Interactive Lecture
Contents (SAP)	
	1 Understanding of remediation and bioremediation
	2 Fate of pollutant in the environment
	3 Role of microbial in bioremediation process of organic and inorganic
	4 Treatability study I
	5 Treatability study II
	6 Field Characterisation
	7 Bioremediation technique
	8 Mid-Term Test
	9 Solid-phase bioremediation
	10 Liquid-phase bioremediation
	11 Slurry-phase bioremediation

12	Monitoring
13	Regulation in bioremediation
14	Safety in bioremediation
15	Topic presentation
16	Final Test
Literature / Sources	<ul style="list-style-type: none"> - Sheehan, D. 1997. Bioremediation Protocols. Humana Press. Totowa. New Jersey. - Eweis, J.B., Ergas, S.J., Chang, D.P.Y. and Schroeder, E.D. (1998) "Bioremediation Principles", McGraw-Hill. - Cookson JR, J.T (1995)"Bioremediation Engineering", McGraw-Hill, Inc - Committee on In Situ Bioremediation, Water Science and Technology Board, Commission on Engineering and Technical Systems, and National Research Council (1993) "In Situ Bioremediation" National Academy Press, Washington, USA. - International Journals of: Applied and Environmental Microbiology, Environmental Science and Technology, Bioresource Technology, Environment International, Marine & Pollution Bulletin, Marine Environmental Research, International Biodeterioration & Biodegradation