Module XV: Techniques in Microbiology IA

1.1. Module Objectives

On completion of this module, the students will:

- Able to asses in team to create and distribute the fermented product which are safe and useful for people
- Able to describe the suitable variation of methods in clasic and moleculer microbiology with the principal in microbial detection, isolation, enumeration, cultivation, and preservation
- Able to combine and summarise the microbiology analysis results with its existing basic standard
- Able to apply techniques in fermentation process (bioprocess) so that it can be used to construct the efficiency process
- Able to apply microbial fermentation techique in laboratory scale and able to asses its supply in bigger scale
- Able to isolate, screen, and cultivate the microorganisms that will be used in fermentation process ·
- Able to assess the standarisation fermentation product by applied fermentation techniques in microbiology

1.2. Module Data

Person in charge	Dr. Eng. Isty Adhitya Purwasena
Credits	9
Course	BM 3201 Metabolomics
	BM3202 Analytical Microbiology
	BM3203 Principle of fermentation technique
Modules Examination	written test

1.2.1. Sub-module I: Metabolomics

Course Name:	Elementary Physics 1B
Course Level:	Undergraduate
Abbreviation, if applicable:	BM3201
Sub-heading, if applicable:	
Course included in the module, if applicable:	
Semester/term:	6
Course coordinator(s):	Dr. Dea Indriani Astuti; Dr. Intan Taufik
Lecturer(s):	to be determined in each semester
Language:	Bahasa Indonesia
Classification within the curriculum:	General Studies / Compulsory Course/ Elective Course
Teaching format / class hours per week during the semester:	2 hours lectures

Workload:	2 hours lectures, 2 hours structured activities, 2 hours individual study, 16 weeks per semester, and total 96 hours a semester
Credit Points:	2
Requirements:	-
Course Target / Outcome	After completion of this course students are expected to be able to: A. <u>Conceptual Knowledge and Competence:</u> - Students understand the basic principles and stages of metabolom studies, general analysis, and the latest research and potential applications of metabolomics - Students understand the processes and approaches of metabolomic studies in studying biological phenomena or systems. B. <u>Scientific Skills:</u> - Apply qualitative and quantitative analysis methods in solving problems related to metabolism - Communicate the results of qualitative and quantitative analysis related to microbial metabolism well and clearly - Identify the relationship between the results of metabolomic analysis for the development of human life C. <u>Social Skills:</u> - Able to work together and communicate in teams
Contents (SAP)	– Introductory to Metabolomic – Metabolomic In Functional Genomics & System Biology – The Chemical Challenge of the Metabolome – Sampling & Sample Preparation – Analytical Tools – Data Analysis – Yeast Metabolomics : The Discovery of New Metabolic Pathways in S. cerevisiae – Microbial Metabolomics: Rapid Sampling Techniques to Investigate Intracellular Metabolite Dynamics - An Overview – Microbial Metagenomics: Concept, Methodology & Prospects for Novel

	Biocatalysts and Therapeutics from Mammalian Gut Microbiome – Plant Metabolomics – Mass Profiling of Fungal Extracts from Penicillium Species – Metabolmics in Humans and Other Mammals
Literature / Sources	1. Silas G. Villas-Bôas, Ute Roessner, Michael A.E. Hansen, Jorn Smedsgaard, and Jens Nielsen (2007) Metabolome Analysis: An Introduction. John Wiley & Sons, Inc. 2. Nielsen, J. and Jewett, M.C. (2010) Metabolomics: a powerful tool in system biology. Springer 3. Lammerhofer, M. and Weckwerth, W. (2012) Metabolomics in practice. Willey – VCH 4. Knapp, J.S. and Cabrera, W.L. (2011) Metabolomics: Metabolites, Metabonomics and Analytical Technologies. Nova Science Publisher. 5. Claverie, Jean-Michel and Notredame, Cedric (2007) Bioinformatics for Dummies. Wiley Publishing, Inc..

1.2.2. Sub-module II: Analytic microbiology

Course Name:	Analytic microbiology
Course Level:	Undergraduate
Abbreviation, if applicable:	BM3202
Sub-heading, if applicable:	
Course included in the module, if applicable:	
Semester/term:	6
Course coordinator(s):	Prof. Dr. Pingkan Aditiawati; Dr. Eng. Isty Adhitya Purwasena
Lecturer(s):	to be determined in each semester
Language:	Bahasa Indonesia
Classification within the curriculum:	General Studies / Compulsory Course/ Elective Course
Teaching format / class hours per week during the semester:	2 hours lectures, 3 hours laboratory,
Workload:	2 hours lectures, 3 hours laboratory, 2 hours structured activities, 2 hours individual study, 16 weeks per semester, and total 144 hours a semester
Credit Points:	3
Requirements:	-

Course Target / Outcome	A. Conceptual Knowledge and Competence - Understand the process of microbial metabolism associated with energy and its use for resistance, growth, and interaction with the environment - Understand the principles of microorganism detection and enumeration methods and their applications in life B. Laboratory Skills: - Able to apply standard microbiological laboratory methods and techniques for the detection and enumeration of microorganisms, antibiotic potential test methods, toxin testing methods, and test methods for structural components produced by microorganisms. - Able to apply the methods and techniques of molecular microbiology laboratories to test the detection and enumeration of microorganisms - Able to apply safety procedures when working in a laboratory C. Scientific Skills: - Analyze quantitatively and qualitatively the results of enumeration and detection of microorganisms - Communicate the results of the analysis conducted in the form of oral and written reports - Identify the relevance of the results of microbiological analysis for the development of human life D. Social Skills: - Able to work together and communicate in teams
Contents (weekly)	– Introduction – Sampling techniques – Isolation techniques – Cultivation and enumeration techniques – Microbial identification – Nucleid acid based methods of analysis – Techniques in Microbiological Assay – Mid-Term Test – Microbial indicator for analysis – AMES test – Immunological analysis – Food Microbiological assay based on international standard

	– Microbiological Analysis of Water – Presentation
Literature / Sources	1. James , J. 2006. Microbial Hazard Identification in Fresh Fruit and Vegetables. John Wiley & Sons, Publ. Inc. 2. Nga, B. H. & Y. K. Lee. 1990. Microbiology application in food biotechnology. Elsevier App. Sci., New York.
Notes	

1.2.3. Sub-module III: Basic Principal of fermentation

Course Name:	Basic Principal of fermentation
Course Level:	Undergraduate
Abbreviation, if applicable:	BM3203
Sub-heading, if applicable:	
Course included in the module, if applicable:	
Semester/term:	6
Course coordinator(s):	Dr. Dea Indriani Astuti; Dr. Eng. Kamarisima; Neil Priharto, PhD
Lecturer(s):	to be determined in each semester
Language:	Bahasa Indonesia
Classification within the curriculum:	General Studies / Compulsory Course/ Elective Course
Teaching format / class hours per week during the semester:	2 hours lectures and 6 hours laboratory
Workload:	2 hours lectures, 6 hours laboratory, 2 hours structured activities, 2 hours individual study, 16 weeks per semester, and total 192 hours a semester
Credit Points:	4
Requirements:	-
Course Target / Outcome	A. <u>Conceptual Knowledge and Competence:</u> - Understand the fundamental principles in the development of fermentation processes using microorganisms as processing agents on a laboratory scale and understand how to multiply to a larger scale B. <u>Laboratory skills:</u> - Conduct cultivation techniques of microorganisms correctly in accordance with the principles of fermentation techniques

	- Apply the principle of occupational safety in the laboratory C. <u>Scientific Skills:</u> - Possess the ability to think scientifically using quantitative and qualitative approaches in communicating - Measure and calculate bacterial molar growth rate and product production kinetics - Able to communicate the results of calculations and analysis in the form of oral and written reports D. <u>Social Skills:</u> - Demostrate working and communication attitute effectively in team.
Contents (weekly)	– Introduction – Isolation and filtering of industrial microorganisms, and maintenance of microorganisms – Storage and multiplication of microorganisms – Growth kinetics and product formation – Fermentation Media – Mid-Term Test – Sterilization – Development of Inoculum for industrial fermentation – Separation and purification of fermentation product – Processing fermentation waste – Student presentation
Literature / Sources	1. Stanbury, P.F., A. Whitaker., S.J. Hall. 2016. Principles of Fermentation Technology, 3rd ed. Elsevier Science Ltd. 2. Shuler, M.L., Kargi, F., DeLisa, M., Bioprocess engineering, 3, Prentice Hall, 2017 3. Baltz, R.H., Demain, A.L., Davies, J.E, Manual of Industrial Microbiology and Biotechnology, 3, ASM Press, USA, 2010