UNIVERSITAS SEBELAS MARET
FACULTY OF TEACHER TRAINING AND EDUCATION
BACHELOR OF BIOLOGY EDUCATION STUDY PROGRAM
Building D 3rd Floor FTTE UNS Jl Ir. Sutami No. 36 A Kentingan Surakarta 57126 Indonesia
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Microbiology

Undergraduate Programme in Biology Education **Module Handbook**

Module Name	Microbiology (Mikrobiologi)
Module level	Undergraduate Programme
Course Code	02013143005
Abbreviation, if applicable	-
Courses included in the module, if applicable	-
Semester/Term	3rd
Module coordinator (s)	Dr. Umi Fatmawati, M.Si.
Lecturer (s)	Dr. Slamet Santosa, M.Si Drs. Dwi Oetomo, M.Si.
Language	Bahasa Indonesia (Indonesian Language)
Classification within the curriculum	Compulsory/~~Elective~~
Teaching format/class hours per week during the semester	**Direct instruction/face to face/blended learning26.7 hours / Week: lecture, discussion, workshop** **Structured Activity: 32 hours / Week** (Through the analysis of journal articles, students learn to analyze the abnormalities in metabolic diseases, cellular respiration pathways, and biomolecule metabolism and catabolism) **Self-study Activity: 32 hours / Week** (Students learn various learning methods according to the demands of 21st century learning from various sources) **Practicum in laboratory:** 1 x 170 minutes/week/topic
Workload	

Type	**CSU**	**Face to Face**	**Structured Activities**	**Self-study**
T	**2**	**26.7h (0.88 ECTS)**	**32h (1.06 ECTS)**	**32h (1.06 ECTS)**
P	**1**	**Laboratory activity= 10 topic/week x 170 minute = 1700 minutes Hour = 1700 minute/60 minute = 28.3 h ECTS = 28.3 x 0.033 ECTS= 0,933 ECTS**		

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<table>
<tr><td></td><td><table><tr><td>Total</td><td>3</td><td>119 hours (4.5 ECTS)</td></tr></table></td></tr>
<tr><td>Credit point</td><td>3 CSU (4.5 ECTS)</td></tr>
<tr><td>Requirements</td><td>Has taken courses in Cell Biology</td></tr>
<tr><td>Learning goals/competencies</td><td>PLO 2 They are able to apply the basic advance knowledge in biology to solve the problem in biology
PLO 6 They are able to demonstrate laboratory works, design and implement the experiment based on laboratory knowledge, skills, safety, environmental
issue, and social ethics problem
PLO 8 They are able to communicate verbal and nonverbal effectively using the proper media.
PLO 10 They are able to demonstrate creativity, accuracy, discipline, responsibility, adaptability, have an independent initiative, autonomous learning, and do lifelong learning

CLO 1 Explaining the concept and scope of Microbiology
CLO 2 Applying microbiology concepts in practical activities and daily life
CLO 3 Applying microbiological studies of bacterial genetics, bacterial systematics, Interaction and control of pathogenic bacteria, Food microbiology, The role of bacteria in agriculture, and environmental, health and industrial conservation.
CLO 4 Have the ability to solve problems relate to Microbiology

<table><tr><td>CLO/ PLO</td><td>PLO 1</td><td>PLO 2</td><td>PLO 3</td><td>PLO 4</td><td>PLO 5</td><td>PLO 6</td><td>PLO 7</td><td>PLO 8</td><td>PLO 9</td><td>PLO 10</td></tr><tr><td>CLO1</td><td></td><td>*</td><td></td><td></td><td></td><td>*</td><td></td><td>*</td><td></td><td>*</td></tr><tr><td>CLO2</td><td></td><td>*</td><td></td><td></td><td></td><td>*</td><td></td><td>*</td><td></td><td>*</td></tr><tr><td>CLO3</td><td></td><td>*</td><td></td><td></td><td></td><td>*</td><td></td><td>*</td><td></td><td>*</td></tr><tr><td>CLO4</td><td></td><td>*</td><td></td><td></td><td></td><td>*</td><td></td><td>*</td><td></td><td>*</td></tr></table></td></tr>
<tr><td>Content</td><td>Microbiology is a compulsory subject for a study program that discuss: The structure and characteristics of bacteria, Nutrition and bacterial growth, Bacterial genetics, Systematics of bacteria, The interaction and control of pathogenic bacteria, Food microbiology, The role of bacteria in agriculture, Environmental, health and</td></tr>
</table>

<table>
<tr><td></td><td>industrial conservation.

Microbiology practicum is a compulsory subject for a study program that examines: Microbial growth media, sterilization, Microbial isolation, Microbial morphology, Determination of the number of microbes, The influence of the microbial environment, Microbial enzyme activity test, Bacterial staining, Winogratski column, Fermentation, making nata, making yogurt, DNA isolation</td></tr>
<tr><td>Attribute Soft skill</td><td>1. Able to think conceptually, analitically, and logically
2. Have good communication skills
3. Able to demonstrate creativity, accuracy, discipline, responsibility, adaptability</td></tr>
<tr><td>Study/exam achievements</td><td>Students are required to attend the face-to-face lecture minimum 75% to be able to take the Mid and Final exam. Students are considered to complete the course and pass if they obtain at least 60% of maximum final score. The final score (FS) is calculated based on the following ratio:

<table>
<tr><th>Aspect</th><th>(%)</th></tr>
<tr><td>Task/quiz/presentation / laboratory activity</td><td>30</td></tr>
<tr><td>Participation</td><td>10</td></tr>
<tr><td>Mid-Term Test</td><td>30</td></tr>
<tr><td>Final Exam</td><td>30</td></tr>
<tr><td>Final Score</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>Form of Media</td><td>Powerpoint slide, specimen</td></tr>
<tr><td>Literature (primary references)</td><td>1. Albert, Johnson, Lewis, Reff, Roberts, and Walter. (2008). Molecular Biology of the Cell. London: Gerland Science
2. Madigan, Martinko, Stahl, Clark. (2012). Brock</td></tr>
</table>

Biology of Microorganism. San Francisco USA: Benjamin Cummings
3. Sunatmo, T. I. (2009). *Mikrobiologi Esensial Jilid 1 dan 2*. Jakarta: Ardy Agency
4. Irianto, K. (2013). *Mikrobiologi: Menguak Dunia Mikrobiologi Jilid 1*. Bandung : Yrama Widya
5. Irianto, K. (2013). *Mikrobiologi: Menguak Dunia Mikrobiologi Jilid 2*. Bandung: Yrama Widya
6. Oluwadamilare, L.A., et.al. (2019). A Review of Literature on Isolation of Bacteria α-Amylase. *International Research Journal of Engineering and Technology (IRJET)*, 6, 1333-1342
7. Bonnet, M., Lagier, J. C., Raoult, D., & Khelaifia, S. (2020). Bacterial culture through selective and non-selective conditions: the evolution of culture media in clinical microbiology. *New microbes and new infections*, 34, 100622. Doi:10.1016/j.nmni.2019.100622

TEST INSTRUMENT (LO 2)

Answer these questions! Each answered question will gain the score 50.

1. *Streptococcus pyogenes* is a pathogenic bacteria that can infect skin and respiratory organ in humans. Antibiotics are the treatment for this disease. Generally antibiotic used is penicillin at a dose of 500 mg, which can leads to bacterial resistant. *Streptococcus pyogenes* has been shown to be resistant to several types of antibiotics such as penicillin, nafcillin and vancomycin. So that the treatment of the infection is increasingly difficult. The results of research by Seanego and Ndip (2012) suggested that the bioactive compound of *Garcinia kola* seed extract can inhibit the growth of *Streptococcus pyogenes* bacteria, this indicates that bioactive compounds from plants can be antibacterial potential. How is the cellular mechanism of a compound that can be an antibacterial agent, especially to inhibit the growth of pathogenic bacteria?

   (LO 2: Student are able to **apply** the basic advance knowledge in biology to **solve** the problem in biology)

2. A microbiology researcher found several bacterial isolates from a waste disposal site in a fish market that have chitinase enzyme-producing activity, and potential to degrade waste containing chitin compounds. If the researcher wants to further identify the bacterial isolate,

what characteristics need to be identified and what are the steps for molecular identification to find out which species group the bacterial isolate belongs to?

(LO 2: Student are able to **apply** the basic advance knowledge in biology to **solve** the problem in biology)

ANSWER KEY AND ASSESSMENT RUBRIC
MID-TERM EXAM OF MICROBIOLOGY

No	Answer	Band description	score
1	the mechanism of a bioactive compound being antibacterial (inhibiting the growth of pathogenic bacteria) by: - Inhibits cell wall synthesis/damages cell walls in bacterial cells, thereby weakening the strength of the cell wall - Inhibits protein synthesis on the plasma membrane - Inhibits RNA synthesis - inhibit DNA replication	Student can describe at least four mechanism of a bioactive compound as an antibacterial agent	50
		Student can describe at least three mechanism of a bioactive compound as an antibacterial agent	40
		Student can describe at least two mechanism of a bioactive compound as an antibacterial agent	30
		Student can describe at least two mechanism of a bioactive compound as an antibacterial agent	20
		Student can write the answer but not relate to the main question	10
2	Phenotypic and genetic characterization of bacterial isolates: - microbial form (rod/bulat.vibrio), color, size, - gram staining, - motility, - host-range, - pathogenicity, - type of assimilation source C if not sufficient for identification, coupled with Chemotaxonomy: - numeric taxonomy (data base, gene bank), - DNA -DNA hybridisation, - DNA amplification	Student can elaborate the phenotypic and genetic method in bacterial species identification at least 10 methods	50
		Student can elaborate the phenotypic and genetic method in bacterial species identification at least 7 methods	40
		Student can elaborate the phenotypic and genetic method in bacterial species identification at least 5 methods	30
		Student can elaborate the phenotypic and genetic method in bacterial species identification at least 3 methods	20

	- sequencing, Whole Genome Sequencing (WGS) molecular identification stage: - DNA extraction which includes the process of destroying cell walls (lysis), destruction of proteins and RNA, and purification of DNA. - DNA amplification = doing PCR that is by multiplying DNA - DNA sequencing = sorting DNA based on the results of determining the primary structure of unbranched biopolymer chains (sequencing) - analysis of sequencing results = sorting the taxonomy of bacteria based on the results of the analysis and finally arranged in a phylogenetic tree	Student can write the answer but not relate to the main question	

PAPER ASSESSMENT RUBRIC

ASPECT	INDICATOR	SCORE
Background	All the descriptions in this section lead to the main problem and writing of the paper	4
	Just get to the point	3
	Irrelevant general statements	2
	No background	1
The aim of writing	The formulation of the purpose of writing is clear, pithy and systematic	4
	The formulation of the goal is long, but the goal is clear enough	3
	The formulation of objectives is stated in general and the purpose is not clear	2
	No goals written	1
Formulation of the problem	Problems are formulated in a clear, pithy and systematic way	4
	The formulation of the problem is prolonged, but the purpose is quite clear	3
	The formulation of the problem is stated in general terms and the purpose is not clear	2
	There is no written problem formulation	1
Writing Systematics	The systematics of logical writing follows the rules of writing scientific reports	4
	Systematic writing logical but not sequential	3

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	Systematic writing is not logical and not in sequence	2
	There is no good writing systematic	1
Discussion	A systematic, logical, original and comprehensive discussion and presents the latest research results	4
	A systematic, logical, original and comprehensive discussion but does not present the latest research results	3
	The discussion is not systematic, logical and comprehensive and does not present the latest research results	2
	Short discussion and copy paste from the internet	1
Conclusion	Conclusions are drawn based on the discussion and the data presented in a clear, concise and systematic way	4
	Conclusions are not drawn based on the discussion and the data presented in a clear, concise and systematic way	3
	Conclusions are not drawn based on the discussion and the data presented are less clear, less concise and less systematic	2
	No conclusion written	1
Reference	Bibliography from trusted sources, following the rules of writing and up to date	4
	Bibliography from trusted sources, following the rules of writing, but not up to date	3
	The bibliography is not from a trusted source, does not follow the rules of writing and is not up-to-date	2
	There is no bibliography	1

CPL Assessment Instrument 06/LO 06 Have knowledge related to biological research methodology and its learning, can apply and publish the results

PRACTICUM PERFORMANCE ASSESSMENT

Practicum Performance Observation Sheet

No	Name	Aspects of Performance Assessment										Total Score	Note
		1	2	3	4	5	6	7	8	9	10		
1													
2													
3													
4													
5													
Dst													

Information:
1 = Practical equipment

2 = Physical appearance readiness
3 = Interpret
4 = Predict
5 = Applying the concept
6 = Planning an experiment
7= Doing an experiment
8 = Communicate

Practicum Performance Assessment Rubric

No	Aspect	Criteria	Score
Preparation			
1	**Practical equipment**	Bring/prepare all (100%) tools and materials.	4
		Not bringing 25% of the total tools/materials or 25% of the total tools/materials not in accordance with the provisions.	3
		Not bringing 50% of the total tools/materials or 50% of the total tools/materials not in accordance with the provisions	2
		Not bringing 75% of the total tools/materials or 75% of the total tools/materials not in accordance with the provisions	1
2	**Physical appearance readiness**	Lab coat worn and neat appearance.	4
		Wearing a lab coat and looking untidy (wearing t-shirts, shorts, or not wearing shoes)	3
		Do not wear a lab coat and look presentable.	2
		Not wearing a lab coat and looking untidy (wearing t-shirts, shorts, or not wearing shoes).	1
Using tools and materials			
3	**Discipline of practical tools/materials**	All tools/materials are taken neatly and not scattered.	4
		25% of the total tools/materials were taken untidy and scattered.	3
		50% of the total tools/materials were taken untidy and scattered.	2
		75% of the total tools/materials were taken untidy and scattered.	1
4	**Appropriateness of practical tools/materials**	All tools/materials are taken as needed.	4
		Take 25% of the total tools/materials that are not as needed.	3
		Take 50% of the total tools/materials that are not as needed.	2
		Taking 75% of the total tools/materials that are not as needed.	1
5	**Correct operation of the tool**	All tools are operated properly.	4
		25% of the total tools are operated incorrectly.	3
		50% of the total tools are operated incorrectly.	2
		75% of the total tools are operated incorrectly.	1
6	**Practicum Procedure**	melakukan 100% langkah praktikum dengan benar.	4
		melakukan 75% langkah praktikum dengan benar.	3

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		melakukan 50% langkah praktikum dengan benar.	2
		melakukan 25% langkah praktikum dengan benar.	1
Result			
7	**Practical result**	Using as many senses as possible in making observations and doing it carefully according to procedures	4
		Using few senses in making observations and doing it according to procedures	3
		Using as many senses as possible in making observations but not being thorough	2
		Observing the practical results at a glance	1
8	**Practical data**	Complete the table according to the results of observations, accompanied by pictures, and accompanied by additional data (information) on the results of the practicum (3 aspects are all fulfilled)	4
		Complete the table according to the results of observations, accompanied by pictures, or accompanied by additional data (information) on the results of the practicum (2 aspects are well fulfilled)	3
		Complete the table according to the results of observations, accompanied by pictures, and accompanied by additional data (information) on the results of the practicum (1 aspect is well fulfilled)	2
		Complete the table according to the results of observations, accompanied by pictures, and accompanied by additional data (information) on the results of the practicum (no aspect is fulfilled properly)	1
Closing			
9	**Cleanliness of tools that have been used**	All tools that have been used are cleaned properly and returned	4
		Clean all tools that have been used but are not completely clean and return them	3
		Only clean half of used tools and return them	2
		Only clean one or two tools and don't restore all tools	1
10	**Practice table cleaning**	Clean the table until it's really clean	4
		Cleaning the table but still leaving dirt or trash	3
		Only clean part of the side of the table	2
		The table is still dirty, but throw away the dirt or trash	1

PRACTICUM REPORT RUBRIC ASSESSMENT

No	Aspek	Score			
		1	2	3	4
1	Write the title and purpose of the practicum correctly				
2	Formulate the problem				
3	Write the theoretical basis clearly and concisely				

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4	Arrange tools, materials and work steps appropriately				
5	Presenting data systematically and communicatively				
6	Analyze data and discussion comprehensively				
7	Drawing conclusions				
8	Writing bibliography				
9	Attachments (evidence of activities, documentation, interim reports)				
10	Timely collection				