06 December 2018

Course: Animal Microbiology

1. **Type** **:** Specialization's Elective
2. **Code** **:** PTN 6107
3. **Credit** **:** 1/1
4. **Semester** **:** Odd
5. **Description** **:**

The growth, production, and reproduction of ruminants and non-ruminants are determined by microbial activities (bacteria, protozoa, and fungi) in rumen and other digestive tracts, in which, they interact each other. The Animal Microbiology course begins by discussing classification and role of bacteria, protozoa, and fungi in the ecology of digestive tract. Biochemical interactions between microbes-microbes and microbes-host animal will be explained. The study of microbial activity at the process of fermentation in the digestive tract, followed by and understanding of metabolic interactions between microbes need to be studied including the strategy to adjust fermentation to maximize efficiency. Continuous fermentation analysis, theory and application of rumen simulation techniques in the feed evaluation will be explained. Later, microbial genetic engineering and fermentation manipulation will be discussed to produce probiotics and prebiotics and their application in the digestive tract to improve livestock performance. Inter-microbial interaction studies in the feed utilization need to be conducted to support the implementation of environmental-friendly livestock and the achievement of efficient livestock production.

6. **Course Outcomes (CO)**

CO 1 : Students can explain the types and roles of microbes, fungi, and gastrointestinal protozoa.
CO 2 : Students can explain degradation, nutrient metabolism, and their interaction in rumen microbial cells.
CO 3 : Students can explain the kinetic and manipulation of fermentation in rumen.
CO 4 : Students can explain genetic engineering of gastrointestinal microbes.
CO 5 : Students are able to design simple research, analyse, and create report.

7. **The Alignment Between CO and ELO**

CO*	ELO**																	
	A				B			C				D						
	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	5	6
CO 1					✓	✓			✓								
CO 2					✓	✓			✓								
CO 3					✓	✓			✓								
CO 4					✓	✓			✓								
CO 5			✓	✓											✓	✓	

*CO refers to point 6.

**Expected Learning Outcomes (ELO) are written below,

A. Attitudes and Behaviors

The graduates are able to behave well, correctly, and culturally as the result of internalization and actualization of values and norms, which is reflected in a spiritual and social life through learning process, experience, research, and/or community development in the animal husbandry.	
1	Piety to God and be able to show religious attitude and maintain the humanity values in carrying the task, which is based on religion, moral, and ethics.
2	Be proud and love the homeland show nationalism, and contribute to the improvement of the life quality in the community, nation and country, and the advancement of civilization according to Pancasila.
3	Showing the social sensitivity and attention to the community and environment by respecting the culture diversity, view, religious, beliefs, and other people's opinion, and also obey the rules.
4	Be accountable in carrying the professional practice that includes ability to accept accountability towards decision and professional action. It shall be according to the scope of the practice under their responsibility and laws.
B. Mastery in Sciences Master the theory of the current science in the animal husbandry and its application.	
1	Able to master the current animal science and its application theory.
2	Able to master the livestock production science, animal nutrition and fed science, animal products technology, and the livestock social economics in relation to food security and environment.
3	Able to master the design, management, and development of livestock research.
C. Special Skills The graduates are able to develop science, technology, and arts in the animal husbandry through interdisciplinary/multidisciplinary innovative and tested research.	
1	Able to make innovation in the animal husbandry based on the development of science and technology.
2	Able to design interdisciplinary and multidisciplinary research in the animal husbandry.
3	Able to formulate and solve problems in the national development especially in terms of animal husbandry.
4	Able to solve problems and anticipate issues in the development of animal science and industry.
D. General Skills The graduates are able to manage resources by utilizing science, technology, and arts to solve problems in the animal husbandry with current science and also conduct research with accountability and full responsibility.	
1	Able to develop logical, critical, systematic, and creative thought through scientific research, creation of design in the science and technology, which pays attention and applies humanity values according to their expertise. The graduates are able to arrange scientific concept and the study result based on the principles, procedures, and scientific ethics.
2	Able to identify the science that becomes their research object and position it to a research map by using information technology in the context of science development and expertise implementation developed through interdisciplinary or multidisciplinary approaches.
3	Able to make a decision in the context of solving problems in the development of science and technology, which pays attention and applies humanity values based on analysis study or experiment towards information and data.
4	Able to communicate the result of reasoning and scientific research in form of thesis and scientific writing responsibly based on academic ethics in the accredited national journal.
5	Able to maintain the academic integrity generally and avoid the plagiarism practice.
6	Able to communicate spoken and written English effectively by using the information technology for the development of animal science and its implementation.

8. Course Content

Week	CO	Topic/Subtopic	Learning Activity	Assessment Tools	Allocated Time	Lecturer

1	CO 1	Introduction Gut's microbes • Type and roles of gut's microbes • Classification, morphology, identification, description, species, characteristic and habitat of rumen's bacteria, mycoplasma, and bacteriophage	Classical lecture and discussion	Midterm	1 x 50 minutes	Dr. Ir. Chusnul Hanim, M.Si., IPM.
2	CO 1	Fungi and protozoa in animal's digestive tracts • Classification, morphology, identification, description, species, characteristic, and habitat of fungi and protozoa	Classical lecture and discussion	Midterm	1 x 50 minutes	
3	CO 2	Nutrient degradation by ruminal microbes • Nutrient requirement and roles for microorganism • Substrate degradation by ruminal microbes; and microbe's interaction on nutrient utilization	Classical lecture and discussion	Midterm	1 x 50 minutes	
4	CO 2	Cellular-nutrient metabolism on ruminal microbes • Carbohydrate metabolism; catabolism/fermentation and synthesis, its association with energy production on rumen	Classical lecture and discussion	Midterm	1 x 50 minutes	Prof. Dr. Ir. Lies Mira Yusiati, SU., IPU.

5	CO 2	Cellular-nutrient metabolism on ruminal microbes: • Lipid metabolism: catabolism/fermentation and synthesis; its association with biomass production on rumen	Classical lecture and discussion	Midterm	1 x 50 minutes	Prof. Dr. Ir. Lies Mira Yusiati, SU., IPU.
6	CO 2	Cellular-nutrient metabolism on ruminal microbes: • Metabolism of N-compounds: catabolism and synthesis of protein and nucleic acids, its association with biomass production on rumen	Classical lecture and discussion	Midterm	1 x 50 minutes	Prof. Dr. Ir. Lies Mira Yusiati, SU., IPU.
7	CO 2	Metabolism interaction by ruminal microbes • Nutrient metabolism interaction • Detoxification of various metabolites by ruminal microbes	Classical lecture and discussion	Midterm	1 x 50 minutes	Dr. Asih Kurniawati, S.Pt., M.Si., IPM.
Midterm Examination						
8	CO 3	Fermentation kinetics on rumen: • Fermentation types • Fermentation kinetics and fermentation products efficiency • Theory and application	Classical lecture and discussion	Final Exam	1 x 50 minutes	Prof. Dr. Ir. Zaenal Bachruddin, M.Sc., IPU.
9	CO 3	Manipulation on ruminal fermentation: • Manipulation on methanogenesys • Manipulation on fatty acids hydrogenation	Classical lecture and discussion	Final Exam	1 x 50 minutes	Prof. Dr. Ir. Zaenal Bachruddin M.Sc., IPU.

		• Manipulation on proteolysis				
10	CO 3	Manipulation on ruminal fermentation • Manipulation on microbes biodevirsity	Classical lecture and discussio n	Final Exam	1 x 50 minutes	Prof. Dr. Ir. Zaenal Bachruddin , M.Sc., IPU.
11	CO 1	Microbes and Intestines: • Types of microbes; characteristics and metabolism activity • Microbe-microbes and microbes-host animal interactions	Classical lecture and discussio n	Final Exam	1 x 50 minutes	Dr. Asih Kurniawati, S.Pt., M.Si., IPM.
12	CO 1	Microbes and cecum • Types of microbes; characteristics and metabolism activity • Microbe-microbes and microbes-host animal interactions	Classical lecture and discussio n	Final Exam	1 x 50 minutes	Dr. Asih Kurniawati, S.Pt., M.Si., IPM.
13	CO 4	Genetic engineering and gastrointestinal tracts: • Genetic engineering on gut's microbes	Classical lecture and discussio n	Final Exam	1 x 50 minutes	Muhlisin S.Pt., M.Agr. Ph.D.
14	CO 5	Paper presentation Students assignments	Classical lecture and discussio n	Presentatio n	1 x 50 minutes	Muhlisin, S.Pt., M.Agr., Ph.D.
Final Examination						

9. Practicum

Week	Activity	Methods	Total Hours
1	Cellulose and xylanase activity	Group practicum	4 hours
2	Measurement of ruminal microbe's biomass	Group practicum	4 hours

3	Techniques on in vitro gas production	Group practicum	24 hours
4	Protozoa counting	Group practicum	4 hours
5	Practicum report	Individual and Group	-

10. Assessment

Component	CO	Percentage (%) for final grade	Minimum Satisfactory Level
Midterm	CO 1 CO 2	6 15	70
Presentation	CO 5	8	70
Final Exam	CO 1 CO 3 CO 4	6 9 3	70
Practicum	CO 5	50	70
Total		100	

11. Lecturer

1. Dr. Ir. Chusnul Hanim, M.Si., IPM.
2. Prof. Dr. Ir. Lies Mira Yusiati, SU., IPU.
3. Prof. Ir. Zaenal Bachrudin, M.Sc., Ph.D., IPU.
4. Dr. Ir. Asih Kurniawati, S.Pt., M.Si., IPM.
5. Muhlisin, S.Pt., M.Agr., Ph.D.

12. Reference