MPAS MODULES

Compulsory Courses

<table>
<tr><td colspan="7">BIG DATA AND ARTIFICIAL INTELLIGENCE IN ANIMAL SCIENCE</td></tr>
<tr><td colspan="2">Module/Course Code
PEF80002</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semesters</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Compulsory courses</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours (structural assignment 80 hours and self learning 100 hours)</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Intended Learning Outcomes:
1. Applying logical, critical, systematic, and creative thinking in the field of animal husbandry through scientific research and the results of studies based on rules, procedures, and scientific ethics in the form of a thesis (ILO1)
2. Take decisions in the context of resolving the problem of developing science and technology based on analysis or experimental studies of information and data (ILO5)
3. Have the ability to utilize application or software in animal husbandry field (ILO8)</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course discusses the application of artificial intelligence in the livestock industry and the use of big data in answering the current and future problems of the livestock industry.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Prof. Dr.M.Halim Natsir,S.Pt,MP. IPM. ASEAN Eng</td></tr>
<tr><td>9.</td><td colspan="6">Other information (References)
1. Costa, EZX. 2009. Artificial intelligence in Animal Science. R. Bras. Zootec., v.38, p.390-396
2. Murray Shanahan,Matthew Crosby, Benjamin Beyret, and Lucy Cheke. 2020. Artificial Intelligence and the Common Sense of Animals. Trends in Cognitive Sciences, November 2020, Vol. 24, No. 11
3. Gota Morota, Ricardo V. Ventura Fabyano F. Silva,Masanori Koyama, and Samodha
4. C. Fernand. 2018. BIG DATA ANALYTICS AND PRECISION ANIMAL AGRICULTURE SYMPOSIUM: Machine learning and data mining advance predictive big data analysis in precision animal agriculture1. J. Anim. Sci. 2018.96:1540–1550
5. Big Data Now. O'Reilly Media, Inc. 2015
6. Introduction to Data Mining and Analytics Big</td></tr>
</table>

RESEARCH METHODOLOGY AND SCIENTIFIC WRITING					
module/ course code PEF80001	**Student work- load** 228 hours	**Credits** 3 SCU	Semester 1st Sem.	**Frequency** Each Semester	**Duration** 1 semester

1.	**Types of courses**	**Contact hours**	**Independent study**	**Class size**
	Compulsory Course	48 hours	180 hours	20-25 students

2. Prerequisites for participation (if applicable)

-

3. Learning outcomes

1. Applying logical, critical, systematic, and creative thinking in the field of animal husbandry through scientific research and the results of studies based on rules, procedures, and scientific ethics in the form of a thesis (ILO1)
2. Arrange and communicate ideas, scientific ideas and opinions responsibly and are based on academic ethics and communicate the results of livestock industry research in a forum (ILO2)
3. Identify the scientific fields that are the object of research and position them into a research map developed through an inter and multi-disciplinary approach (ILO6)

4. Subject aims/Content

This course includes understanding in preparing a research proposal, research report and scientific work in the field of animal science, which includes the preparation of research background, identification and formulation of problems, research objectives and benefits, hypotheses, literature review, a framework of thought, research methods and operational research frameworks, literature study research, statistical design selection and data analysis, results and discussion, conclusions and suggestions, bibliography and attachments, as well as writing scientific papers

5. Teaching methods

1. Speech
2. Project Based Learning
3. Case based learning
4. Group Discussion

6. Assessment methods

1. Individual work
2. Group work

7. This module/course is used in the following study programme/s as well

N/A

8. Responsibility for module/course

Prof. Dr. Ir. Trinil Susilawati, MS. IPU. ASEAN Eng

9. Other information

1. Statistika dan rancangan percobaan penerapan dalam bidang peternakan(Herni sudarwati dkk, UB Press)
2. Metode Penelitian (Metode percobaan dan karya ilmiah) (Yogi sugito, UBpress)

	3. Metode penelitian (kupas tuntas mencapai tujuan)(Sri kumala ningsih , UBpress) 4. Prinsip-prinsip menyusun kuisioner (Eko Nugroho, UB Press)

Department of Animal Production
Compulsory Courses

<table>
<tr><td colspan="7">ANIMAL PRODUCTION PHYSIOLOGY</td></tr>
<tr><td colspan="2">Module/Course Code
PEP 80001</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each semester</td><td>Duration
1 semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Compulsory Course</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours (structural assignment 80 hours, self learning 100 hours)</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Intended Learning Outcomes:
1. Develop and communicate ideas, thoughts and scientific opinions responsibly and based on academic ethics and communicate research results in a forum.
2. Able to master the theory of the livestock industry (breeding, feeding, management, livestock product technology and livestock agribusiness) and have the ability to develop competitive local resources.
3. Able to apply innovative technology based on inter-disciplinary and multi-disciplinary in the development of the livestock industry.
Course Learning outcomes:
1. Students are able to describe the physiological mechanism of the production process including internal and external factors that affect the growth and development of livestock
2. Students are able to describe the physiological mechanism of the production process including internal and external factors that affect the parturition process.
3. Students are able to describe the physiological mechanism of the production process including internal and external factors that affect lactation.
4. Students are able to describe the physiological mechanism of the production process including internal and external factors that affect the egg formation process.
5. Students are able to describe the physiological mechanism of the production process including internal and external factors that affect environmental adaptation.</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course explains the physiological mechanism of the production process including internal and external factors that support livestock productivity, including; growth and development, physiology of parturition, lactation, egg formation, and environmental adaptation.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Dr. Ir. Ita Wahyu Nursita, M.Sc</td></tr>
</table>

9.	Other information (References) 1. Bath, L.D., Dickinson, F.N., Tucker, A.H and Appleman, R.D. 1985. Dairy Cattle., Principle, Practice, Problems, Profits. Third Edition. LEA and FEBRIGER PHILADEPLHIA. 2. Lim-Sylianco, C.Y. 1984. Modern Biochemistry. Second Edition. First Printing. Aurum Technical Books. Balintawak-Quezon City, Phillipines. 3. Schmidt, G,H and Van Vleck., L.D. 1970. Principles of Dairy Science. W.H. Freeman and Company. San Francisco. 4. Bykov, K.M., Vladimirov, G.A., Delov, V.Y., Konradi, G.P and Slonim, A.D. 1960. Textbook of Physiology. Foreign Languages Pubishing House Moscow. 5. Wilson, J,A.1979. Principles Of Animal Physiology. Second Edition. Collier Macmillan International Editions. OHO University New York. London 6. Campbell, Reece, and Mitchell, Biologi, Edisi 5, 2000. 7. Chapman and Hall, N.Y., A Textbook of Histology 12th edition, 1994. 8. Alberts et al. Molecular Biology of the Cell, Garland Publishing, N.Y. Third edition, 1994. 9. Altan O, Pabuccuoglu A, Alton A, Konyalioglu S, Bayraktar H.,2003. Effect of Heat 10. Stress on Oxidative Stress, Lipid Peroxidation And Some Stress Parameters In Broilers. Br Poult Sci 2003; 4: 545-50. 11. FAO. 2006a. Livestock's Long Shadow – Environmental Issues And Options, H. Steinfeld, P. Gerber, T. Wassenaar, V. Castel, M. Rosales, and C. de Haan (eds), Rome, Italy: Food and Agriculture Organization of the United Nations. 12. Dr Muhammad Ashiq Toor DVM , B s c (Zoology) Islamia University of Bahawal Pur (IUB) (2010 – 2015) +92-344-499-7375 +92-300-364-2402 Mammary system, Milk Synthesis, Milk Let-down & Milking

<table>
<tr><td colspan="7">ANIMAL PRODUCTION TECHNOLOGY</td></tr>
<tr><td colspan="2">Module/Course Code
PEP80002</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semesters</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Compulsory Course</td><td>Contact hours
48 hours</td><td>Independent study
180 hours (structural assignment 80 hours and self learning 100 hours)</td><td colspan="2">Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Intended Learning Outcomes:
1. Able to apply innovative technology based on inter-disciplinary and multi-disciplinary in the development of the livestock industry (CP4)
2. positioning into a research map developed through an inter and multi-disciplinary approach (CP6)
3. Increase independent learning capacity (CP7)
Course learning outcomes:
1. Students are able to choose technic for the development of livestock production.
2. Students are able to evaluate the production of technological results.
3. Students are able to apply and apply technology to increase production.</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course explains the development of livestock production potential by applying technic and innovation to dairy cattle, broilers, poultry and miscellaneous livestock on an industrial level, including breeding and increasing productivity (breeding, feeding, management), molecular technology and evaluation of production based on livestock welfare.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Dr. Ir. Tri Eko Susilorini, MP. ASEAN Eng</td></tr>
<tr><td>9.</td><td colspan="6">Other information (References)
1. Taylor. R.E. (1992) Sientific Farm Animal Producton. Mac. Millan Publishing Com New York
2. Davaendra C. (2007) Goats: Biology, Production and Development in Asia. Academy Sciences Malaysia.</td></tr>
</table>

<table>
<tr><td colspan="7">ANIMAL PRODUCTION DEVELOPMENT</td></tr>
<tr><td colspan="2">Module/Course Code
PEP80003</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Compulsory Course</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours (structural assignment 80 hours, self learning 100 hours)</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Intended Learning Outcomes:
1. Implement a strategy to increase livestock production on dairy, meat, poultry, and various livestock on the scale of smallholder and industrial farms.
2. Describe the science of animal husbandry management for the development of dairy, meat, poultry, and various livestock production.
3. Able to plan livestock production development.
Course Learning outcomes:
1. Mastering the theory of livestock management (breeding, feeding, and management) according to Good Farming Practices (GFP) guidelines
2. Describe the science of livestock management for the development of dairy, meat, poultry, and miscellaneous livestock production
3. Implement a strategy to increase livestock production on dairy, meat, poultry, and miscellaneous livestock on the scale of smallholder and industrial farms.</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course explores livestock management and designs the development of dairy, meat, poultry, and miscellaneous livestock production according to Good Farming Practices (GFP), animal welfare, and regulations.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Dr. Ir. Edy Sudjarwo, MS</td></tr>
<tr><td>9.</td><td colspan="6">Other information (References)
1. S.J. Oosting, H.M.J. Udo, T.C. Viets, Development of livestock production in the tropics: farm and farmers' perspectives, Animal, Volume 8, Issue 8, 2014, Page 1238-1248 ISSN 1751-7311, https://doi.org/10.1017/S1751731114000548.
2. Abrahamsson, P., and Tauson, R.,. 1995. Aviary systems and conventional cages for laying hens. Effects on production, egg quality, health and bird location in three hybrids. Acta Agric. Scand. A Anim. Sci. 45:191–203.
3. Chambers J.R., 1990. Genetics of growth and meat production in chickens. In: Crawford RD, editor. Poultry Breeding and Genetics. Publication by Amsterdam. New York: Elsevier; pp. 599-644</td></tr>
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Department of Animal Production
Elective Courses

<table>
<tr><td colspan="7">INDUSTRY OF RUMINANT PRODUCTION</td></tr>
<tr><td colspan="2">Module/Course Code
PEP80004</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semesters</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Elective Courses</td><td>Contact hours
48 hours</td><td>Independent study
180 hours (structural assignment 80 hours and self learning 100 hours)</td><td colspan="2">Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Intended Learning Outcomes:
1. Able to master the theory of the livestock industry (breeding, feeding, management, livestock product technology and livestock agribusiness) and have the ability to develop competitive local resources (CP3)
2. Able to apply innovative technology based on interdisciplinary and multi-disciplinary in the development of the livestock industry (CP4)
3. Identify the scientific field that is the object of research and position it into a research map developed through an inter and multi-disciplinary approach (CP 6)
4. Increase independent learning capacity (CP7)
Course Learning outcomes:
1. Students are able to master the concept and analyze the dynamics of the ruminant livestock industry based on the development and projection of the livestock population and its development strategy in accordance with regulations
2. Students are able to apply the concept of ruminant livestock growth and development in accordance with the ruminant livestock production process
3. Students are able to design the structure, function and layout of the cage along with the instruments (livestock engineering)
4. Students are able to evaluate the quality assurance of ruminant livestock products (breed and breeding production of livestock that are healthy and whose welfare is guaranteed as well as traceability of halal products in accordance with good farming practices/good dairy farming practices and regulations.</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course describes the development and application of optimal management of the ruminant livestock industry based on good farming practices/good dairy practices and regulations to produce quality products with traceability and traceability of supply chains sustainable.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Dr. Ir. Kuswati, MS.,IPM. ASEAN. Eng</td></tr>
</table>

9.	Other information (References)

INDUSTRY OF NON-RUMINANT PRODUCTION					
Module/Course Code PEP 80005	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1st semester	**Frequency** Each Semesters	**Duration** 1 Semester

1.	**Types of courses** Elective Course	**Contact hours** 48 hours	**Independent study** 180 hours (structural assignment 80 hours and self learning 100 hours)	**Class size** 20-25 students
2.	Prerequisites for participation -			
3.	**Intended Learning Outcomes:** 1. Able to apply innovative technology based on inter-disciplinary and multi-disciplinary in the development of the livestock industry (CP4) 2. Identify the scientific field that is the object of research and position it into a research map developed through an inter and multi-disciplinary approach (CP6) 3. Increase independent learning capacity (CP7) **Course Learning Outcomes:** 1. Students are able to master the concept and analyze the dynamics of the non-ruminant livestock industry based on the development and projection of the livestock population and its development strategy in accordance with regulations 2. Students are able to apply the concept of non-ruminant livestock growth in accordance with the non-ruminant livestock production process. 3. Students are able to design the structure, function and layout of the house along with the instruments/equipment (livestock engineering) 4. Students are able to evaluate the quality assurance of non-ruminant livestock products (breed and production) from healthy and guaranteed welfare and traceability of halal products in accordance with good farming practices and regulations.			
4.	Subject aims/content This course describes the development and application of optimal management of the non-ruminant livestock industry based on good farming practices and regulations to produce quality products with traceability and sustainable supply chains.			
5.	Teaching methods 1. Speech 2. Project Base Learning 3. Case Base Learning 4. Group Discussion			
6.	Assessment methods 1. Individual work 2. Group work			
7.	This module/course is used in the following study programme/s as well N/A			
8.	Responsibility for module/course Prof.Dr.Ir. Veronica Margareta Ani Nurgiartiningsih , M.Sc.			
9.	Other information (References) 1. Anonimous. 2020. Buku Statistik dan Kesehatan Hewan. Direktorat Jenderal Peternakan. Jakarta.			

	2. Bell, D.D., W.D. Weaver. 2002. Commercial Chicken Meat and Egg Production. Academic Publisher. United States of America. 3. Journal Poultry Science 4. Journal Animal Production

ANIMAL WASTE MANAGEMENT INDUSTRY						
Module/Course Code PEP 80006	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1st semester	**Frequency** Each Semester	**Duration** 1 Semester	
1.	**Types of courses** Elective Course	**Contact hours** 48 hours	**Independent study** 180 hours (structural assignment 80 hours and self learning 100 minutes)	**Class size** 20-25 students		
2.	Prerequisites for participation -					
3.	**Intended Learning Outcomes:** 1. Able to master the theory of the livestock industry (breeding, feeding, management, livestock product technology and livestock agribusiness) and have the ability to develop competitive local resources (CP3) 2. Able to apply innovative technology based on inter-disciplinary and multi-disciplinary in developing the livestock industry (CP4) **Course Learning outcomes:** 1. Students are able to conduct anaerobic and aerobic waste management technology and evaluate product quality in accordance with applicable regulations. 2. Students are able to design open (aerobic) and closed (anaerobic) animal waste technology and evaluate product quality. 3. Students are able to implemented animal waste technology aerobic and anaerobic, and evaluate product quality 4. Students are able to evaluate product quality assurance in accordance with applicable regulations or Standar Nasional Indonesia (SNI).					
4.	Subject aims/content This course discusses livestock industry waste management technology with learning sub-achievements: open management technology (aerobic/air/blowing/added air) and closed management technology (anaerobic/without oxygen) as well as product quality evaluation technology to be marketed/commercialized.					
5.	Teaching methods 1. Speech 2. Project Base Learning 3. Case Base Learning 4. Group Discussion					
6.	Assessment methods 1. Individual work 2. Group work					
7.	This module/course is used in the following study programme/s as well N/A					
8.	Responsibility for module/course Prof. Dr. Ir. Moch. Yunus, MS.					
9.	Other information (References) 1. Teodorita Al Seadi, Dominik Rutz, Heinz Prassl, Michael Köttner, Tobias Finsterwalder, Silke Volk, Rainer Janssen (2008) Biogas Handbook. Published by University of Southern Denmark Esbjerg, Niels Bohrs Vej 9-10, DK-6700 Esbjerg, Denmark					

	2. Design and development and testing of an improved tilting hydraulic flume for runoff and soil loss simulation studies. - Scientific Figure on ResearchGate. Available https://www.researchgate.net/figure/JANTA-Model-Biogas-Plant_fig4_282182725 [accessed 11 Apr, 2020]

Department of Nutrition and Animal
Compulsory Courses

FEED PROCESSING SCIENCE AND TECHNOLOGY					
Module/Course Code PEN80001	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1st semester	**Frequency** Each Semester	**Duration** 1 Semester

1.	**Types of courses** Compulsory course	**Contact hours** 48 hours	**Independent study** 180 hours Structural assignment 100 hours independence study 80 hours	**Class size** 20-25 students

2.	Prerequisites for participation -
3.	Learning outcomes 1. Arrange and communicate ideas, scientific ideas and opinions responsibly and are based on academic ethics and communicate the results of livestock industry research in a forum (ILO2)) 2. Able to master the livestock industry theory (specifically breeding, feeding, and management, animal product technology and agribusiness) and have ability to develop competitive local resources (ILO3) 3. Able to apply innovative, multidisciplinary technology in the development of the livestock industry (ILO4)
4.	Subject aims/content This course discusses feed ingredient processing technology (protection, fermentation, preservation) and feed additive production technology for ruminant, non-ruminant and forage livestock. Furthermore, this course examines the formulation of non-ruminant and ruminant animal feed.
5.	Teaching methods 1. Speech 2. Project Based Learning 3. Case Based Learning 4. Group Discussion
6.	Assessment methods 1. Individual work 2. Group work
7.	This module/course is used in the following study programme/s as well N/A
8.	Responsibility for module/course 1. Prof. Dr.Ir. Hartutik, MP. IPU. ASEAN Eng (Coordinator) 2. Prof. Dr.Ir. Siti Chuzaemi, MS. IPU ASEAN Eng 3. Dr.Ir. Eko Widodo, M.Agr.Sc. M.Sc. 4. Dr.Ir. M. Halim Natsir, MP. IPM. ASEAN Eng 5. Dr.Ir. Siti Nurul Kamaliyah, MP

	6. Dr. Ir. Hermanto, MP
9.	Other information (References) 1. Dijkstra, J., Forbes, J.M. and France, J. 2005. Quantitative aspects of ruminants digestion and metabolism. CAB International. Cambridge, USA. 2. Puniya, A.K., Singh, R. and Kamra, D.N. 2015. Rumen Microbiology: From Evolution to Revolution. Springer. New Delhi. India 3. Mane, S. H., Mandakmale, S. D., Nimbalkar, C. A., Kankhare, D. H., & Lokhande, A. T. (2017). Economics of feeding protected protein and protected fat on crossbred cattle. Indian Journal of Animal 4. Research, 51(6), 1080-1085. 5. Kamalak, A., Canbolat, O., G√ºrb√ºz, Y., & √ñzay, O. (2005). Protected protein and amino acids in ruminant nutrition. Journal of Science and Engineering, 8(2), 84-88. 6. Gulati, S. K., Garg, M. R., & Scott, T. W. (2005). Rumen protected protein and fat produced from oilseeds and/or meals by formaldehyde treatment; their role in ruminant production and product quality: a review. Australian Journal of Experimental Agriculture, 45(10), 1189-1203. 7. Sarnklong, C., Cone, J. W., Pellikaan, W., & Hendriks, W. H. (2010). Utilization of rice straw and different treatments to improve its feed value for ruminants: a review. Asian-Australasian Journal of Animal Sciences, 23(5), 680-692. 8. Tarigan, A., Ginting, S. P., Ii, A., Astuti, D. A., & Abdullah, L. (2018). Body Weight Gain, Nutrients Degradability and Fermentation Rumen Characteristics of Boerka Goat Supplemented Green Concentrate Pellets (GCP) Based on Indigofera zollingeriana. Pakistan journal of biological sciences: PJBS, 21(2), 87-94. 9. Bolsen, K. K., Ashbell, G., & Weinberg, Z. G. (1996). Silage fermentation and silage additives-Review. Asian-Australasian journal of animal sciences, 9(5), 483-494. 10. Horky, P., Skalickova, S., Smerkova, K., & Skladanka, J. (2019). Essential Oils as a Feed Additives: Pharmacokinetics and Potential Toxicity in Monogastric Animals. Animals, 9(6), 352. 11. Bakshi, M.P.S, M.Wadhwa and H.P,S,Makkar. 2017. Hydroponic fodder production: A critical assessment. Broadening Horizons. www.feedipedia.org 12. Nail, P.K., B.K. Swain and N.P. Singh. 2015. REVIEW: Production and Utilisation of Hydroponics Fodder. Indian J.Anim.Nutr. 32(1):1-9. 13. Loyola-Vargas, V.M. and Ochoa-Alejo, N. 2018. An Introduction to Plant Tissue Culture: Advances and Perspectives. In chapter: Methods in molecular biology (Clifton, N.J.) 1815: 3-13, in book: Plant Cell Culture Protocols. DOI: 10.1007/978-1-4939-8594-4_1 14. Dumont, B., Groot, J. C. J., & Tichit, M. (2018). Make ruminants green again-how can sustainable intensification and agroecology converge for a better future?. animal, 12(s2), s210-s219. 15. Windisch, W., Schedle, K., Plitzner, C., & Kroismayr, A. (2008). Use of phytogenic products as feed additives for swine and poultry. Journal of animal science, 86(suppl_14), E140-E148. 16. Wenk, C. (2003). Herbs and botanicals as feed additives in monogastric animals. Asian-Australasian Journal of Animal Sciences, 16(2), 282-289. 17. San Juan, L. D., & Villamide, M. J. (2001). Nutritional evaluation of sunflower products for poultry as affected by the oil extraction process. Poultry Science, 80(4), 431-437. 18. Rahimi, S., Teymouri, Z. Z., Karimi, T. M., Omidbaigi, R., & Rokni, H. (2011). Effect of the three herbal extracts on growth performance, immune system, blood factors and intestinal selected bacterial population in broiler chickens.

19. Nouri, A. (2019). Chitosan nano-encapsulation improves the effects of mint, thyme, and cinnamon essential oils in broiler chickens. British poultry science, 60(5), 530-538.
20. Zhang, K. Y., Yan, F., Keen, C. A., & Waldroup, P. W. (2005). Evaluation of microencapsulated essential oils and organic acids in diets for broiler chickens. International Journal of Poultry Science, 4(9), 612-619.
21. Cui, L. H., Yan, C. G., Li, H. S., Kim, W. S., Hong, L., Kang, S. K., ... & Cho, C. S. (2018). A new method of producing a natural antibacterial peptide by encapsulated probiotics internalized with inulin nanoparticles as prebiotics. J. Microbiol. Biotechnol, 28(4), 510-519.
22. Gangadoo, S., Stanley, D., Hughes, R. J., Moore, R. J., & Chapman, J. (2016). Nanoparticles in feed: Progress and prospects in poultry research. Trends in Food Science & Technology, 58, 115-126.
23. Fascina, V. B., Sartori, J. R., Gonzales, E., Carvalho, F. B. D., Souza, I. M.
24. G. P. D., Polycarpo, G. D. V., ... & Pel√≠cia, V. C. (2012). Phytogenic additives and organic acids in broiler chicken diets. Revista Brasileira de Zootecnia, 41(10), 2189-2197.
25. Koshchaev, A. G., Lysenko, Y. A., Nesterenko, A. A., Luneva, A. V., & Gneush, A. N. (2019). Development of feed additives for poultry farming. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 10(1), 1567-1572.

<table>
<tr><td colspan="7">DEVELOPMENT OF FEED AND ANIMAL NUTRITION</td></tr>
<tr><td colspan="2">Module/Course Code
PEN80002</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Compulsory courses</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours Structural assigment 100 hours independence study 80 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Arrange and communicate ideas, scientific ideas and opinions responsibly and are based on academic ethics and communicate the results of livestock industry research in a forum (ILO2)
2. Able to master the livestock industry theory (specifically breeding, feeding, and management, animal product technology and agribusiness) and have ability to develop competitive local resources (ILO3)
3. Able to apply innovative, multidisciplinary technology in the development of the livestock industry (ILO4)</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course explains the development and function of animal feed nutrition science and technology in a livestock business that can produce livestock products (high productivity and large scale livestock business), ASUH (safe, healthy, intact and halal), friendly and safe for the environment, as well as sustainable to meet/balance the number of requests/needs for livestock products which are continually increasing rapidly. The material discussed mainly focuses on the development of science that underlies the role and function of nutrition and animal feed science and technology in achieving the current and future demands of the livestock business and its products.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
1. Prof. Dr.Ir. Hendrawan Soetanto, M.Rur.Sc.
2. Prof. Dr.Ir. Ifar Subagiyo, M.Agr. St.
3. Dr.Ir. Marjuki, M.Sc.</td></tr>
</table>

	4. Dr.Ir. Irfan H. Djunaedi. M.Sc. 5. Dr. Rini Dwi S., S.Pt., MP
9.	Other information (References) 1. Encyclopedia of Meat Sciences. 2004. Animal Production. https://www.sciencedirect .com/topics/agricultural-and-biological-sciences/animal-production/pdf 2. Zuidhof, M. J. 2020. Precision livestock feeding: matching nutrient supply with nutrient requirements of individual animals. 2020 J. Appl. Poult. Res. 29:11-14 https://doi.org/10.1016/j.japr.2019.12.009 3. Reddy D V and Krishna N 2009: Precision animal nutrition: A tool for economic and eco-friendly animal production in ruminants. Livestock Research for Rural Development. Volume 21, Article #36. Retrieved January 20, 2021, from http://www.lrrd.org/lrrd21/3/redd21036.htm 4. Dijkstra, J., Forbes, J.M. and France, J. 2005. Quantitative aspects of ruminants digestion and metabolism. CAB International. Cambridge, USA. 5. Puniya, A.K., Singh, R. and Kamra, D.N. 2015. Rumen Microbiology: From Evolution to Revolution. Springer. New Delhi. India 6. Mane, S. H., Mandakmale, S. D., Nimbalkar, C. A., Kankhare, D. H., & Lokhande, A. T. (2017). Economics of feeding protected protein and protected fat on crossbred cattle. Indian Journal of Animal Research, 51(6), 1080-1085. 7. K. J. Shingfield1-, M. Bonnet2,3 and N. D. Scollan. 2013. Recent developments in altering the fatty acid composition of ruminant-derived foods. Animal (2013), 7:s1, pp 132-162 & The Animal Consortium 2012. doi:10.1017/S1751731112001681 8. Kamalak, A., Canbolat, O., G√ºrb√ºz, Y., & √ñzay, O. (2005). Protected protein and amino acids in ruminant nutrition. Journal of Science and 9. Engineering, 8(2), 84-88. 10. Gulati, S. K., Garg, M. R., & Scott, T. W. (2005). Rumen protected protein and fat produced from oilseeds and/or meals by formaldehyde treatment; their role in ruminant production and product quality: a review. Australian Journal of Experimental Agriculture, 45(10), 1189-1203. 11. Sarnklong, C., Cone, J. W., Pellikaan, W., & Hendriks, W. H. (2010). Utilization of rice straw and different treatments to improve its feed value for ruminants: a review. Asian-Australasian Journal of Animal Sciences, 23(5), 680-692. 12. Tarigan, A., Ginting, S. P., Ii, A., Astuti, D. A., & Abdullah, L. (2018). Body Weight Gain, Nutrients Degradability and Fermentation Rumen Characteristics of Boerka Goat Supplemented Green Concentrate Pellets (GCP) Based on Indigofera zollingeriana. Pakistan journal of biological sciences: PJBS, 21(2), 87-94. 13. Abdul Shakoor Chaudhry, 2008. Forage based animal production systems and sustainability, an invited keynote. R. Bras. 14. Zootec. vol.37 no.spe Vi√ßosa July 2008. https://doi.org/10.1590/S1516-35982008001300010 15. L.'t Mannetje. 1993. Practical technologies for the optimal use of tropical pastures and rangelands in traditional and improved livestock production systems. http://www.fao.org/3/t0582e/T0582E14.htm. 16. Serkan Ates, Hayley C. Norman, Hichem Ben Salem, Bradley Nutt and Harun Cicek. 2015. Promising forage options to enhance livestock production in Mediterranean climate agricultural systems. Proceedings of 23rd International Grassland Congress 2015-Keynote Lectures. https://core.ac.uk/download/pdf/232600341.pdf

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32. S. (2018). A new method of producing a natural antibacterial peptide by encapsulated probiotics internalized with inulin nanoparticles as prebiotics. J. Microbiol. Biotechnol, 28(4), 510-519.
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34. Nanoparticles in feed: Progress and prospects in poultry research. Trends in Food Science & Technology, 58, 115-126.
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37. Koshchaev, A. G., Lysenko, Y. A., Nesterenko, A. A., Luneva, A. V., & Gneush,

	38. A. N. (2019). Development of feed additives for poultry farming. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 10(1), 1567-1572

FEED EVALUATION SCIENCE AND TECHNIQUES					
Module/Course Code PEN80003	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1 st semester	**Frequency** Each Semester	**Duration** 1 Semester

1	**Types of courses** Compulsory course	**Contact hours** 48 hours	**Independent study** 180 hours Structural assigment 100 hours independence study 80 hours	**Class size** 10-15 students

2.	Prerequisites for participation -
3.	Learning outcomes 1. Arrange and communicate ideas, scientific ideas and opinions responsibly and are based on academic ethics and communicate the results of livestock industry research in a forum (ILO2) 2. Able to master the livestock industry theory (specifically breeding, feeding, and management, animal product technology and agribusiness) and have ability to develop competitive local resources (ILO3)
4.	Subject aims/content This course discusses: 1. Various feed evaluation methods have been developed or modified to predict feed quality. 2. Various techniques for evaluating feed and forage ingredients, antinutrients, contaminants and feed biotechnology products physically, chemically and biologically. 3. Quality standards of feed (ISO, KAN, HCCP and Sigma) 4. Evaluation of feed associated with various parameters in research. It is obtaining quality feed that can support the potential for livestock productivity. 5. Interpretation of data from the evaluation of nutrition and its benefits for livestock to support livestock business following the development of science. 6. No more discussing the evaluation procedure technique
5.	Teaching methods 1. Speech 2. Project Base Learning 3. Case Base Learning 4. Group Discussion
6.	Assessment methods 1. Individual work 2. Group work
7.	This module/course is used in the following study programme/s as well N/A

8.	Responsibility for module/course 1. Prof. Dr.Ir. Hartutik, MP. IPU. ASEAN Eng (Coordinator) 2. Osfar Sjofjan, Dr. Ir. M.Sc. IPU. ASEAN Eng. 3. Prof. Dr. Ir. Kusmartono 4. Mashudi, Dr. Ir. M.Agr.Sc. IPM. ASEAN Eng. 5. Irfan H. Djunaidi, Dr. Ir., M.Sc. IPM. ASEAN Eng. 6. Dr. Ir. Herni Sudarwati, MS 7. Dr. Ir. Hermanto, MP
9.	Other information (References) 1. AAFCO, 2018. Recommendations and Critical Factors in Determining Moisture in Animal Feeds. Moisture Best Practices Working Group. Association of American Feed Control Officials. 2. Association of Official Analytical Chemist. 2005. Official Methods of Analysis of AOAC International Horwitz W, editor. Ed ke-18. Publ, AOAC International. Maryland USA. 3. Bachruddin, Z., 1996. Pengukuran pH dan Asam Lemak Terbang (Vollatile Fatty Acid - VFA) Cairan Rumen dengan Gas Khromatografi (Kursus Singkat Teknik Evaluasi Pakan Ruminansia). Fakultas Peternakan. Universitas Gadjah Mada. Yogyakarta 4. Bl√ºmmel M, Makkar H P S, Becker K. 1997. In vitro gas production: a technique revisited. Journal of Animal Physiology and Animal Nutrition, 77, 24-34. 5. Blummel, M. H. Steingas and K. Becker. 1997. The relationship between in vitro gas production, in vitro microbial biomass yield and 15N incorporation and its implications for the prediction of foluntary feed intake of roughages. British Journal of Nutrition, 77 : 911-921 6. Csap√≥, J., Schmidt, J. and Martin, T.G. 2001. Quantitative determination of protein of bacterial origin. Trends in Analytical Chemistry 20: 42-48. 7. Conway, E. J. 1957. Microdiffusion analysis and volumetric error. 4th ed. Crosby and Lookwood and Son, Ltd. 8. Chuch D. C., and Fond W. G. 1982. Basic Animal Nutrition and Feeding, 2nd. Canada. John Wiley and Sons. 9. Goering, H.K. and Van Soest, P.J. (1970) Forage Fiber Analysis (Apparatus Reagents, Procedures and Some Applications). Agriculture Handbook. United States Department of Agriculture, Washington DC. 10. Givens, D.I., Owen, E. & Adesogan, A.T. 2000b. Current procedures, future requirements and the need for standardization. Ch. 21. In D.I. Givens, E. Owen, R.F.E. Axford & H.M. Ohmed, eds. Forage evaluation in ruminant nutrition, pp. 449-474. CABI Publishing, Wallingford, UK. 11. Jemimah, E. R., P. Tensingh Gnanaraj, T. Muthuramalingam, T. Devi and C.Vennila, 2018. Productivity, Nutritive Value, Growth Rate, Biomass Yield and Economics of Different Hydroponic Green Fodders for Livestock. International Journal of Livestock Research,Ä® 8 (09) : 261 - 270. 12. Makkar, H.P.S., M. Bl√ºmmel & K. Becker. 1995. Formation of complexes between polyvinyl pyrrolidones or polyethylene glycols and tannins, and their implication in gas production and true digestibility in in vitro techniques. Br. J. Nutr. 73: 897-913.

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Department of Animal Nutrition
Elective Courses

<table>
<tr><td colspan="7">RUMINANT FEED DEVELOPMENT STRATEGY</td></tr>
<tr><td>Module/Course Code
PEN80004</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semester</td><td colspan="2">Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Elective Course</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours
Structural assigment 100 hours
independence study 80 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Arrange and communicate ideas, scientific ideas and opinions responsibly and are based on academic ethics and communicate the results of livestock industry research in a forum (ILO2)
2. Able to master the livestock industry theory (specifically breeding, feeding, and management, animal product technology and agribusiness) and have ability to develop competitive local resources (ILO3)
3. Able to apply innovative, multidisciplinary technology in the development of the livestock industry (ILO4)</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course is a follow-up to the three compulsory courses for Nutrition and Animal Feed Department that have been given in semester 1, especially those related to ruminants. This course subject is focused on comprehensive studies in terms of technical aspects and the impact of the application of research results or the results of the application of a strategy/technique to increase the efficiency of feed utilization by livestock both to increase the production of high ruminant livestock, ASUH, friendly and environmentally safe and sustainable, as well as opportunities for their development. Some of these strategies/techniques start from selecting the feed ingredients, processing, formulating and giving them to livestock (precision feeding), including feed additives (rumen fermentation manipulation). This course material is in the form of reviewing research articles or applying a strategy/technique to increase the efficiency of feed by livestock for the above production purposes.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
</table>

7.	This module/course is used in the following study programme/s as well N/A
8.	Responsibility for module/course 1. Prof.Dr.Ir. Hendrawan Soetanto, M.Rur.Sc. 2. Prof.Dr.Ir. Siti Chuzaemi, MS, IPU, ASEAN Eng. 3. Prof.Dr.Ir. Hartutik, MP, IPU, ASEAN Eng. 4. Prof.Dr.Ir. Kusmartono 5. Dr.Ir. Mashudi, M.Sc. Agr. 6. Dr.Ir. Marjuki, M.Sc.
9.	Other information (References) 1. Zuidhof, M. J. 2020. Precision livestock feeding: matching nutrient supply with nutrient requirements of individual animals. 2020 J. Appl. Poult. Res. 29:11–14 https://doi.org/10.1016/j.japr.2019.12.009 2. Reddy D V and Krishna N 2009: Precision animal nutrition: A tool for economic and eco- friendly animal production in ruminants. Livestock Research for Rural Development. Volume 21, Article #36. Retrieved January 20, 2021, from http://www.lrrd.org/lrrd21/3/redd21036.htm 3. Hopkins, DL, Safari, E, Thompson, JM and Smith, CR 2004. Video image analysis in the Australian meat industry – precision and accuracy of predicting lean meat yield in lamb carcasses. Meat Science 67, 269–274. 4. Schellberg, J, Hill, MJ, Gerhards, R, Rothmund, M and Braun, M 2008. Precision agriculture on grassland: applications, perspectives and constraints. European Journal of Agronomy 29, 59–71. 5. W.Z. Yang, K.A. Beauchemin, L.M. RodeEffects of barley grain processing on extent of digestion andmilk production of lactating cows J. Dairy Sci., 83 (2000), pp. 554-568 6. Vaage, A. S., and J. A. Shelford. 1984. Weibull-type function to describe particle length in chopped forage. Page 177 in Techniques in Particle Size Analysis of Feed and Digesta in Ruminants. P. M. Kennedy, ed. Can. Soc. Anim. Sci. Occas. Publ. No. 1. 7. W.Z. Yang, K.A. Beauchemin, L.M. RodeEffects of grain processing, forage to concentrate ratio, and forage particle size on rumen pH and digestion by dairy cows J. Dairy Sci., 84 (2001), pp. 2203-2216 8. Kim YK, Schingoethe DJ, Casper DP, Ludens FC. Supplemental dietary fat from 9. extruded soybeans and calcium soaps of fatty acids for lactating dairy cows. J Dairy Sci. 1993; 76:197-204. 10. Garg MR, Mehta AK. Effect of feeding bypass fat on feed intake, milk production and body condition of Holstein Friesian cows. Indian J of Anim. Nutr. 1998; 15:242-245 11. Mane, S. H., Mandakmale, S. D., Nimbalkar, C. A., Kankhare, D. H., & Lokhande, A. T. (2017). Economics of feeding protected protein and protected fat on crossbred cattle. Indian Journal of Animal Research, 51(6), 1080-1085. 12. K. J. Shingfield1-, M. Bonnet2,3 and N. D. Scollan. 2013. Recent developments in altering the fatty acid composition of ruminant-derived foods. Animal (2013), 7:s1, pp 132–162 & The Animal Consortium 2012. doi:10.1017/S1751731112001681 13. Adam L. Lock*‡ and Kevin J. Shingfield. 2018. Optimising Milk Composition. Downloaded from https://www.cambridge.org/core. INSEAD, on 07 Nov 2018 at 19:02:29, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/S0263967X00040076

14. Kamalak, A., Canbolat, O., Gürbüz, Y., & Özay, O. (2005). Protected protein and amino acids in ruminant nutrition. Journal of Science and Engineering, 8(2), 84-88.
15. Gulati, S. K., Garg, M. R., & Scott, T. W. (2005). Rumen protected protein and fat produced from oilseeds and/or meals by formaldehyde treatment; their role in ruminant production and product quality: a review. Australian Journal of Experimental Agriculture, 45(10), 1189-1203.
16. Sarnklong, C., Cone, J. W., Pellikaan, W., & Hendriks, W. H. (2010). Utilization of rice straw and different treatments to improve its feed value for ruminants: a review. Asian-Australasian Journal of Animal Sciences, 23(5), 680-692.
17. Tarigan, A., Ginting, S. P., Ii, A., Astuti, D. A., & Abdullah, L. (2018). Body Weight Gain, Nutrients Degradability and Fermentation Rumen Characteristics of Boerka Goat Supplemented Green Concentrate Pellets (GCP) Based on Indigofera zollingeriana. Pakistan journal of biological sciences: PJBS, 21(2), 87-94.

<table>
<tr><td colspan="7">NON-RUMINANT FEED DEVELOPMENT STRATEGY</td></tr>
<tr><td>Module/Course Code
PEN80005</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semester</td><td colspan="2">Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Elective Courses</td><td>Contact hours
48 hours</td><td>Independent study
180 hours
Structural assigment 100 hours
independence study 80 hours</td><td colspan="2">Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Arrange and communicate ideas, scientific ideas and opinions responsibly and are based on academic ethics and communicate the results of livestock industry research in a forum (ILO2)
2. Identify the scientific fields that are the object of research and position them into a research map developed through an inter and multi-disciplinary approach (ILO6)
3. Have the ability to utilize application or software in animal husbandry field (ILO8)</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course discusses the efforts to improve the quality and effectiveness of feeding non-ruminants, including aspects of supply and quality of local feed raw materials, application of microbial-based feed additive technology, substantive active substances and metabolic substances, feeding strategies related to environmental problems and agricultural locations, increasing nutritional efficiency, through the concept of Nutribiome, meta-analysis studies on aspects of nutrition and non-ruminant animal feed, as well as reviewing non-ruminant feed formulations.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
1. Dr. Irfan H.Djunaidi. MSc. IPM. ASEAN Eng
2. Dr. Osfar Sjofjan, MSc.IPU.ASEAN Eng
3. Prof. Dr.Ir.M. Halim Natsir, SPt.MP.IPM.ASEAN Eng</td></tr>
</table>

	4. Dr.Ir. Eko Widodo MAgr.Sc.MSc
9.	Other information (References) 1. Rick Kleyn. 2018 . Chicken Nutrition. Packington. England 2. Baracho et al. June 2019. Factors Affecting Broiler Production: A Meta Analysis. Brazilian Journal of Poultry Science 3. Remus A. 2014. A meta-analysis of the feed intake and growth performance of broiler chickens challenged by bacteria. Poultry Science. 93 :1149–1158 . http://dx.doi.org/ 10.3382/ps.2013-03540 4. Azmat Khan et al. 2018. Advances in Nutrigenomics and its Application in Poultry . Article in International Journal of Current Microbiology and Applied Sciences · 5. Liuting Wu., et al. Dec 2020. The mutual interaction between gut microbiota and protein/amino acid metabolism for host mucosal immunity and health. J, Animal Nutrition. https://doi.org/10.1016/j.aninu.2020.11.003 6. NasrinNoohi, et al . Dec. 2020. Screening for probiotic characters in lactobacilli isolated from chickens revealed the intra-species diversity of Lactobacillus brevis. Animal Nutrition, J. https://doi.org/10.1016/j.aninu.2020.07.005 7. Sujuan, D. et al. Dec 2020. The impact of probiotics on gut health via alternation of immune status of monogastric animals. Animal Nutrition, J. https://doi.org/10.1016/j.aninu.2020.11.004

<table>
<tr><td colspan="7">FORAGE DEVELOPMENT STRATEGY</td></tr>
<tr><td colspan="2">Module/Course Code
PEN80006</td><td>Student workload
228 hours</td><td colspan="2">Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Elective Courses</td><td colspan="2">Contact hours
48 hours</td><td>Independent study
180 hours
Structural assigment 100 hours
independence study 80 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Arrange and communicate ideas, scientific ideas and opinions responsibly and are based on academic ethics and communicate the results of livestock industry research in a forum (ILO2)
2. Able to master the livestock industry theory (specifically breeding, feeding, and management, animal product technology and agribusiness) and have ability to develop competitive local resources (ILO3)
3. Able to apply innovative, multidisciplinary technology in the development of the livestock industry (ILO4)</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course describes the role of science. This course discusses strategies for increasing production and availability of animal forage, including intensive/monoculture, mixed cropping systems, vertical farming, phytoremediation, planting and the efficiency/accuracy for livestock. Furthermore, Analysis of the forage production systems and measurement of the capacity of extensive and intensive areas.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
1. Prof. Dr.Ir. Ifar Subagiyo, M.Agr.St. (Coordinator)
2. Dr.Ir. Hermanto, MP
3. Dr.Ir. Siti Nurul Kamaliyah, MP
4. Dr.Ir. Herni Sudarwati, MS</td></tr>
</table>

9.	Other information (References) 1. Yeşil, V. and Ö. Tatar. 2020. An Innovative Approach to Produce Forage Crops : Barley Fodder in Vertical Farming. Scientific Papers. Series A. Agronomy, Vol. LXIII, No. 1, 2020ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785. https://www.researchgate.net/publication/345779976_AN_INNOVATIVE_APPROACH_TO_PRODUCE_FORAGE_CROPS_BARLEY_FODDER_IN_VERTICAL_FARMING_SYSTEM 2. Naik, P.K., B.K. Swain and N.P. Singh. 2015. Review-Production and Utilisation of Hydroponic Fodder. Indian J.Anim.Nutr. 32(1):1-9. 3. Kumar, R., M. Mathur, M. Karnani, S. Dutt, Choudhary and D. Jain. 2018. Hydroponics: An alternative to cultivated green fodder: A review. J. Entomol.Zool. Stud. 6(6): 791-795 4. Barth, S. 2012. Breeding strategies for forage and grass improvement. Annals of Botany 110 (6): 1261-1262 5. Acquaah, G. 2007. Principles of plant genetics and breeding. Blackwell Publishing. Victoria. Australia. 6. Tasma, I.M. 2015. Pemanfaatan teknologi sekuensing genom untuk mempercepat program pemuliaan. J. Litbang Pert. Vol. 34 No. 4 : 159-168. 7. Kalantari, F., Mohd Tahir, O., Mahmoudi Lahijani, A., & Kalantari, S. (2017). A Review of Vertical Farming Technology: A Guide for Implementation of Building Integrated Agriculture in Cities. *Advanced Engineering Forum*, *24*(October), 76–91. http://doi.org/10.4028/www.scientific.net/aef.24.76 8. Khodijah, N. S., Suwignyo, R. A., Harun, M. U., & Robiartini, L. (2019). Phytoremediation potential of some grasses on lead heavy metal in tailing planting media of former tin mining. *Biodiversitas*, *20*(7), 1973–1982. http://doi.org/10.13057/biodiv/d200725 9. Maria Royston, R., & M.p, P. (2018). Vertical Farming: a Concept. *International Journal of Engineering and Techniques*, *4*(3), 500–506. Retrieved from http://www.ijetjournal.org 10. Shafi, U., Mumtaz, R., García-nieto, J., & Hassan, S. A. (2019). Precision Agriculture Techniques and Practices : From Considerations to Applications. *Sensors*, *19*(3796), 1–25. http://doi.org/10.3390/s19173796 11. Attwood, G.T., S.A.Wakelin, S.C.Leahy, S.Rowe, S.Clarke, D.F.Chapman, R.Muirhead and M.E.Jacobs. 2019. Application of the Soil, Plant and Rumen Microbiomes in Pastoral Agriculture. Front. Nutr., 16 July 2019 | https://doi.org/10.3389/fnut.2019.00107 12. BusbyPE,Soman, C,Wagner, MR,Friesen, ML,Kremer, J,Bennett A,etal. 2017.Research priorities for harnessing plant microbiomes in sustainable agriculture. PLoSBiol15(3): e2001793. https://doi.org/10.1371/journal.pbio.2001793

Department of Animal Product Technology
Compulsory Courses

ANIMAL FOOD BIOTECHNOLOGY					
module/ course code PET 80001	**Student work- load** 228 hours	**Credits** 3 SCU	Semester 1st Sem.	**Frequency** Each Semester	**Duration** 1 Semester

1	**Types of courses**	**Contact hours**	**Independent study**	**Class size**
	Compulsory course	48 hours	180 hours Structural assignment 100 hours Independence study 80 hours	20-25 students

2	**Prerequisites for participation (if applicable)** **-**
3	**Learning outcomes** 1. Students are able to explain the principles of biotechnology 2. Students are able to explain enzymes, fermentation technology, genetic engineering, and methods in livestock product biotechnology as well as regulation and safety of food produced by biotechnology processes **3.** Students are able to apply knowledge of biotechnology to real problems regarding the processing of livestock products **4.** Students are able to develop biotechnology in processing livestock products
4	**Subject aims/Content** This course aims to provide students with an understanding of the principles of biotechnology, fermentation and enzyme technology, genetic engineering in livestock products and how to regulate and secure food products from biotechnology processes.
5	**Teaching methods** 1. Speech 2. Project Based Learning 3. Case based learning 4. Group Discussion
6	**Assessment methods** 1. Individual work **2.** Group work
7	**This module/course is used in the following study programme/s as well**
8	**Responsibility for module/course** Dr. Khotibul Umam Al-Awwaly,S.Pt., M.Si
9	**Other information** 1. Primrose, S.B. (1987). Modern Biotechnology. London: Blackwell Scientific Publications. 2. Thieman, William.J., and Palladino, Michael, A. (2013). Introduction toBiotechnology. 3rd edition. Boston: Pearson. 3. Baret, J.M., Peter Abramoff, Kumaran, A.K., and Millington, W.F. (1986).Biology. Prentice Hall: New Jersey

4. Higgins, I.J. (1985). Biotechnology Principles and Applications. London:Blackwell Scientific Publications.
5. Raven, P.H. (1986). Biology. New York: Times Mirror/Mosby College Publishing.

<table>
<tr><td colspan="7">DESIGN AND PROCESSES ANIMAL PRODUCTS</td></tr>
<tr><td colspan="2">Module/Course Code
PET 80002</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Compulsory Courses</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours
Structural assignment 100 hours
Independence study 80 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Students are able to understand the design components of livestock food processes and process flow diagrams.
2. Students are able to explain the optimization of thermal, chilling, freezing and thawing processes.
3. Students are able to develop food processing and control processes including the extraction process.
4. Students are able to apply aseptic process design, and process safety.</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course discusses the components of animal product food process design, flow diagrams of livestock product processing processes, optimization of thermal processes such as pasteurization and sterilization, optimization of chilling, freezing and thawing processes, food processing and control, extraction process design, aseptic process design, and security during processing.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Prof. Dr. Lilik Eka Radiati, MS., IPU., ASEAN Eng</td></tr>
<tr><td>9.</td><td colspan="6">Other information (References)
1. Jasim Ahmed (Editor), Mohammad Shafiur Rahman (Editor). Handbook of Food Process Design, Volume Set 2
2. Food Engineering Handbook: Food Process Engineering.</td></tr>
</table>

<table>
<tr><td colspan="7">REGULATION OF ANIMAL PRODUCT INDUSTRY</td></tr>
<tr><td colspan="2">Module/Course Code
PET 80003</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semesters</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Compulsory courses</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours
Structural assignment 100 hours
Independence study 80 hours</td><td>Class size
10-15 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Understand information related to issues in Food Regulation Affairs.
2. Apply the principles of primary food regulation for public health.
3. Apply principles of scientific inquiry including evidence-based practice, auditing, evaluation to research and solve specific food regulatory issues that require detailed research investigations.</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course discusses the policies and regulations issued by the government regarding processed livestock products including milk, meat, eggs, honey and leather products. This includes distribution permits, import policies for livestock products from abroad, veterinary control number certification, PIRT/MD/ML licensing, free market policies, halal requirements, packaging requirements and labels.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
1. Prof. Dr. Ir. Lilik Eka Radiati, MS., IPU
2. Prof. Dr. Ir. Djalal Rosyidi, MS., IPU., ASEAN Eng
3. Dr. Ir. Purwadi, MS
4. Dr. Ir. Mustakim, MP., IPM
5. Dr. Ir. Imam Thohari, MP., IPM., ASEAN eng
6. Dr. Ir. Manik Eirry Sawitri, MS
7. Dr. Ir. Aris Sri Widati, MS
8. Dr. Ir. Eny Sri Widyati, MP
9. Dr. Abdul Manab, S.Pt., MP</td></tr>
</table>

	10. Dr. Khotibul Umam Al-Awwaly, S.Pt., M.Si 11. Dr. Ir. Agus Susilo, S.Pt., MP., IPM., ASEAN Eng 12. Dr. Herly Evanuarini, S.Pt., MP 13. Dr. Dedes Amertaningtyas, S.Pt., MP
9.	Other information (References) 1. Jasim Ahmed (Editor), Mohammad Shafiur Rahman (Editor). Handbook of Food Process Design, Volume Set 2 2. Food Engineering Handbook: Food Process Engineering

Department of Animal Product Technology
Elective Courses

<table>
<tr><td colspan="7">TECHNOLOGY OF MEAT, LEATHER AND BY-PRODUCT INDUSTRY</td></tr>
<tr><td colspan="2">module/ course code
PET 80004</td><td>Student work- load
228 hours</td><td>Credits
3 SCU</td><td>Semester
2nd Sem.</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1</td><td colspan="2">Types of courses
Elective course</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours
Structural assignment 100 hours
Independence study 80 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2</td><td colspan="6">Prerequisites for participation (if applicable)</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes
1. Students are able to explain industrial developments and meat product, leather and by-products
2. Students are able to explain the standardization of meat-based food products, leather and by-products and non-food products
3. Students are able to solve the problem of proper handling of meat, leather and by-products including handling before processing/processing and storage
4. Students are able to develop products from meat, leather and by-products as well as processing technology, such as restructured meat, meat fermentation, furry and leather tanning.</td></tr>
<tr><td>4</td><td colspan="6">Subject aims/Content
This course aims to improve students' understanding of Meat, Leather and By-products: This course discusses the industrial development and technology of meat, leather and by-products which are important and strategic commodities from the nutritional aspect, from the preparation of industrial raw materials to proper environmental management. caused by industry. Selection and assessment of raw materials, HACCP on processing, Handling and maintenance of core tools and equipment in the industry, as well as simple testing methods for its products.</td></tr>
<tr><td>5</td><td colspan="6">Teaching methods
1. Speech
2. Project Based Learning
3. Case based learning
4. Group Discussion</td></tr>
<tr><td>6</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7</td><td colspan="6">This module/course is used in the following study programme/s as well</td></tr>
</table>

8	**Responsibility for module/course** Prof. Dr. Ir. Djalal Rosyidi, MS., IPU., ASEAN Eng.
9	**Other information** 1. Editor: Y. H. Hui , J. L. Aalhus , L. Cocolin , I. Guerrero-Legarreta , L. M. Nollet, R. W. Purchas , M. W. Schilling , P. Stanfield , Y. L. Xiong. Handbook of Meat and Meat Processing 2. Soeparno. Ilmu dan Teknologi Daging 3. Hari Purnomo. Ilmu dan Teknologi Pengolahan Daging 4. Fidel Toldra. Handbook of Meat Processing 5. Suharjono Triatmojo dan M. Zainal Abidin: Penyamakan Kulit Ramah Lingkungan, UGM Press 6. Stephanie Clark (Editor), Stephanie Jung (Co-Editor), Buddhi Lamsal (Co-Editor). Food Processing: Principles and Applications, 2nd Edition 7. Gelatin Manufactures Institute Of America (GMIA), 2012. Gelatin Handbook. Written and produced by the members of the GMIA. 8. Immeson, A. 1999.Thickening and Gelling Agents for Food. Aspen Publisher Inc. New York. 9. Ockerman, H.W., and C.L. Hansen. 2000. Animal By Products Processing and Utilization. CRC Press. USA. 10. Schrieber, R., and H. Gareis. 2007. Gelatine Handbook.Theory and Industrial Practice. Wiley-VCH Verlag GmbH & Co. KGaA. Weinham. Germany. 11. de Wolf, F.A. 2003. Collagen and Gelatin. Progress in Biotechnology, Elsevier Science B.V, Amsterdam, Netherlands, 133-218 12. Jurnal BBKKP (Balai Besar Kulit Karet dan Plastik) Yogyakarta 13. Meat Science - Journal Elsevier 14. The Journal of the American Leather Chemists Association : JALCA

<table>
<tr><td colspan="7">TECHNOLOGY OF DAIRY AND BY-PRODUCTS INDUSTRY</td></tr>
<tr><td colspan="2">Module/Course Code
PET80005</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Elective Course</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours
Structural assignment 100 hours
Independence study 80 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Students are able to understand the direction of national milk policy
2. Students are able to explain the proper handling of milk before processing
3. Students are able to explain about products from milk, by-products and processing technology
4. Students are able to understand the aseptic processing and packaging of dairy products and their by-products
5. Students are able to explain the standardization of milk-based food products and their by-products.</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
This course discusses related to national dairy and international trade, the process of processing milk which is an important and strategic commodity from the aspect and fulfillment of nutrition for the community in the industry, starting from the preparation of industrial raw materials to the proper handling of by-products and increasing added value.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Dr. Ir. Agus Susilo, S. Pt, MP., IPM., ASEAN Eng.</td></tr>
<tr><td>9.</td><td colspan="6">Other information (References)</td></tr>
</table>

	1. Murlidhar Meghwal, PhD (Editor), Megh R. Goyal, PhD, PE (Editor), Rupesh S. Chavan, PhD (Editor). Handbook: Dairy Engineering Advanced Technologies and Their Application.

<table>
<tr><td colspan="7">TECHNOLOGY OF EGG AND HONEY INDUSTRY</td></tr>
<tr><td colspan="2">Module/Course Code
PET 80006</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Elective Courses</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours</td><td>Class size
10-15 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes
1. Students are able to explain the functional properties of eggs, the development of added value of egg products, processes and equipment
2. Students are able to develop technology for the fresh egg industry and egg processing industry, quality control and assurance
3. Students are able to explain the physicochemical, microbiological and biochemical properties of honey and analyze the quality testing of honey, propolis, bee poolen, and royal jelly
4. Students are able to explain the technology and industry of honey, propolis, bee poolen, and royal jelly</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content
The Egg and Honey Industry Technology course discusses the egg and honey industry which is an important and strategic commodity from the aspect and fulfillment
nutrition for people in industry from the preparation of raw materials to the proper handling of the environment caused by the industry.</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
1. Dr. Ir. Imam Thohari, MS, IPM Asean Eng
2. Dr. Herly Evanuarini, SPt., M.P.</td></tr>
<tr><td>9.</td><td colspan="6">Other information (References)
1. Stadelman, W.J., Newkirk, D and L.Newby. 1995. Egg Science and technology. CRC Press
2. Nys, Y., Bain, M., and F.V. Immerseel. 2011. Improving the Safety and Quality of Eggs and Eggs Products.
3. Hester, P. 2017. Egg inovation and strategies for Improements. Academic Press.</td></tr>
</table>

Department of Livestock Agribusiness
Compulsory Courses

<table>
<tr><td colspan="7">AGRIBUSINESS SUPPLY CHAIN MANAGEMENT</td></tr>
<tr><td colspan="2">module/ course code PES 80001</td><td>Student work-load
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st Sem.</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1</td><td colspan="2">Types of courses
Compulsory course</td><td>Contact hours
48 hours</td><td>Independent study
180 hours
Structural assignment 100 hours
Independence study 80 hours</td><td colspan="2">Class size
20-25 students</td></tr>
<tr><td>2</td><td colspan="6">Prerequisites for participation (if applicable)
-</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes
1. Students are able to formulate the concept of livestock agribusiness supply chain management
2. Students are able to design supply chain concepts that can improve the competitiveness of livestock agribusiness
3. Students are able to design a supply chain model that can be integrated with information technology</td></tr>
<tr><td>4</td><td colspan="6">Subject aims/Content
This course aims to improve student skills in aspects of Competitive advantage, understanding the concept of Integrated Supply Chain and Competitive Advantage, Supply Chain Management and Strategic Lead Time Management, Information Technology in Supply Chain Management and integrated corporate systems, the core concept of e-SupplyChain, B-to-B Landscape in e-Supply Chain and Chain, Extraprise Value Network, Strategy of Integrating Two Systems and Collaboration of Information Technology between Companies, Concept of Digital Economy in Supply Chain and Concept of Value Matrix in Virtual Value Chain, shifting from Linear Supply Chain to Networked Supply Chain and Case Study : Supply Chain Management in Industrial Era 4.0 vs New Normal Era</td></tr>
<tr><td>5</td><td colspan="6">Teaching methods
1. Speech
2. Project Based Learning
3. Case based learning
4. Group Discussion</td></tr>
<tr><td>6</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7</td><td colspan="6">This module/course is used in the following study programme/s as well</td></tr>
<tr><td>8</td><td colspan="6">Responsibility for module/course
Ir. Hari Dwi Utami , MS., M.AppL.Sc., Ph.D., IPM.,ASEAN Eng.</td></tr>
</table>

9	**Other information** Collins,R.,Dunne,T.A, Murray,A.P. 2004. Forming and Managing supply chain in agribusiness : learn from others. Department of Agriculture, fisheries and forestry development. Leraning CD. Australian. Mentzer,J.T. 2004. Fundamentals of Supply Chain Management : twelve drivers of competitive advantage. Sage publication. Thousand oaks. CA Roekel,JV. Williems S & Boselie, DM. 2002. Agri-Supply Chain Management - to stimulate cross border trade in developing countries and emerging economics. Washington DC, World bank.

<table>
<tr><td colspan="7">AGRIBUSINESS POLITICS AND POLICY</td></tr>
<tr><td colspan="2">module/ course code PES 80002</td><td>Student work-load
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st Sem.</td><td>Frequency
Each Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1</td><td colspan="2">Types of courses
Compulsory course</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours
Structural assignment 100 hours
Independence study 80 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2</td><td colspan="6">Prerequisites for participation (if applicable)
-</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes
1. Students understand the concept of Politics and Policies of livestock Agribusiness
2. Students are able to identify problems and political prospects and livestock agribusiness policies.
3. Students understand the regulation of livestock agribusiness</td></tr>
<tr><td>4</td><td colspan="6">Subject aims/Content
This course aims to improve student skills through aspects of understanding agribusiness, agribusiness structures, agribusiness development models, agribusiness problems and prospects, and agribusiness policies.</td></tr>
<tr><td>5</td><td colspan="6">Teaching methods
1. Speech
2. Project Based Learning
3. Case based learning
4. Group Discussion</td></tr>
<tr><td>6</td><td colspan="6">Assessment methods
1. Individual work
2. Group work</td></tr>
<tr><td>7</td><td colspan="6">This module/course is used in the following study programme/s as well</td></tr>
<tr><td>8</td><td colspan="6">Responsibility for module/course
Dr. Ir. Suprih Bambang Siswijono,. MS.</td></tr>
<tr><td>9</td><td colspan="6">Other information
Agricultural Policies in Developing Countries. Jounal Agicultural Economics. May 1993.</td></tr>
</table>

	Bechtold, K.W. 1988. Politik dan Kebijaksanaan Pembangunan Pertanian. Terjemahan. Yayasan Obor Indonesia. Jakarta. Mosher, A.T. 1991. Menggerakkan dan Membangun Pertanian: Syarat-syarat Pokok Pembanagunan dan Modernisasi., Cetakan Ke 13. C.V. Yasaguna. Jakarta. Perundangan dan Peraturan Peternakan tentang Kesehatan Hewan dan Peternakan serta Kesehatan Masyarakat Veteriner

STRATEGIC MANAGEMENT OF LIVESTOCK AGRIBUSINESS					
module/ course code PES 80003	**Student work-load** 228 hours	**Credits** 3 SCU	Semester 1st Sem.	**Frequency** Each Semester	**Duration** 1 Semester

1	**Types of courses**	**Contact hours**	**Independent study**	**Class size**
	Compulsory course	48 hours	180 hours Structural assignment 100 hours Independence study 80 hours	20-25 students

2	**Prerequisites for participation (if applicable)** -
3	**Learning outcomes** 1. able to critically evaluate and apply strategic management in livestock agribusiness. 2. able to analyze external and internal factors of livestock agribusiness companies structurally and independently (choosing and applying strategic management methods in strategy making, analysis and implementation). 3. able to solve problems and make analytical strategic decisions in livestock agribusiness 4. Able to decide, compile and suggest adequate livestock agribusiness strategies
4	**Subject aims/Content** The focus of strategic management has shifted from business policy towards competitive advantage and finally to corporate governance. The direction of strategic management has also been changed from focusing on long-term planning, five force model analysis, strategic advantages, core competencies, and blue ocean strategy, to combining flexible corporate strategies that are suitable for modern environments which is changing rapidly. The course material introduces students to the concept of strategic management. Through the strategy design process, students are introduced to the mission, vision and approach to setting strategic goals. Methods for evaluating external factors and competitiveness as well as internal strengths and weaknesses are included (EFE and IFE matrices, Competitiveness matrix and PEST analysis). Different business strategies (expansion, mergers and acquisitions, vertical integration, diversification). Strategy selection and analysis includes the application of SWOT, SPACE, BCG and QSPM matrix. The core objectives of this course are to understand strategic planning processes, concepts, and tools and be able to apply them to certain business situations, develop knowledge related to the current livestock agribusiness sector, which includes the driving forces of change, industry trends, and industry scope, develop and perfecting analytical, communication and team work skills.
5	**Teaching methods** 1. Speech 2. Project Based Learning 3. Case based learning 4. Group Discussion
6	**Assessment methods** 1. Individual work **2.** Group work

7	**This module/course is used in the following study programme/s as well**
8	**Responsibility for module/course** **1.** Dr. Ir. Bambang Ali Nugroho, MS., DAA.,IPM., ASEAN Eng
9	**Other information** 1. Wheelen, Thomas L. 2012. Strategic management and business policy : toward global sustainability 2. Thomas L. Wheelen, J. David Hunger. — 13th ed. Copyright © 2012, by Pearson Education, Inc., publishing as Prentice Hall. 3. David, Fred R. 2011. Strategic management: concepts and cases / Fred R. David.—13th ed. Copyright © 2011, by Pearson Education, Inc., publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey 07458. 4. Thomas H. Davenport, Marius Leibold and Sven Voelpel. 2006. Strategic Management in the Innovation Economy. Strategy Approaches and Tools for Dynamic Innovation Capabilities. © 2006 by Publicis KommunikationsAgentur GmbH, GWA, Erlangen. 5. White, Colin. 2004. Strategic management. First published 2004 by PALGRAVE MACMILLAN

Department of Livestock Agribusiness
Elective Courses

SOCIAL ENGINEERING					
module/ course code PES 80004	**Student work-load** 228 hours	**Credits** 3 SCU	Semester 2nd Sem.	**Frequency** Each Semester	**Duration** 1 Semester

1	**Types of courses** Elective course	**Contact hours** 48 hours	**Independent study** 180 hours Structural assignment 100 hours Independence study 80 hours	**Class size** 20-25 students

2	**Prerequisites for participation (if applicable)** -
3	**Learning outcomes** 1. Students understand the concepts of social change and social-capital. 2. Students are able to identify social-capital and its role in the development of livestock agribusiness. 3. Students understand the regulations and provisions related to institutional development in livestock agribusiness. 4. Students understand the principles of social analysis related to the interests of social engineering and supporting institutions for the development of livestock agribusiness. 5. Students are able to design and narrate institutional work mechanisms in accordance with the lines and segmentation in livestock agribusiness. 6. Students understand and are able to develop indicators for assessing social and institutional development in livestock agribusiness.
4	**Subject aims/Content** This course includes activities to provide students with an understanding in identifying and mapping existing social situations related to the nodes of activities in the livestock sector; then students can work on institutional intervention opportunities for livestock agribusiness development in accordance with agribusiness interests, the dynamics of social change and applicable regulations. Based on the intended objectives, the lectures are given materials: Understanding of social change and social-capital, Production-regime and organization of production, Social-analysis, Sustainable-Livelihoods approach and analysis, Regulations and policies for the development of livestock agribusiness , Land-tenure systems and livestock agribusiness, SDGs in agriculture-livestock, Climate change and smart-agriculture, Concepts of sovereignty and food security, Internet of things (IoT) in agriculture, Social inclusion and gender in agriculture, Agribusiness development with millennial youth , as well as research and development agenda of social institutions in agribusiness.
5	**Teaching methods** 1. Speech 2. Project Based Learning 3. Case based learning 4. Group Discussion
6	**Assessment methods** 1. Individual work

	2. Group work
7	**This module/course is used in the following study programme/s as well**
8	**Responsibility for module/course** Dr. Ir. Priyo Sugeng Winarto, MA.
9	**Other information** FAO, 2014, Social analysis for agriculture and rural investment projects, FAO-Rome. FAO, 2018, Social network analysis for territorial assessment and mapping of Food Security and Nutrition Systems (FSNS) : A methodological approach, FAO-Rome. FAO, 2001, Socio-Economic and Gender Analysis Programme, SEAGA, FAO-Rome. FAO, 2016, Strengthening coherence between agriculture and social protection to combat poverty and hunger in Africa : Framework for Analysis and Action, FAO-Rome. Appadurai, Arjun. 1996. Modernity at Large: Cultural Dimensions of Globalization. Minneapolis: University of Minnesota Press. Tirivayi, N., Marco Knowles, M. and Davis, B., 2013, The interaction between social protection and agriculture : A review of evidence, FAO-Rome. Bryant, C.R., 2012, The social transformation of agriculture: the case of Québec. Allen, D.W. and Lueck, D., 2003, The Nature of the Farm Contracts, Risk, and Organization in Agriculture, The MIT Press Cambridge, Massachusetts London, England. Rehber, E., 2007, Contract Farming : Theory and Practice, The ICFAI University Press, Hyderabad, India.

LIVESTOCK BUSINESS COMMUNICATION					
module/ course code **PES 80005**	**Student work-load** 152 hours	**Credits** 2 SCU	Semester 2nd Sem.	**Frequency** Each Semester	**Duration** 1 Semester

1	**Types of courses** Elective course	**Contact hours** 32 hours	**Independent study** 120 hours Structural assignment 53,33 hours Independence study 66,67 hours	**Class size** 20-25 students

2	**Prerequisites for participation (if applicable)** -
3	**Learning outcomes** 1. Students are able to correlate business communication with agricultural development 2. Students are able to detail the components in the communication system in the livestock business 3. Students are able to analyze the role and contribution of actors involved in the livestock business 4. Students are able to formulate messages in communication so that they are able to realize effective communication in the livestock business 5. Students are able to design effective methods, media and technology in livestock business communication 6. Students are able to design and evaluate communication systems in the livestock business **7.** Students are able to analyze and interpret communication in supply chain activities
4	**Subject aims/Content** Students are able to apply the concept of business communication in animal husbandry which includes a basic understanding of agricultural development, communication systems, actors in business, communication messages, message delivery methods, media and communication and communication technology in supporting supply chains
5	**Teaching methods** 1. Speech 2. Project Based Learning 3. Case based learning 4. Group Discussion
6	**Assessment methods** 1. Individual work **2.** Group work
7	**This module/course is used in the following study programme/s as well** 1.
8	**Responsibility for module/course** Dr. Siti Azizah,S.Pt.,M.Sos.,M.Commun.

9	**Other information** Bisen, V and Priya. (2009) Business Communication. New Age International (P) Limited, Publishers. New Delhi. Barnard, F., Akridge, J., Dooley, F., and Foltz, J. (2012) Agribusiness Management. Routledge New York. Kurtzo, Fawn; Hansen, Maggie Jo; Rucker, K. Jill; and Edgar, Leslie D. (2016) "Agricultural Communications: Perspectives from the Experts," Journal of Applied Communications: Vol. 100: Iss. 1. https://dx.doi.org/10.4148/1051- 0834.1019 Hagiu, A and Bărbulescu, M. (2014) Communication - A Key to Agribusiness Success. Lucrări Ştiinţifice, Seria I, Vol.XVI (2) pp.53-58

AGRIBUSINESS RISK MANAGEMENT					
module/ course code **PES 80006**	**Student work-load** 152 hours	**Credits** 2 SCU	Semester 2nd Sem.	**Frequency** Each Semester	**Duration** 1 Semester

1	**Types of courses** Elective course	**Contact hours** 32 hours	**Independent study** 120 hours Structural assignment 53,33 hours Independence study 66,67 hours	**Class size** 20-25 students

2	**Prerequisites for participation (if applicable)**
3	**Learning outcomes** 1.Explain the concept of risk and uncertainty and the theory of decision making 2. Identify the types of risks and sources of risk in agribusiness 3.Using analysis tools and interpreting risk in agribusiness 4.Analyzing strategies for dealing with risks.
4	**Subject aims/Content** This course aims to improve students' abilities in risk line analysis based on the concept of uncertainty, risk management, understanding individual behavior in dealing with risk, correlating between risk and income, individual behavior in dealing with risk (risk averse, risk taker, risk neutral), identifying and skilled in applying corporate risk management, understanding the types and sources of Agribusiness risks, skilled in decision making and calculating risky income with several methods and able to design risk management strategies.
5	**Teaching methods** 1. Speech 2. Project Based Learning 3. Case based learning 4. Group Discussion
6	**Assessment methods** 1. Individual work **2.** Group work
7	**This module/course is used in the following study programme/s as well**
8	**Responsibility for module/course** Prof. Dr. Ir. Budi Hartono, MS. IPU. ASEAN. Eng
9	**Other information** 1. Tunggal Widjaya A. 2016. Enterprise Risk Management. Harvarindo. Jakarta. 2. Darmawi Herman. 2016. Manajemen Risiko. Edisi 2. PT Bumi Aksara. Jakarta. 3. Hery, SE, Msi. 2016. Integrated Business Management. PT Grasindo. Jakarta.

4. Pratama Tony. 2011. Manajemen Risiko Bisnis. Sinar Ilmu. Jakarta.
5. Soekartawi dkk. 1993. Risiko dan Ketidakpastian Dalam Agribisnis. Teori dan Aplikasi. PT Raja Grafindo Persada. Jakarta.
6. Kountur . 2006. Mudah Memahami Manajemen Risiko peusahaan. PPM. Jakarta.
7. Ali, Masyhud. 2006. Manajemen Risiko. Strategi Perbankan dan Dunia Usaha Menghadapi Tantangan Globalisasi Bisnis. PT Raja Grafindo Persada Jakarta.
8. Darmawi, Herman. 2008. Manajemen Risiko. Bumi Aksara Jakarta

Department of Livestock Reproduction and Breeding
Compulsory Courses

ANIMAL REPRODUCTIVE EFFICIENCY					
Module/Course Code PER80001	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1st semester	**Frequency** Each semester	**Duration** 1 semester

1.	**Types of courses** Department of Animal Reproduction and Breeding Compulsory Courses	**Contact hours** 48 hours	**Independent study** 180 hours	**Class size** 20-25 students

2.	Prerequisites for participation -
3.	Learning outcomes 1. Able to understand the meaning of Reproductive Efficiency and the parameters to measure it 2. Able to understand the basic science of reproduction which includes reproductive physiology, endocrinology and the factors that influence it in ruminants and poultry 3. Able to understand how to prevent reproductive disorders and how to manage breeding efforts to achieve reproductive efficiency (CP4)
4.	Subject aims/content This course discusses about the strategy produces reproductive efficiency so that it contains knowledge from reproductive physiology and regulation to achieve reproductive efficiency through accelerating puberty. Normal estrus cycle, mating system that produces high success with increased productivity, produces healthy offspring until weaning, and no reproductive disorder occurs
5.	Teaching methods 1. Speech 2. Project Base Learning 3. Case Base Learning 4. Group Discussion
6.	Assessment methods 1. Discussion 2. Presentation
7.	This module/course is used in the following study programme/s as well N/A
8.	Responsibility for module/course Prof. Dr.Ir .Trinil Susilawati,MS, IPU, ASEAN Eng.
9.	Other information (References) ▪ Farm Animal Reproduction (Hafez and Hafez, 2000) ▪ Fisiologi Reproduksi (Yekti dkk, 2018) ▪ Biologi Reproduksi (Rahayu dkk 2020)

ANIMAL GENETIC EVALUATION AND BREEDING PROGRAM DESIGN					
Module/Course Code PER80002	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1st semester	**Frequency** Each semester	**Duration** 1 semester

1.	**Types of courses** Department of Animal Reproduction and Breeding Compulsory Courses	**Contact hours** 48 hours	**Independent study** 180 hours	**Class size** 20-25 students
2.	Prerequisites for participation -			
3.	Learning outcomes 1. Able to explain the concept of inheritance of superior traits, improvement of genetic quality and conservation of genetic potential of animal, quantitative genetic models, animal breeding and population genetics at the molecular level 2. Able to analyze and evaluate genetic potential, animal breeding value and population genetic progress due to selection 3. Able to develop self-learn insight in evaluating and solving problems in implementing animal breeding programs in Indonesia			
4.	Subject aims/content This course discusses about the concept of genetic diversity, the concept of inheritance and repetition of traits and their applications, animal genetic quality improvement programs, quantitative genetic models and estimation of variance components, genetic evaluation methods and models, genetic changes for several traits, increasing selection accuracy, utilization of heterosis and inbreeding pressure in breeding programmes, application of software for genetic analysis, molecular genetics in animal breeding, analysis of genetic diversity and population genetics at the molecular level			
5.	Teaching methods 1. Speech 2. Project Base Learning 3. Case Base Learning 4. Group Discussion			
6.	Assessment methods 1. Individual work 2. Goup work 3. Mid and Final Term Exam			
7.	This module/course is used in the following study programme/s as well N/A			
8.	Responsibility for module/course Prof.Dr.Ir. Veronica Margareta Ani Nurgiartiningsih , M.Sc.			
9.	Other information (References) 1. Allendorf, F. W dan G. H. Luikart. 2007. Conservation And The Genetics of Populations. 2. Blackwell Publishing. USA 3. Ciptadi, G. A. Budiarto, Aulani'am, Y Oktanella. 2019. Genetika dan Pemuliaan : Peternakan- Veteriner. UB Press. Malang. ISBN 978-602-432-950-1 4. Falconer, DS. Introduction to Quantitative Genetics. 1989. Longman Scientific & Technical. New York. 5. Hakim, L. 2011. Dasar Pemuliaan Ternak. Darkah Media Malang. ISBN: 978-602-96331-5-3 Hardjosubroto, W. 1994. Aplikasi Pemuliabiakan Ternak di Lapangan. PT Gramedia 6. Widiasarana Indonesia. Jakarta.			

	7. Khatib, H. 2015. Molecular And Quantitative Animal Genetics. Wiley-Blackwell. USA 8. Maylinda, S. 2010. Buku Pengantar Pemuliaan Ternak. UB Press. Malang 9. Mrode, R. A. 2015. Linear Models for the prediction of Animal Breeding Value. 2nd edition. 10. CABI Publishing 11. Nurgiartiningsih,V. M. A. 2017. Pengantar Parameter Genetik pada Ternak. UB Press, Malang. 12. ISBN:978-602-432-331-8 13. Van der Werf, J. H. J. 2019. Genetic Evaluation and Breeding Program Design. University of New England 14. Viljoen GJ, Nel LH, Crowther JR. 2005. Molecular Diagnostic PCR Handbook. Springer, Dordrecht, The Netherlands 15. Warwick, E. J., M. Astuti, dan W. Hardjosubroto. 1990. Pernuliaan Ternak. Gadjah Mada University Press. Yogyakarta

ANIMAL BREEDING MANAGEMENT						
Module/Course Code PER80003	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1st semester	**Frequency** Each semester	**Duration** 1 semester	
1.	**Types of courses** Department of Animal Reproduction and Breeding Compulsory Course	**Contact hours** 48 hours	**Independent study** 180 hours	**Class size** 20-25 students		
2.	Prerequisites for participation -					
3.	Learning outcomes 1. Able to explain the mating system and selection program to produce male and female breeds 2. Able to calculate the success of mating 3. Able to compile a data base and make data corrections for evaluating animal performance as a basis for animal selection 4. Able to calculate the need for breeds and animal supply 5. Able to design and evaluate crossbreeding programs					
4.	Subject aims/content This course discusses about the concept of reproduction and breeding in management to produce animal breeds (factors that affect animal performance, understanding of genetic potential), the mating system includes the application of Artificial Insemination Techniques (AI), embryo transfer, Assisted Reproductive Technology (ATR), assessment of mating success and its calculations using reproductive parameters (NRR, S/C, CR, PR, Calving Interval, calving rate, calf crop and weaning rate), recording and correcting data, selection program on male/female through performance test and progeny test, calculation of population structure and animal development patterns, calculation of the need for breeds and animal supply as well as methods and evaluation of crossbreeding programs to produce breeds					
5.	Teaching methods 1. Speech 2. Project Base Learning 3. Case Base Learning 4. Group Discussion					
6.	Assessment methods 1. Individual work 2. Goup work 3. Mid and Final Term Exam					
7.	This module/course is used in the following study programme/s as well N/A					
8.	Responsibility for module/course Prof.Dr.Ir. Veronica Margareta Ani Nurgiartiningsih , M.Sc.					
9.	Other information (References) 1. Ciptadi, G. A. Budiarto, Aulani'am, Y Oktanella. 2019. Genetika dan Pemuliaan : Peternakan-Veteriner. UB Press. Malang. ISBN 978-602-432-950-1 2. Journal of Animal Breeding and Genetics. 2020. 3. Hafez and Hafez. 2000. Farm Animal Reproduction 4. Hardjosubroto, W. 1994. Aplikasi Pemuliabiakan Ternak di Lapangan. PT Gramedia Widiasarana Indonesia. Jakarta. 5. Nurgiartiningsih, V. M. A. 2017. Pengantar Parameter Genetik pada Ternak. UB Press.					

	6. Rahayu, dkk. 2020. Biologi Reproduksi. 7. Schultz, B. et al. 2020. Genetic improvement of livestock, from conventional breeding to biotechnological approaches in Animal Agriculture. Academic Press 8. Thiagarajan, R. 2014. Text book of Animal Breeding. 9. Van der Werf, J. H. J. 2019. Genetic Evaluation and Breeding Program Design. University of New England 10. Yekti, dkk. 2018. Fisiologi Reproduksi. UB Press.

Department of Livestock Reproduction and Breeding
Elective Courses

ANIMAL REPRODUCTIVE BIOTECHNOLOGY					
Module/Course Code PER80004	**Student workload** 228 hours	**Credits** 3 SCU	**Semester** 1st semester	**Frequency** Each semester	**Duration** 1 semester

1.	**Types of courses** Department of Animal Reproduction and Breeding Elective Course	**Contact hours** 48 hours	**Independent study** 180 hours	**Class size** 20-25 students
2.	Prerequisites for participation -			
3.	Learning outcomes 1. Able to understand the animal reproduction technology that has been developed at this time and in the future 2. Able to understand the role of reproductive technology in improving animal genetic quality and productivity 3. Able to know and understand the basic principles and applications of sperm and embryo sexing techniques, embryo transfer, in vitro fertilization, embryo manipulation (cloning), chimeras, transgenic and embryonic steam cells 4. Able to apply the principles of gamete and embryo manipulation techniques correctly 5. Able to prepare research in animal reproduction			
4.	Subject aims/content This course discusses about Sexing technology and then embryo transfer which includes estrus synchronization, multiple ovulation/super ovulation, in vivo fertilization, in vitro fertilization, embryo manipulation, cloning, nuclear transfer and application of reproductive technology as well as analysis of the success and failure of each technology. In addition, students are required to participate in practice to achieve competence regarding gamete and embryo manipulation techniques and research in the field of animal reproduction,			
5.	Teaching methods 1. Speech 2. Project Base Learning 3. Case Base Learning 4. Group Discussion			
6.	Assessment methods 1. Individual work 2. Group work 3. Mid and Final term Exam			
7.	This module/course is used in the following study programme/s as well N/A			
8.	Responsibility for module/course Prof. Dr.Ir. Sri Wahyuningsih ,Msi			
9.	Other information (References) 11. Buku Ajar Teknologi Reproduksi (Sri Wahjuningsih, dkk, 2019)			

	12. Farm Animal Reproduction (Hafez and Hafez, 2000)

<table>
<tr><td colspan="7">RUMINANT AND NON-RUMINANT BREEDING</td></tr>
<tr><td colspan="2">Module/Course Code
PER80005</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each semester</td><td>Duration
1 semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Department of Animal Reproduction and Breeding Elective Course</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes

1. Able to explain the recording system and breeding patterns, procedures and preparation of breeding patterns for ruminants (beef cattle, dairy cattle, goats and sheep) and non-ruminant (poultry) to increase animal productivity
2. Able to analyze and evaluate animal breeding policies and the formation of new breeds in Indonesia and in several developed countries
3. Able to develop self-learning method in evaluating and solving problems in implementing animal breeding programs in Indonesia</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content

This course discusses about recording system, methods, procedures and preparation of breeding patterns for ruminants (beef cattle, dairy cattle, goats and sheep) and non-ruminants (poultry) to increase animal productivity as well as animal breeding policies and the formation of new breeds in Indonesia and several developed countries</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work
2. Group work
3. Mid and Final term Exam</td></tr>
<tr><td>7.</td><td colspan="6">This module/course is used in the following study programme/s as well
N/A</td></tr>
<tr><td>8.</td><td colspan="6">Responsibility for module/course
Prof. Dr.Ir.Sucik Maylinda,MS</td></tr>
<tr><td>9.</td><td colspan="6">Other information (References)

1. Allendorf, F. W dan G. H. Luikart. 2007. Conservation And The Genetics of Populations.
2. Blackwell Publishing. USA
3. Ciptadi, G. A. Budiarto, Aulani'am, Y Oktanella. 2019. Genetika dan Pemuliaan : Peternakan- Veteriner. UB Press. Malang. ISBN 978-602-432-950-1
4. Hardjosubroto, W. 1994. Aplikasi Pemuliabiakan Ternak di Lapangan. PT Gramedia Widiasarana Indonesia. Jakarta.
5. Maylinda, S. 2010. Buku Pengantar Pemuliaan Ternak. UB Press. Malang</td></tr>
</table>

	6. Nurgiartiningsih,V. M. A. 2017. Pengantar Parameter Genetik pada Ternak. UB Press, Malang. ISBN:978-602-432-331-8 7. Schultz, B. et al. 2020. Genetic improvement of livestock, from conventional breeding to biotechnological approaches in Animal Agriculture. Academic Press 8. Thiagarajan, R. 2014. Text book of Animal Breeding. 9. Van der Werf, J. H. J. 2019. Genetic Evaluation and Breeding Program Design. University of New England

<table>
<tr><td colspan="7">ANIMAL REPRODUCTIVE MOLECULAR GENETICS</td></tr>
<tr><td colspan="2">Module/Course Code
PER80006</td><td>Student workload
228 hours</td><td>Credits
3 SCU</td><td>Semester
1st semester</td><td>Frequency
Each semester</td><td>Duration
1 semester</td></tr>
<tr><td>1.</td><td colspan="2">Types of courses
Department of Animal Reproduction and Breeding Elective Courses</td><td>Contact hours
48 hours</td><td colspan="2">Independent study
180 hours</td><td>Class size
20-25 students</td></tr>
<tr><td>2.</td><td colspan="6">Prerequisites for participation
-</td></tr>
<tr><td>3.</td><td colspan="6">Learning outcomes

1. Able to understand the importance of reproduction in developing and increasing the efficiency of livestock business as well as genetic factors that influence the mechanism of reproduction
2. Able to understand the mechanism of expression of reproductive traits in male and female animal in both genetic and non-genetic control
3. Able to understand and carry out laboratory activities to analyze polymorphism, genomic, proteomic on reproductive characteristics of male livestock (spermatogenesis and semen production) and female animal (folliculogenesis, embryonic development, pregnancy, reproductive disorders), nutrigenomic analysis in reproduction and its role in animal development
4. Able to identify other factors related to genetics on reproductive performance in male and female animal (physiological factors, the influence of environmental stress, nutrition)
5. Able to identify genetic aspects in the field of reproduction and develop them in research ideas in order to complete the final project and answer field problems in a multidisciplinary manner
6. Able to increase the level of scientific and laboratory skills for the analysis of reproductive genetics and other traits in the field of animal science in accordance with the development of science and technology</td></tr>
<tr><td>4.</td><td colspan="6">Subject aims/content

This course discusses about three main aspects in reproductive molecular genetics, namely: (1) the mechanism of expression of reproductive traits (starting from the performance of DNA, RNA, RNA transcription for reproductive traits, non-genetic factors that affect reproductive traits), (2) the main aspects in regulating the expression of reproductive traits in male cattle (spermatogenesis processes, semen production; folliculogenesis, genetics in pregnancy and embryonic growth, reproductive disorders, nutrigenomics and reproduction); and (3) molecular analysis for reproductive traits using ELECTROPHORESIS PCR, RFLP, SNP, GENOMIC TECHNIQUES and RNA SEQUENCING,</td></tr>
<tr><td>5.</td><td colspan="6">Teaching methods
1. Speech
2. Project Base Learning
3. Case Base Learning
4. Group Discussion</td></tr>
<tr><td>6.</td><td colspan="6">Assessment methods
1. Individual work</td></tr>
</table>

	2. Group work 3. Mid and Final term Exam
7.	This module/course is used in the following study programme/s as well N/A
8.	Responsibility for module/course Prof. Dr. Sc.Agr. Ir. Suyadi, MS, IPU, ASEAN Eng
9.	Other information (References) 1. Jiang, Zhiau and Troi L. Ott. 2010. Reproductive Genomics in Domectic Animals. Willey-Blacwell. Ames, IOWA, USA. 2. Fatchiyah, Laras E., S Widiyarti, S Rahayu. 2011. Biologi Molekular: Prinsip Dasar Analisis. Penerbit Erlangga. Jakarta 3. Yuwono, T. 2005. Biologi Molekular. Penerbit Erlangga. Jakarta