COURSE HANDBOOK

BIOLOGY BACHELOR PROGRAMME

Biology Department

Faculty of Mathematics and Natural Sciences

Andalas University

2022

TABLE OF CONTENTS

1ST SEMESTER

Bioethics

CourseID	*BIO61104*
Course name	*Bioethics*
Semester(s) in which the course is taught	*1st semester*
Person responsible for the course	*Dr. Wilson Novarino* *Dr. Syaifullah* *Prof. Dr. Dewi Imelda Roesma* *Dr. Anthony Agustien* *Dr. Tesri Maedaliza*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lectures, lessons*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Be able to explain the conception and definition of Bioethics, Morals, Philosophy and Religion 2. Be able to explain the history of the development of bioethics and examples of its application in life 3. Be able to explain value conflicts and their solutions related to animal and experimental objects plants and microorganisms 4. Be able to explain value conflicts and their solutions related to GMOs and biological weapons 5. Be able to explain value conflicts and their solutions in the medical and medical fields 6. Be able to explain conflict of values and their solutions in the field of development 7. Be able to explain conflict of values and their solutions in the field of environment 8. Able to explain research methodology related to bioethics 9. Be able to explain the basic principles of bioethics in research and writing of scientific articles 10. Be able to explain the basic principles of bioethics in building cooperation with industry 11. Be able to explain the national and global bioethical framework 12. Be able to explain the bioethical framework in an actual context

Content	*The Bioethics course will invite students to understand and be aware of ethics in academic and scientific issues, as well as possible ethical changes that will occur in the future with discoveries in the latest fields of science. Students are expected to be able to understand universal ethics in the field of science and make it the basis for carrying out daily activities both related to themselves and in treating other organisms as well as the activities and research results obtained. Students are also expected to be able to understand the framework of bioethics in national and global settings. In the end, students are also expected to be able to understand and apply ethics in establishing cooperation both nationally and globally. In detail, the studies carried out in this course are related to animal and plant objects, microbiology and biomedicine, GMOs, development activities and the environment.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	
reading list	*Main* *1. Bertens, K. Ethics* *Supporters* *1. National Guidelines for Health Research Ethics* *2. Law No. 5 of 1990 concerning Conservation of Natural Resources and their ecosystems* *3. Declaration of Ethical Principles in relation to Climate Change, UNESCO*

Structure and Development of Animals

CourseID	*BIO61103*
Course name	*Structure and Development of Animals*
Semester(s) in which the course is taught	*1st semester*
Person responsible for the course	*Dr. Djong Hon Tjong*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	Students have competence in animal structure courses, that is able to explain and describe: 1. Vertebrate bodies in general and organ systems, skin and peculiarity 2 . The structure and components of the frame builder and their development 3 . Muscle structure and development 4 . The structure and development of the organ systems found in vertebrates 5 . Microstructure and function of bones and muscles 6 . Microstructure and function of tissues making up organ systems b. Students are able to explain the basics of animal structural science and apply it in everyday life c. Students are able to discuss and cooperate in understanding about Animal structure especially about tissues and organ systems. d. Students can understand the ins and outs of the structure of animals through The discussions carried out included macro and micro structures of animals anatomy. e. Students are able to recognize, understand and explain about structure macro and micro structure of animals through practicum.
Content	*The Animal Structure course (BIO 4202) is a compulsory subject in the Biology Study Program, Faculty of Mathematics and Natural Sciences, Andalas University. This course consists of 2 credits of lectures in class and 1 credit of carrying out practicum in the laboratory and is given in semester III (Odd).*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Kent, GC, and Miller. 1997. Comparative Anatomy of The Vertebrate. WCB Publishers. Bogota.* *2. Hildebrand. 1991. Analysis of the structure of the vertebrates. WB Souders.* *3. Eroschenko, VP 2008. Atlas of Histology With Functional Correlations. Wolter Klower Lippincott William and Wilkin.* *4. Tamboying, S., and Winodirekso. 1993. Textbook of Histology Edition V. EGC Medical Book Publisher.*

Plant Structure and Development

CourseID	*BIO61102*
Course name	*Plant Structure and Development*
Semester(s) in which the course is taught	*1st semester*
Person responsible for the course	*Prof. Dr. Mansyurdin, MS* *Prof. Dr. Syamsuardi, MSc.* *Drs. Zuhri Syam, MP* *Dr. Tesri Maideliza, M.Sc.* *Dr. Solfiyeni, MP* *Dr. Nurainas, MSc.* *Ahmad Taufiq, MSc.*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology. CPMk-1: Able to explain terminology and concepts in structure and plant development. CPMk-2: Be able to explain morphological characteristics and root and stem development CPMk-3: Be able to explain morphological characteristics and leaf development CPMk-4: Be able to explain morphological characteristics and flower development and its uses in plant biosystematics. CPMk-5: Be able to explain the characteristics of morphology and fruit development CPMk-6: Be able to explain the morphological characteristics and development of seeds CPMk-7: Able to classify primary, secondary and intercalary meristems and their roles in plant growth. CPMk-8: Be able to explain the characteristics of basic and supporting tissues and their role in plant adaptation. CPMk-9: Be able to explain the anatomy and development of roots and their relation to adaptation. CPMk-10: Able to differentiate between primary and secondary growth. CPMk-11: Be able to explain the components of vascular tissue and their role in transportation. CPMk-12: Be able to explain the anatomical structure and leaf epidermis derivatives, as well as their functions CPMk-13: Be able to explain the anatomical structure of the generative organs and their role in the reproductive system.

Content	*MK Plant Structure and Development discusses concepts and terminology in plant structure and development, morphological characteristics of vegetative and generative organs, anatomical structure and development of vegetative and generative organs.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Dutta, AC 1968. Botany for Degree Students, 2nd edition, Oxford University Press. Bombay-Calcuta-Madras.* *2. Gembong, T. 2001. Plant Morphology, Gajah Mada University Press. Yogyakarta* *3. Syamsuardi and Nurainas. 2015. Textbook of Plant Morphology. Sukabina. Padang.* *4. Esau, K. 1977. Anatomy of Seed Plants, 2nd edition, John Willey & Sons Inc. New York* *5. Fahn, A. 1990. Plant Anatomy, 4th edition, Bergamon Press New York.* *Supporters:* *1. Harris, JG and Melinda Woolf Harris. 1994. Plant Identification Terminology: An Illustrated Glossary. Spring Lake publishing. Utah* *2. Radford, AE 1986. Fundamentals of Plant Systematics, Harper & Row Publisher, Inc. New York* *3. BM Johri. 1984. Embryology of Angiosperms. Springer Verlag. Berlin.*

Herbarium Management

CourseID	*BIO60267*
Course name	*Herbarium Management*
Semester(s) in which the course is taught	*1st semester*
Person responsible for the course	*Dr. Nurainas M.Sc* *Prof. Dr. Syamsuardi M.Sc* *Ahmad Taufiq M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	***1. Able to master the concepts, principles and application of biological knowledge in the fields of food, health, environment (biological), and biological resources in the management and utilization of biological and environmental resources.*** *CPMk-1: Standard collection method for plants* *CPMk-2: Management of plant collections (dry and wet)* *CPMk-3: Management of herbarium specimens* *CPMk-4: Herbarium specimen-based database (specimen base database)* *CPMk-5: Management of data and information on herbarium specimens* *CPMk-6: Ethics of examining herbarium specimens* *CPMk-7: Utilization of Herbarium specimens* ***2. Able to use related instruments and methodologies in observing and measuring biological objects*** *PI-2: Able to apply biological knowledge to benefit oneself and society in everyday life.* *CPP-1: Able to plan a project investigation for a certain topic. CPP-2: Able to carry out project investigations for certain topics. CPP-3: Able to interpret data and information on projects for specific topics* *CPP-4: Able to find and solve problems on projects for certain topics* *CPP-5: generates a work (report) of a project for a specific topic*
Content	*MK Majemen Herbarium discusses standard collection methods for plants, management of preserved plant samples, management of herbarium samples, specimen-based databases*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	

reading list	1. *Bridson, DM and Forman, L., 1998. Herbarium handbook. Royal Botanic Gardens, Kew.* 2. *Singh, G., 2016. Plant Systematics, 3/ed.: An Integrated Approach. CRC Press.* 3. *De Vogel, EF, 1987. Manual of herbarium taxonomy. UNESCO.* 4. *Woodland, DW 1997. Contemporary Plant Systematics. 2nd Edition. Berrien Spring, Michigan, United State of America.* 5. *Harris, JG and MW Harris. 1994. Plant Identification Terminology. An Illustrated Glossary. Spring lake Publishing. United States of America.* 6. *Alexey Shipunov. 2019. How to make a herbarium* 7. *Syamsuardi and Nurainas. 2015. Textbook of Plant Morphology. Sukabina. Padang* 8. *Articles in related scientific journals*

Animal Taxonomy

CourseID	*BIO 62102*
Course name	*Animal Taxonomy*
Semester(s) in which the course is taught	*1st semester*
Person responsible for the course	*Prof. Dr. Dahelmi, MS* *Dr. Mairawita, M.Sc.* *Dr. Henny Herwina, M.Sc.* *Dr. Djong Hon Tjong, M.Sc.* *Dr. Dewi Imelda Roesma, MS* *Dr. Wilson Novarino* *M. Nazri Janra, S.Si, M.Si, MA*
language	*Indonesian Language or English*
Relationship to curriculum	*Compolsorry*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Be able to explain the rules of taxonomy and nomenclature.* *2. Be able to explain the Classification and Introduction of the Phylum Protozoa, Mesozoa and Porifera* *3. Be able to explain the Classification and Introduction of Phylum Coelentrata and Ctenophora, Phylum Coelentrata* *4. Be able to explain the Classification and Introduction of the Phylum Platyhelminthes and Nemathelminthes* *5. Be able to explain the Classification and Introduction of the Phylum Annelida and Mollusca* *6. Be able to explain the Classification and Introduction of the Phylum Bryozoa, Branchiopoda, and Tentaculata* *7. Be able to explain the Classification and Introduction of Phylum Arthropoda (Class Onychopora and crustaceans)* *8. Be able to explain the Classification and Introduction of Phylum Arthropoda (Class Insecta)* *9. Be able to explain the Classification and Introduction of Phylum Arthropoda (Class Myriapoda and arachnids)* *10. Be able to explain the Classification and Introduction of the Phylum Echinodermata* *11. Be able to explain the Classification and Introduction of the Vertebrata Phylum (Pisces, Amphibians and reptiles)* *12. Be able to explain the Classification and Introduction of Vertebrates (Aves and Mammals)*
Content	*Animal taxonomy courses aim to increase student understanding about taxonomy, especially its relation to morphological characters. More specifically the study of this course covers the basis and procedures for*

	naming animals, procedures grouping and classification and identification techniques.
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Hickman,Jr. C. P, L. S Roberts and Larson, 1997. Integrated Principles of Zoology. WCB MCs. Graw Hill. Boston. 2. Kerkut, GA 1961. The Invertebrates. A. manual for the use of students. Cambridge, Univ. press. 3. Marshall, AC and WD William. 1974. Text book of Zoology Invertebrates, 7th edition, Mc Millan Press Ltd. London 4. Storer, TI and RL User. 1957. General Zoology, Mac Graw Hill Book Company Inc. New York 5. McFarland, WN, FH Pough, TJ Cade and JB Heiser. (1979). Vertebrate Life. Macmillan Publishing Co., Inc. New York. 6. Margulis L. And KV Schwartz, 1998. Five Kingdoms Third Edition. WH Feeman and Company. New York. 7 . Gloefert-Tarp and Kailola. (1981). Trawled Fishes of Southern Indonesia and Northwestern Australia. ADAB-DGFI-GATC. Singapore. 8 . Saanin, H. (1981). Taxonomy and Fish Identification Kuntji. Binatjipta Bandung. 9 . Goin, GJ, OB Goin and GR Zug. (1978). Introduction to Herpetology. WH Freeman and Company. San Francisco. 10 . King, FB and EC Dickinson. (1975). A Field Guide to the Birds of Southeast Asia. William Collins Sons and Co Ltd. Glasgow. 11 . Vaughan, TA (1978). Mammalogy. Saunders College. Philadelphia

Plant Taxonomy

CourseID	*Bio6 2103 _*
Course name	*Plant Taxonomy*
Semester(s) in which the course is taught	*1st semester*
Person responsible for the course	*Prof. Dr. Syamsuardi, MSc. Prof. Dr. Indra Junaidi Z* *Dr. Nurainas, MSc. Dr. Nofrita, MSc. Dr. (cand.) Mildawati, MSi.*
language	*Indonesian Language or English*
Relationship to curriculum	*Compolsory*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-5.1 Able to solve science and technology problems in the field of management and utilization of biological resources through organizing principles systematics, predicting, analyzing information and biological materials as well as modulating cell structures and functions and applying technology relevant* *CPP-1: Able to distinguish taxa in the Chlorophyta, Cyanophyta, Euglenophyta, Pyrrophyta, Phaeophyta, Rhodophyta and Crysophyta groups* *CPP-2: Able to distinguish taxa in the Bryophyta group including the Division Hephatophyta, Anthophyta and Bryophyta* *CPP-3: Able to distinguish taxa in the Pteridophyta group including the Division, Sphenophyta and Pterophyta* *CPP-4: Able to distinguish taxa in the Spermatophyta group in the Gymnospermae Division including the Cycadophyta, Coniferophyta, Gynkgophyta and Gnetophyta classes* *CPP-5: Able to distinguish taxa in the Spermatophyta group in the Angiospermae Division including the class Magnoliopsida* *CPP-6: Able to distinguish taxa in the Spermatophyta group in the Angiospermae Division including class Liliopsida* *PI-5.3 Able to present alternative solutions to problems in the field of management and utilization of living biological resources* *specific scope, which can be used as a basis for making appropriate decisions PI-5.4 Skilled in preparing, handling, and managing biological resources within a specific scope such as taxonomy, ecology, conservation etc.* *CPP-7: Skilled in managing plant specimens, making herbarium specimens and introducing plant species with* *direct observation of plant objects in the field* *CPP-8: Skilled in preparing fieldwork reports regarding descriptions of species found in the field* *PI-5.5 Skilled in analyzing and managing conservation at the ecosystem, species and genetic level*

Content	*The Plant Taxonomy course discusses the basic concepts of classification, identification and nomenclature in plants. Course language This includes the scope and history of classification, identification concepts, plant nomenclature and the introduction of several types of plant taxa in the group of algae, mosses (Brophyta), ferns (Pterydophyta) and seed plants (Angiopsermae). Study Material 1. Scope of Plant Taxonomy, history of classification, identification concepts and Plant nomenclature*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1 . Simpson, MG 2010. Plant Systematics. All Elsevier Academic Press Publication. USA 2 . Brisbane. Bellinger, EG and Sigee, DC 2010. Freshwater Algae Identification and Use as Bioindicators. AJohn Willey & Sons. Ltd. Publications. New Delhi. India 3 . Holttum, RE 1967. A Revised Flora of Malaya Volume II. Fern of Malaya. Government Printing Office. Singapore 4 . Johnson, A. 1960. Student Guide to the Ferns of Singapore Island. Singapore UniversityPress. Singapore 5 . Johnson, A. 1980. Mosses of Singapore and Malaysia. Singapore UniversityPress.

2ND SEMESTER

Biophysics

CourseID	*BIO62104*
Course name	*Biophysics*
Semester(s) in which the course is taught	*2nd semester*
Person responsible for the course	*Muhammad Syukri Fadil, M.Sc* *Suwirmen, MS* *Robby Jannatan, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	PI-1 : Able to master the theoretical concepts of Biophysics CPMk-1: Be able to explain the terms and concepts as well as the scope of Biophysics CPMk-2: Able to explain about Biooptics CPMk-3: Able to explain about Bioacoustics CPMk-4: Able to explain about Biosensors CPMk-5: Able to explain about Bioelectricity and Magnetism CPMk-6: Able to explain biomechanics CPMk-7: Able to explain about Bioradiation CPMk-8: Able to explain about Biomaterials CPMk-9: Able to explain about Biothermal CPMk-10: Able to explain Fluids CPMk-11: Be able to explain Membranes CPMk-12: Able to explain Biomolecular
Content	*Vertebrate Pathophysiology course, studies the physiological disorders that occur in the body of vertebrate animals, especially livestock and especially laboratory test animals used for animal physiology research*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	-

Biochemistry

CourseID	*BIO62105*
Course name	*Biochemistry*
Semester(s) in which the course is taught	*2nd semester*
Person responsible for the course	*Dr. pil. nat. Periadnadi* *Dr. Anthony Agustien* *Dr. phil. nat. Nurmiati* *Prof. Dr. Efrizal*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*181.32*
credit points	*4 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Able to understand philosophy, concepts, principles and procedures in the field biochemistry. 2. Able to understand philosophy, concepts, principles and procedures in carbohydrate metabolism 3. Able to understand philosophy, concepts, principles and procedures in Metabolism of carbohydrates in the body of animals and plants 4. Able to understand philosophy, concepts, principles and procedures in Fatty Acid metabolism 5. Able to understand philosophy, concepts, principles and procedures in Fat Metabolism 6. Able to understand philosophy, concepts, principles and procedures in Metabolism of Fats and Fatty Acids in the body of animals and plant 7. Able to understand philosophy, concepts, principles and procedures in amino acid metabolism 8. Able to understand philosophy, concepts, principles and procedures in protein metabolism 9. Able to understand philosophy, concepts, principles and procedures in Metabolism of Protein and Amino Acids in the body of animals and plant 10. Able to understand philosophy, concepts, principles and procedures in enzyme metabolism 11. Able to understand philosophy, concepts, principles and procedures in nucleic acid metabolism 12. Able to understand philosophy, concepts, principles and procedures in structure of DNA and RNA 13. Be able to master the concept of all material Comprehensively

Content	*The biochemistry course contains the main points of biomolecule and cell molecular organization hierarchy, lipids, carbohydrates, amino acids and proteins, protein purification techniques, enzymes and enzyme kinetics, vitamins as cofactors, bioenergetics, carbohydrate metabolism, lipid metabolism, protein metabolism, nucleic acids , RNA and DNA. In addition, it discusses various diseases that occur related to the disorders that occur as well as examples of drugs that can be used to treat these diseases. The biochemistry practicum contains qualitative examination subjects in the form of general reactions for the identification of lipids, carbohydrates, amino acids and proteins, protein electrophoresis, biological oxidation reactions, vitamin antioxidant tests, urine analysis and kidney function as well as quantitative tests for enzyme activity tests and analysis. blood.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Elliot WH, and Elliot, DC, 1996. Biochemistry and Molecular Biology, John Willey & Sons, New York.* *2. Horton RH, et al, 2006, Principles of Biochemistry, 4 th ed, Pearson Education, Inc, United States of America* *3. Lehninger AL, 2003. Principles of Biochemistry, Tata McGraw Hill Co., New Delhi* *4. Murray KR, et al, 2003, Harper's Biochemistry, translated by Andri Hartono, 25th edition, Jakarta, EGC* *5. Koolman J, Rohm HK, 2001, Color Atlas and Texts of Biochemistry, Translated by Septelia Inawati, Jakarta, Hippocrates*

Cell and Molecular Biology

CourseID	*BIO62101*
Course name	*Cell and Molecular Biology*
Semester(s) in which the course is taught	*2nd semester*
Person responsible for the course	*Prof. Dr. Mansyurdin, MS* *Prof. Dr. Dewi Imelda, MS* *Dr. Tesri Maideliza, M.Sc* *Dr. Djong Hon Tjong*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology. CPMk-1: Be able to state the theory and history of cell discovery, the differences between viruses, prokaryotic cells and cells eukaryotes and examples. CPMk-2: Be able to name and explain the structure and materials that make up the cell membrane, the function of the material constituent of cell membranes, and transport of substances across the plasma membrane. CPMk-3: Be able to name and explain the structure and function of the cytoskeleton which includes actin filaments, intermediate filaments and microfilaments. CPMk-4: Be able to name and explain the structure and function of mitochondria, the structure and function of chloroplasts , mitochondria and chloroplasts as semi-autonomous organelles. CPMk-5: Be able to name and explain the structures and functions of the endoplasmic reticulum, functions endoplasmic reticulum, structure and arrangement of ribosomes, prokaryotic and eukaryotic ribosomes. CPMk-6: Be able to name and explain the structure and function of the parts of the Golgi complex, lysosomes, peroxisomes and glyoxisomes. CPMk-7: Be able to name and explain intracellular communication and cell interactions with the environment. CPMk-8: Be able to name and explain the molecular structure of DNA, RNA, tRNA and snRNA, and structure chromosome. CPMk-9: Able to explain and simulate cell cycle, cell division (amitosis and mitosis) and karyokinesis, cytokinesis, and apoptosis. CPMk-10: Able to describe and simulate meiosis, genetic recombination and genetic variation of gametes, and gamete formation. CPMk-11: Able to describe and simulate linear and circular DNA replication and DNA repair.

	CPMk-12: Able to explain and simulate transcription in prokaryotes and eukaryotes, translation and post- translation. CPMk-13: Be able to name and explain the structure and function of proteins and protein maturation.
Content	*Cell and Molecular Biology courses include: theory and history of cell discovery; organelle structure and function, membrane and cell wall, cell cycle, cell division and apoptosis; communication between cells and interaction with the environment; molecular structure of DNA-RNA, tRNA and snRNA; gene regulation; proteins; genetical manipulation; techniques of studying cells, fractionation and analysis of cellular components, membrane lipid permeability); and molecular biology analysis techniques.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and JD Watson. 1993. Molecular Biology of the Cell, 3rd edition, Garland Publishing, Inc., New York, London.* *2. Watson, JD, NH Hopkins, JW Roberts, JAS Steitz and AM Weiner. 1987. Molecular Biology of the Gene, Vol. I & II, 4th edition, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California.* *Supporters:* *1.David Clark. 2005. Molecular Biology, Elsevier Academic Press, Amsterdam, Boston, Heidelberg, London , New York, Oxford , Paris, San Diego, San Francisco, Singapore, Sydney & Tokyo* *2. Brian ES Gunning and Martin W. Steer. Plant Cell Biology: Structure and Function. Jones and Bartlett Publishers International, London, England.*

3RD SEMESTER

Biosystematics

CourseID	*BIO 61106*
Course name	*Biosystematics*
Semester(s) in which the course is taught	*3rd semester*
Person responsible for the course	*Prof. Dr. Syamsuardi M.Sc* *Prof. Dahelmi* *Dr. Nurainas M.Sc* *Dr. Wilson Novarino* *Dr. Henny Herwina* *Dr. Syaifullah*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*Lectures , lessons,*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2 credits*
Required and recommended prerequisites for joining the Course	-
Course objectives/intended learning outcomes	*PI-2 Able to master the basic principles of software for the analysis and synthesis of biological resources in a specific scope* *PI-6 Able to master the principles and concepts of tropical biodiversity for the development of mass science and technology front* *CPMk -1 Be able to explain concepts, differences in taxonomy, systematics and biosystematics* *CPMk -2 Be able to explain the history of classification, classification hierarchy, classification period of organisms* *CPMk -3 Be able to explain the concept of identification, how to identify organisms* *CPMk -4 Able to explain and apply Biological Nomenclature* *CPMk -5 Be able to explain concepts, how to compose, and determine the usefulness of a description of organisms* *CPMk -6 Able to explain species concepts* *CPMk -7 Able to explain and analyze a phenetic study* *CPMk -8 Able to explain and analyze a phylogenetic study* *CPMk -9 Able to explain and apply biosystematic evidence* *CPMk -10 Able to apply Methodology in biosystematics*
Content	*MK Biocythematics discusses the concept of biocymatics, different terms taxonomy and systematics, Classification concept, Identification, Nomenclature, Description of organisms, Concept of species, Phenolic studies and Phylogenetics, evidence in biosystematics and Methodology in biosystematics*

Examination forms	*oral presentation, essay, Written test .*
Study and examination requirements	
reading list	*1. Stace, CA 1991. Plants Taxonomy and Biosystematics. 2nd edition. Cambridge UniversityPress. Cambridge.* *2. Radford, AE 1986. Fundamentals of plant systematics. Harper & Row. New York.* *3. Rana, TS. KN. Nair and Upreti DK. 2014. Plant Taxonomy & Biosystematics Classical & Modern Methods. New India Publishing Agency. New Delhi.* *4. Ubaidilla, R. and H. Sutrisno. 2009. Introduction to Biosystematics, Theory and Practice. LIPPress.*

Animal physiology

CourseID	*BIO 61108*
Course name	*Animal physiology*
Semester(s) in which the course is taught	*3rd semester*
Person responsible for the course	*Dr. Santoso's son* *Dr. Rest Rahayu* *Muhammad Syukri Fadhil M.*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lectures, lessons, lab works*
Workload (incl. contact hours, self-study hours)	*181.32*
credit points	*4*
Required and recommended prerequisites for joining the Course	-
Course objectives/intended learning outcomes	*PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology.* *CPMk-1: Be able to explain the scope of animal physiology and the central concept of homeostasis* *CPMk-2: Be able to explain the physiology of the respiratory system in animals* *CPMk-3: Be able to explain the physiology of the cardiovascular system in animals* *CPMk-4: Able to explain blood physiology* *CPMk-5: Be able to explain the physiology of the digestive system in animals* *CPMk-6: Able to explain nutrition and metabolism in animals* *CPMk-7: Be able to explain the physiology of thermoregulation* *CPMk-8: Be able to explain the physiology of osmoregulation* *CPMK 9: Be able to explain the physiology of the excretory system in animals* *CPMk-10: Be able to explain the physiology of the immune system* *CPMk-11: Be able to explain the physiology of the endocrine system* *CPMk-12: Be able to explain the physiology of the nervous system* *CPMk-13: Be able to explain muscle physiology* *CPMk-14: Be able to explain the physiology of the system*
Content	*This course examines the basic concepts of animal physiology, the central concept of homeostasis, and physiological systems including systems respiration, cardiovascular, blood, digestion and nutrition, metabolism and thermoregulation, osmoregulation and excretion, immune, endocrine, nervous, muscle, and physiology of the reproductive system.*
Examination forms	*oral presentation, essay, Written test .*

Study and examination requirements	
reading list	*Main* *1. Santoso P. 2020. Animal Physiology: Basic Principles. Andalas University Press, Indonesia.* *2. Sherwood L, Klandorph, Yancey PH. 2015. Animal Physiology: From Genes to Organisms, Second Edition. Brooks/Cole, Cengage Learning, USA.* *3. Moyes CD, Schulte P. 2014. Principles of Animal Physiology. Pearson, USA.* *4. Boron WF and Boulpaep EL. 2017. Medical Physiology Third Edition. Elsevier. Philadelphia USA.* *Supporters:* *5. Hill RW, Wyse GA, Anderson M. 2012. Animal physiology third edition. Sinauer Associates, USA* *6. Sherwood L, Ward C. 2016. Human Physiology: From Cells to Systems (4th Canadian edition). Boston, Mass.: Cengage Learning.*

Plant physiology

CourseID	*BIO 61107*
Course name	*Plant Physiology*
Semester(s) in which the course is taught	*3rd semester*
Person responsible for the course	*Suwirmen MS* *Dr. Zozy Aneloy Noli* *Muhammad Idris M.*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lectures, lessons, lab works*
Workload (incl. contact hours, self-study hours)	*181.32*
credit points	*4*
Required and recommended prerequisites for joining the Course	*-*
Course objectives/intended learning outcomes	*a. Students have competency in Physiology courses Plants, which is able to explain and describe the science of Physiology Plant* *b. Students are able to explain the basics of Plant Physiology* *c. and apply it in everyday life.* *d. Students are able to discuss and work together in formulating and solving plant physiology problems.* *e. Students can understand and explain assignments sourced from scientific papers/journals.* *f. Students are able to do experiments in the laboratory.* *g. Students have the ability to manage themselves (intrapersonal skills) in the dimensions of creative thinking and critical thinking.* *h. Students have the ability to interact with others (interpersonal skills) in the dimensions of teamwork and oral communication.* *i. Students have basic values (values) in the dimensions of motivation, integrity and discipline*
Content	*Physiology Plants is the science that studies how plants function: how is the energy of sunlight used for carbon assimilation, how plants get and distribute nutrients and water, how plants grow and develop, how plants respond to the environment surroundings, how plants react to vulnerable situations, and how plants reproduce. For that Plant Physiology studies the shape and the composition of plant parts, their functions, processes and mechanisms of action. In Physiological point of view, the plant is a biochemical machine. To explain that all, Plant Physiology also needs help from structural science, physics, and chemistry, which in subsequent developments also included thermodynamics and mathematics. So this course really contributes to competence or achievement learning in the Biology study program curriculum.*

Examination forms	*oral presentation, essay, Written test .*
Study and examination requirements	
reading list	*Bidwell, RGS 1979. Plant Physiology. Macmillan Publishing Co., Inc. New York. Collier Macmillan Publishers. London.* *Devlin, RM and FHWitham. 1983. Plant Physiology. Willard Grant Press. Boston.* *Hopkin, WG 1995. Introduction To Plant Physiology. John Wiley & Sons, New York Inc., Toronto, Singapore.* *Taiz, L. and E. Zeiger. 2002. Plant Physiology 3th. Sinauer Associates Inc.* *Publishers. Sunderland, Massachusetts.* *Salisbury, FB & CW Ross. translation DR Lukman and Sumaryona 1995. Plant Physiology Volume 1, 2 and 3. ITB-Bandung Publisher.*

Introduction to Biotechnology

CourseID	*BIO611 10*
Course name	*Introduction to Biotechnology*
Semester(s) in which the course is taught	*3rd semester*
Person responsible for the course	*Dr. Zozy Aneloi Noli* *Dr. Nurmiati* *Dr. Anthony Agustin* *Dr. Feskaharny Alamsjah* *Dr. Fuji Astuti Febria* *Dr. Periadnadi*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lectures, lessons*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2*
Required and recommended prerequisites for joining the Course	
Course objectives/intended learning outcomes	*1. Introduction (definition of biotechnology, history and supporting science biotechnology),* *2. Conventional biotech (MOL, superior isolates, enzymes, cell biomass),* *3. Conventional biotech products,* *4. State of the art of conventional biotechnology,* *5. Mutagenesis (uv light, protoplast fusion, chemical),* *6. Modern Biotech (Plant and animal tissue culture),* *7. Basic genetic engineering techniques (electrophoresis, PCR, restriction enzymes, ligases, vectors)* *8. Recombinant DNA and DNA Cloning,* *9. Genetic transformation steps produce transgenic products* *10. Pros and cons of GMO products (related protocols, laws, rights),* *11. Application of genetic engineering in various fields (agriculture, health, environment, food, etc.)*
Content	*The Introductory Course in Biotechnology (BIO611 10) is a compulsory subject in the Biology Study Program, Faculty of Mathematics and Natural Sciences, Andalas University. This course consists of 2 credits and is given in semester III (Odd).*
Examination forms	*oral presentation, essay, Written test .*
Study and examination requirements	
reading list	-

Microbiology

CourseID	*BIO61109*
Course name	*Microbiology*
Semester(s) in which the course is taught	*3rd semester*
Person responsible for the course	*Dr. Anthony Agustien* *Dr. Periadnadi* *Dr. Nurmiati* *Dr. Feskarny Alamsjah* *Dr. Fuji Astuti Febria*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lectures, lessons, lab works*
Workload (incl. contact hours, self-study hours)	*181.32*
credit points	*4*
Required and recommended prerequisites for joining the Course	
Course objectives/intended learning outcomes	*PI-2: Demonstrate honesty in exams, report scientific data and information, and include literacy sources.* *PI-4: Demonstrate a fully responsible attitude towards assigned tasks* *PI-5: Have confidence in presenting theories and concepts as well as empirical facts in scientific forums.* *PI-1: Demonstrate an attitude to work harder by devoting all of his abilities, so that the work is completed faster and the results are as expected* *Pl-7: Able to master the principles and concepts of microbiology* *CPMk-1: Able to explain the definition, history, and function of microbiology* *CPMk-2: Able to explain cell structure of microbes* *CPMk-3: Able to explain media and sterilization* *CPMk-4: Able to explain isolation, screening, purification, and maintenance of microbes* *CPMk-5: Able to explain microbe staining* *CPMk-6: Able to explain the identification of microbes* *CPMk-7: Able to explain microbe genetics* *CPMk-8: Able to explain the growth of microbes* *CPMk-9: Able to explain the control of a microbe* *CPMk-10 Able to explain the microbial applications in various fields* *CPMk-10: Able to analyze microbial applications for medicine* *CPMk-11: Able to analyze the application of microbes in food* *CPMk-12: Able to analyze the potential of microbes for industrial applications*

	CPMk-13: Able to analyze the potential of microbes for agricultural applications *CPMk-14: Able to analyze the microbe potential for environmental application*
Content	*In this course, students are directed to understand the main problems in the definition, history, function of microbiology, function, benefits of microorganisms, microbe distribution, cell structure of microbes, identification and classification of microbe, of growth and control of microorganism, genetics of microbe, analysis of microbe application in food, analysis of microbial potential for industrial applications, analysis of microbial potential for agricultural applications, analysis of microbes potential for human medicine, analysis of microbe potential for environmental application, analysis of primary metabolites, secondary of microbe.*
Examination forms	*oral presentation, essay, Written test .*
Study and examination requirements	
reading list	*Primary:* *1) Madigan, MT, Martinko, JM, Parker, J., 2000, Brock Biology of Microorganisms, Ninth Ed. Prentice-Hall, London.* *2) Willey, J., L. Sherwood and CJ Woolverton. 2017. Prescott's Microbiology., 10 th Ed. McGraw Hill Education. New York.* *3) Brooks, GF, KC Carroll, JS Butel, SA and TA. Mietzner. 2013. MorseJawetz, Melnick, & Adelberg's Medical Microbiology., 26th Ed. Mc Graw-hill Companies. New York.* *4) Johnson, TR and CL Case. 2017. Laboratory experiments in Microbiology. 11th Ed.* *Alternatives :* *1. Ananthanarayan, R. and CKJ, Paniker's. Textbook of Microbiology, 2009. 8 th Ed. Universites Press.*

4TH SEMESTER

Genetics

CourseID	BIO 62108
Course name	Genetics
Semester(s) in which the course is taught	*4th semester*
Person responsible for the course	*Prof. Dr. Dewi Imelda Roesma* *Dr. Djong Hon Tjong* *Dr. Syaifullah*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*Lectures, Lessons, and Lab Works*
Workload (incl. contact hours, self-study hours)	*181.32*
credit points	*4*
Required and recommended prerequisites for joining the Course	-
Course objectives/intended learning outcomes	*PI-1: Able to master the concept of genetics and the scope of genetics* *CPMk-1: Be able to explain the basics of Mendelian inheritance: monohybrid, segregation, back cross, test cross, pleuang and calculate genetic ratios, dihybrid* *CPMk-2: Able to explain and understand the concept of segregation and independent assessment of organisms* *CPMk-3: Able to explain and understand the basics of tetrad analysis and pedigree analysis* *CPMk-4: Be able to explain and use the basics of binomial expressions, Chi-square test, contingency test and homogeneity test* *CPMk-5: Able to explain and analyze interaction and gene expression* *CPMk-6: Able to explain and analyze environmental influences and gene expression* *CPMk-7: Able to explain and analyze the interaction of two gene pairs, gene modifiers, lethality, distortion and* *CPMk-8: Able to explain and analyze Chromosomes, Y Chromosomes and sex determination* *CPMk-9:Able to explain and analyze sex circuits in moths, butterflies, birds and Drosophila* *CPMk-10: Be able to explain and analyze the influence of the female parent in the egg cytoplasm, cytoplasmic inheritance and respiration of Chlamydomonas and Saccharomyces as well as the transmission of killer traits to* *Paramecium* *CPMk-11: Able to explain and analyze multiple factors, the influence of dominant genes, genes with multiplication effects*

	CPMk-12: Able to explain and analyze regression and correlation, components of phenotypic variance and heriability *CPMk-13: Be able to explain linkage groups, perfect and imperfect links, recombination and link tracking* *CPMk-14: Be able to explain and analyze recombinant frequency calculations in autosomal, sex-linked genes and F1x F1 cross recombinant frequencies* *CPMk-15: Be able to explain and analyze gene mapping in diploid organisms Multiple allele crossover, coincidence and interference* *CPMk-16: Able to explain and analyze recombinant frequencies* *CPMk-17: Able to describe and analyze gene linkage maps* *CPMk-18: Be able to explain and analyze the factors that affect recombinant frequency, the relationship between crossover and chiasma* *CPMk-19: Able to explain and analyze allele and genotype frequencies and Hardy-Weinberg law requirements*
Content	*The learning material or subject matter given in the Genetics course includes Cell Division and Chromosomes, Mendelian Genetics: Independent Assortment Segregation, Opportunity Analysis and Statistical Tests, Dominance Analysis and Multiple Alleles, Analysis of Environmental Effects and Gene Expression, Analysis of Gene Interaction and Lethality, Analysis of Determination Sex and Sex Linked, Analysis of Maternal Effects and Cytoplasmic Inheritance, Quantitative Inheritance Analysis, Analysis Quantitative Analysis, Linkage and Recombinant Analysis, Gene Mapping Analysis in Diploid Organisms*
Examination forms	*oral presentations, essays, written tests*
Study and examination requirements	
reading list	1. *Goodenough, U., 1984. Genetics, 3rd Edition. Sounders College Publishing, New York.* 2. *Snyder, LA, D. Freifeler, DL Hartl, 1985. General Genetics, Jones and Bartlett Publ., Inc.* 3. *Strickberger, ALM, 1985. Genetics, 3rd Edition. Macmillan Publ. Co. New York.* 4. *Suzuki, M., DT, AIF, Grifith, RC Lewontin, 1981. An Introduction to Genetics Analysis, 3rd Edition. WK* 5. *Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and JD Watson. 1993. Molecular Biology of the Cell, 3rd edition, Garland Publishing, Inc., New York, London.* 6. *Watson, JD, NH Hopkins, JW Roberts, JAS Steitz and AM Weiner. 1987. Molecular Biology of the Gene, Vol. I & II, 4 th edition, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California.*

Biodiversity

CourseID	*BIO 62109*
Course name	*Biodiversity*
Semester(s) in which the course is taught	*4th semester*
Person responsible for the course	*Prof. Dr. Syamsuardi*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*Lectures , lessons,*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the Course	-
Course objectives/intended learning outcomes	*1. Understand biodiversity, its benefits and scope;* *2. Be able to explain the components of biodiversity* *3. Be able to explain the distribution and spot of biodiversity in the world* *4. Able to understand the current condition of Indonesian bodies* *5. Be able to analyze the interaction between ecosystems and diversity tropical species;* *6. Able to provide solutions to biodiversity problems in Indonesia* *1. Able to understand systematics and diversity, species diversity, loss of diversity and habitats and ecosystems.* *7. Be able to explain the relationship between biodiversity and function ecosystem* *8. Be able to explain genetic diversity and its differences* *9. Be able to explain species loss and species introduction* *10. Be able to explain the effects of climate change and biodiversity* *11. Be able to explain the effect of ocean acidification on marine biodiversity* *12. Be able to explain biodiversity protection; is power individual* *13. Be able to understand past and future biodiversity come*
Content	Biodiversity Course BIO 62109 (3 credits) semester II is compulsory subject in the Biodiversity field group. MK is discussing regarding biodiversity and its interaction with the environment, components of biodiversity, distribution, benefits, problems and biodiversity threats in Indonesia, the form of step funds in management and its preservation.
Examination forms	*eg oral presentation, essay, Written test .*
Study and examination requirements	

reading list	*1. Biodiversity, EO Wilson, Harvard University, Editor;National Academy of Sciences/Smithsonian Institution. ISBN: 0-309-56736-X, 538 pages (1988)* *2. Biodiversity ecosystem and Ecology, California Academy Sciences* *3.DFG . 2008. Biodiversity Research. Willey-FCH and DFG german.* *4 . LIPI. 2014. Current Biodiversity Indonesia. LIPI press.* *5 . Huggets RJ. Fundamentals of Biogeography. Routledge, London and New York*

Biogeography

CourseID	*BIO 62110*
Course name	*Biogeography*
Semester(s) in which the course is taught	*4th semester*
Person responsible for the course	*Prof. Dr. Syamsuardi M.Sc* *Dr. Nurainas M.Sc* *Dr. Wilson Novarino , M.Sc* *Dr. Jabang Nurdin, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*Lectures , lessons, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the Course	-
Course objectives/intended learning outcomes	*CPMk-1: Be able to explain the scope, history, relationship of phytogeography with related sciences and their benefits in life. CPMk-2: Be able to explain areas of natural distribution of plants, naming areas, distribution areas of world flora;* *CPMk-3: Dispersal concept, vectors in dispersal and character modification of dispersal supporting plants. CPMk-4: Be able to explain the concept of endemic, plant cosmopolitan. CPMk-5: Be able to explain the center of origin of plants. CPMk-6: Be able to describe the relationship between the dispersal process and the distribution of animals and their relationship to plants* *CPMk-7: Be able to decipher distribution patterns and geographic regions of global animals* *CPMk-8: Able to explain zoogeographical areas in the Indonesian archipelago* *CPMk-9: Be able to describe geographic patterns in aquatic ecosystems* *CPMk-10: Be able to explain the role of biogeography in efforts to conserve biodiversity*
Content	*The Biogeography course discusses basic concepts related to the distribution and distribution of flora and fauna in the world. The discussion of this course covers the meaning and history of biogeography, the geographical distribution of flora and fauna in the world, the area of distribution of flora and fauna, the center of origin of a plant, the dispersal and diaspora of plants. This lecture will also discuss patterns of global distribution of animals, zoogeographical areas in the Indonesian archipelago, geographic patterns in aquatic ecosystems and ends with the role of biogeography in biodiversity conservation efforts.*

Examination forms	*oral presentation, essay, Written test .*
Study and examination requirements	
reading list	*Main :* *1. Polunin, N. 1960. Introduction to Pant Geography and Some Related Sciences.* *2. Van der Pijl, L. 1982. Principles of Dispersal on the Higher Plants. Third Edition. Springer-Verlag, Berlin Heidelberg New York* *3. Armen Taktajan. 1986. Floristic Regions of the World. University of California Press, Berkeley, 1986. xxii, 522 pp.* *4. Brown JH and Lomolino MV. 1998. Biogeography, 2nd Ed. Sinauer. Sunderland.* *5. Huggets RJ. 2004. Fundamentals of Biogeography. Routledge. London.* *Supporters:* *6. Whitten, JA, Damanik, JS, Anwar, J., Hisyam, N. 1987. The Ecology of Sumatra. Gadjah Mada UniversityPress. Yogyakarta* *7. Laumonier, Y. 1997. The vegetation of physiography of Sumatra. Seameo-Biotrop. Regional Center for Tropical Biology. Bogor. Indonesia* *8. Whittaker RJ and Fernández-Palacios JM. 2007. Island Biogeography. Ecology, evolution, and conservation. Oxford UniversityPress. Oxford.* *9. Related journals (miss Global Ecology & Biogeography).*

Animal Ecology

CourseID	*BIO 62106*
Course name	*Animal Ecology*
Semester(s) in which the course is taught	*4th semester*
Person responsible for the course	*dr. Izmiarti MS* *Dr. Jabang Nurdin MS* *Dr. Nofrita M.Sc* *Dr. Rizaldi* *Prof. Dr. Indra Junaidi Zakaria*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lectures, lessons , and lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the Course	
Course objectives/intended learning outcomes	*1. Be able to understand the definition of ecology, history of ecological development, position of ecology and relations of ecology with other sciences, Division of Ecology, Scope of Animal Ecology, Applied aspects of Animal Ecology* *2. Be able to explain the relationship between animals and the environment, and limiting factors Law of tolerance, Acclimatization and range of tolerance,* *3. Be able to explain several physical factors that act as limiting factors, indicators Ecological* *4. Be able to explain Habitat, microhabitat and Habitat Classification, - Niches and Separations Niche, Ecological Equivalent* *5. Be able to explain Basic Animal Responses, Acclimatization and Adaptation, Physiological Adaptation, Morphological Adaptation, Response and Behavioral Adaptation* *6. Able to explain food and eating relationships* *7. Be able to explain population and population parameters* *8. Be able to explain life tables and population growth* *9. Able to explain and apply population estimation* *10. Be able to explain population interactions* *11. Be able to explain the animal community* *12. Able to analyze community structure* *13. Be able to explain seasonal community dynamics and spatial dynamics*
Content	*Animal Ecology courses include: 1) Definition of Ecology, History of Ecological Development, Position of Ecology and Relationship of Ecology with Other Sciences, Division of Ecology, Space Scope of Animal*

	Ecology, Applied Aspects of Animal Ecology, 2) Relations between Animals and the Environment, *Legal Limiting Factors of Tolerance, Acclimatization and Tolerance Range, 3) Some Physical Factors Acting as Limiting Factors, Ecological Indicators, 4) Habitat, Microhabitat and Habitat Classification, Niche and Niche Separation, Ecological Equivalence, Traits Shift, 5) Response Basic Animal, Acclimatization and Adaptation, Physiological Adaptation, Morphological Adaptation, and Response Behavioral Adaptation, 6) Food and feeding relationships 7) Population and Pop Parameters 1) Community Animals, 12) Community structure analysis, 13) Community dynamics: musian and spatial*
Examination forms	*oral presentation, essay, Written test .*
Study and examination requirements	
reading list	*1. Begon, MJH and CR Townsend. 1986. Ecology, Individual Population and Communation , Blackwell, London.* *2. Odum, EP 1983. Fundamentals of Ecology. Sounders, Philadelphia.* *3 . Brewer, R. and MT McCann. 1982. Laboratory and Field manual ecology Saunders, Philadelphia.* *4 . Krebs, CJ 1985. Ecology: Experimental Analysis of Distribution and Abundance Harper & RowPublisher, Inc., New York*

Plant Ecology

CourseID	*BIO 62107*
Course name	*Plant Ecology*
Semester(s) in which the course is taught	*4th semester*
Person responsible for the course	*Prof. Dr. Chairul M.Sc* *Prof. Dr. Erizal Mukhtar* *Zuhri Syam, MP* *Dr. Solfiyeni, MS*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lectures, lessons, and lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the Course	*-*
Course objectives/intended learning outcomes	1. *Students understand the basic understanding of Ecology and its supporting aspects.* 2. *Able to develop the benefits and various services of natural resources and the environment* 3. *Have the ability to communicate thoughts and ideas orally and in writing.* 4. *Able to cooperate with others*
Content	*Plant Ecology course (BIO4402) is a course compulsory in the Biology Study Program, the Department of Biology FMIPA Andalas University. This course consists of 3 credits, and given in semester IV (Even).*
Examination forms	*oral presentations, essays, and written tests .*
Study and examination requirements	
reading list	*Odum, P .1971. Fundamentals of Ecology . Mc. Graw-Hill. London.* *Brower JEH, Zar and Carl, NE 1990. Field and Laboratory Method For General Ecology Third Edition . Illinois publishers. University.* *Soerianegara, I and A. Indrawan, 1978. Ecology* *Indonesian Forest. Department of Forest Management. Faculty of Forestry Bogor.*

5TH SEMESTER
Plant Ecology

CourseID	*BIO61114*
Course name	*Biodiversity Assessment*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Jabang Nurdin, M.Sc* *Prof. Dr. Indra Junaidi Zakaria* *Dr. Nofrita, M.Sc* *Dr. Aadrean* *Prof. Dr. Chairul, MS* *Dr. Solfiyeni, MP*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	LO courses: 1. Be able to explain the meaning of Biomonitoring and communicate it 2. Able to explain historical developments, Biomonitoring 3. Be able to explain the concept of Biomonitoring and its application 4. Able to explain the concept of bioindicators 5. Able to explain the international biomonitoring program 6. Be able to explain Biomonitoring of air/soil quality 7. Able to explain integrating and analyzing in a Journal Presentation related to biomonitoring 8. Able to explain integrating and explaining water quality bioindicators 9. Able to analyze and explain plants as bio-indicators of change environment 10. Be able to analyze and explain Animals as bioindicators of change environment 11. Be able to analyze and explain Biomonitoring as a deep foundation management of the environment 12. Able to integrate and analyze in Journal Presentations and Reports in the form of journal of the Biomonitoring field course.
Content	*The Biomonitoring course directs students to understand the main problems of biomonitoring related to the life of organisms with the environment and the impact on the environment and human life. The lectures explain what biomonitoring is and the concept of bioindicators, air, soil and water pollution and how pollutants enter the environment/ecosystem, international biomonitoring programs, bioindicators of water, soil and air quality, animals and plants as bioindicators of environmental change, testing of contamination*

	toxicity and Biomonitoring as a foundation in environmental management.
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Markets, BA; Breure, AM; and Zechmeisteer, HG 2003. Bioindicators and Biomnoitors, principles concepts and applications. Trace metals and other contaminants in the environment 6. Elsevier, Amsterdam* *2. Ziglio, G.; Siligardi, M.; and Falim, G. 2006. Biological monitoring of rivers, applications and perspectives. John Wiley $Sons, England*

Bioinformatics

CourseID	*BIO61117*
Course name	*Bioinformatics*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Djong Hon Tjong* *Prof. Dr. Dewi Imelda, MS.*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	PI-1: Able to master bioinformatics concepts. CPMk-1: Able to mention and explain the central principle of dogma (review). CPMk-2: Able to mention and explain the history and principles of bioinformatics. CPMk-3: Able to explain and simulate websites for NCBI bioinformatics CPMk-4: Able to explain and simulate websites for PDB bioinformatics CPMk-5: Able to explain and simulate websites for KEEG and expasy bioinformatics CPMk-6: Able to explain and simulate websites for KEGG bioinformatics CPMk-7: Able to explain and simulate DNA sequence analysis using Blast, Bioedit CPMk-8: Able to describe and simulate contiq DNA CPMk-9: Able to explain and simulate phylogenetic analysis using MEGA X CPMk-10: Able to explain and simulate protein sequence analysis. CPMk-11: Able to explain and simulate docking principles using Swissdoc. CPMk-12: Be able to explain and simulate docking principles using Igemdock.
Content	*Bioinformatics course: central dogmatic principles, history and principles of bioinformatics, website for NCBI bioinformatics, website for PDB bioinformatics, website for KEGG bioinformatics, expasy, DNA sequence analysis using Blast and Bioedit, DNA contiq, phylogenetic analysis using MEGA X, protein sequence analysis , the principle of docking uses swissdoc and the principle of docking uses Igemdock.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-

reading list	*Main :* *1. Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and JD Watson. 1993. Molecular Biology of the Cell, 3rd edition, Garland Publishing, Inc., New York, London.* *2. Watson, JD, NH Hopkins, JW Roberts, JAS Steitz and AM Weiner. 1987. Molecular Biology of the Gene, Vol. I & II, 4 th edition, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California.* *Supporters:* *1.David Clark. 2005. Molecular Biology, Elsevier Academic Press, Amsterdam, Boston, Heidelberg, London , New York, Oxford , Paris, San Diego, San Francisco, Singapore, Sydney & Tokyo* *2. Brian ES Gunning and Martin W. Steer. Plant Cell Biology: Structure and Function. Jones and Bartlett Publishers International, London, England.*

Bioconservation

CourseID	*BIO61115*
Course name	*Bioconservation*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Syaifullah Z.* *Dr. Chairul M.* *Dr. Wilson Novarino* *Dr. Jabang Nurdin* *Dr. Indra Junaidi Zakaria* *Dr. Aadrean*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Lecture contract and main material Portrait of Tropical Biodiversity 2. History of Conservation Development 3. Conservation and Sustainable Development 4. Valuing Biodiversity (Economic value) 5. Genetic Conservation (Population and Species) 6. Conservation of wildlife 7. Ecology and forest conservation 8. Conservation Policy 9. Conservation of marine life 10. Landscape Conservation 11. Wetland conservation 12. Mapping Biodiversity
Content	*The Bioconservation course directs students to understand the main conservation issues related to biodiversity and applications (from various aspects ranging from genetics, species, populations, biogeography, ecology, community) in conservation efforts. Students will also be introduced to methodologies and management in biodiversity conservation efforts, efforts and strategies for conserving biodiversity at the global, national and local levels. Conservation based on species and habitat and case studies of several conservation efforts that have been made.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-

reading list	*Main* *1. Clive Hambler & Susan M. Canney, 2013. Conservation. 2nd edition. Cambridge UniversityPress.* *2. M. Indrawan, RJ. Primack, J. Supriatna. 2007. Conservation Biology. Indonesian Torch Foundation* *3. Morris L., 2000. Behavior and Conservation. Cambridge UniversityPress.* *4. US pullins. 2002. Conservation Biology. Cambridge UniversityPress.* *5. Frankham, R., Ballou, JD, Briscoe, DA, 2005. Introduction to ConservationGenetics. Cambridge.* *6. William J. Shuterland. 2000. The Conservation Handbook: Research Management and Policy. Blackwell Science. Ltd.* *Supporters* *1. Lowe, A., Harris, S., Ashton, P. 2004. Ecological genetics: design, analysis, and application. BlackwellScience Ltd.*

Biostatistics

CourseID	*BIO61119*
Course name	*Biostatistics*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Zozy Aneloi Noli* *Dr. Indra Junaidi Zakaria* *Zuhri Syam, MP*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Introduction which will include; Basic principles of statistics and its application. 2. Sampling techniques 3. Experiment design 4. Data Transformation 5. Parametric test and non-parametric test 6. Missing Data. *7.* Software application supporting data analysis
Content	*Biostatistics Course (BIO 4015) is a compulsory subject in the Biology Study Program, the Department of Biology, Faculty of Mathematics and Natural Sciences, Andalas University. This course consists of 3 credits and is given in semester VI (Even).*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Steel RGD and JH Torie , 1980, Principles and statistical procedures, a biometric approach, Pt. Gramedia Jakarta.* *2. Draper NR and H. Smith. 1992, Applied Regression Analysis. PT. Gramedia Jakarta.* *3. Gomez. KA and AA Gomez. 1995. Statistical Procedures for Agricultural Research. Second Edition (translation). University of Indonesia Press. Jakarta.* *4. Nazir, M. 2011. Research Methods, Ghalia Indonesia, Bogor* *5. Kadir, 2015. Applied Statistics. Second Edition. King of Grafindo Persada. Jakarta* *6. Aji Sastrosupadi. 2000. Design of Practical Experiments in Agriculture. Kanisius, Yogyakarta.*

Evolution

CourseID	*BIO61113*
Course name	*Evolution*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Tesri Maideliza, M.Sc* *Dr. Djong Hon Tjong* *Dr. Rizaldi*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. The relationship between evolutionary biology and other sciences 2. Science and Religion (Galileo's Battle for the Heavens) 3. Introduction to Evolution 4. A Brief History of Evolutionary Thought 5. Modern Synthesis 6. Science and Non-Science 7. Origins 8. Darwin's Dangerous Idea 9. The Great Transformation 10. HIV Case Study 11. Extinction 12. Evidence for Evolution 13. Darwinian Natural Selection 14. Mutation and Genetic Variation 15. Selection and Mutation 16. Evolutionary Arms Race 17. Migration, Genetic Drift and Nonrandom mating 18. Why Sex? 19. Sexual Selection 20. Big Bang Mind 21. Mechanism of Speciation 22. Life and the Cell 23. Human evolution
Content	*This course is a compulsory MK in Biology Masters Degree Study Program, Department of Biology, FMIPA Andalas University which consists of 2 credits given in even semesters. The scope of this MK Basic principles, mechanisms, and patterns of evolutionary biology includes a historical survey of related ideas. This course focuses on modern evolutionary theory in relation to the origins and dynamics of genetic diversity in space and time, reproductive isolation and evolutionary relationships among groups of organisms. Students will be directed how to understand the interactions between mutations, evolutionary*

	forces, recombination, selection, migration and genetic drift driving patterns and processes of biodiversity at various levels of biological organization.
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Ashton, Beryl G. (1969). Genes, Chromosomes and Evolution. New York: Houghton Mifflin Company.* *2.BSCS. (2002). Biology, an Ecological Approach. Ninth Edition. Iowa: Kendall/Hunt Publishing Company.* *3.BSCS. (2006). Biology, A Molecular Approach. Ninth edition. New York: McGraw Hill. Campbell, NA, JB Reece and LG Mitchell. (1999). biology. Fifth Edition. New York* *4. Futuyma, Douglas J. (2005). Evolution. Massachusetts, USA : Sinauer Associates, Inc. Publisher.* *5. Lewin, R. (1993). Human Evolution. New York : Blackwell Scientific Publications.* *Supporters:* *1. Darwin, Charles. (2007). Translator: UNAS Team. the origin of Species - Origins*

Entrepreneurship

CourseID	*AND60102*
Course name	*Entrepreneurship*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Prof. Dr. Refilda* *Prof. Dr. safni* *Dr. Zilfa* *Dr. Yefrida*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Indonesia's condition in the perspective of Entrepreneurship 2. Human Quality 3. The basic concept of entrepreneurship 4. Entrepreneurial characteristics 5. Dreams 6. Business Feasibility Study 7. Business Planning (Business Overview) 8. Business Planning (Management planning) 9. Business Planning (Marketing Planning) 10. Business Planning (Financial Planning)
Content	*This course has an orientation in the form of strengthening and empowering students' personal capacities, as well as positive individual characteristics possessed as basic capital to be applied in the process of establishing a new business/start-up business. For this reason, students will also be equipped with understanding and knowledge from the scientific field of entrepreneurship. Thus, the focus of learning will not only be directed at elements of entrepreneurship as a process that includes aspects of individual personality-spirit-characters that can be applied in various organizations - but further how students use them in the process of establishing a new venture, starting from the process searching for business ideas up to the stage of business management. Students are also directed to be able to produce a business plan that is practically oriented and of a high standard, which is a written plan of the business idea they have, with various considerations regarding certain aspects that influence it. This Business Plan is not only directed at establishing a new business, but also the process of expanding existing businesses and the realization of other business ideas from businesses that are currently being implemented. Thus, students will also be equipped with knowledge about various analytical tools to*

	assess the feasibility of a new business. This lecture combines elements of knowledge, practice and personal reflection of students, with a focus on stimulating the cognitive, affective and psychomotor aspects of the lecture participants. Special challenges are given to students in the form of applying entrepreneurial principles, conceptions and frameworks in a real business.
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Kuratko, DF (2017). Entrepreneurship: Theory, Process, Practice, 10th Ed. Cencage Learning, Boston, MA: USA.* *2. Rahman, H. (2020). Entrepreneurship + Entrepreneurship: A Multi-Perspective Review, RAH Multimedia* *3. Carter, S., Jones-Evans, D. (2000). Enterprises and Small Business: Principles, Practice and Policy, Prentice-Hall: London* *Supporters:* *1. Donard Games, (2017), The New Generation of Indonesian Entrepreneurship, RumahKayu publishing* *2. Rahman, H., Besra, E., & Nurhayati, N. (2021). Entrepreneurial Failure: Causes, Construction and Impact in the Entrepreneurial Process, Publisher Rumah Kayu, Padang: Indonesia* *3. Other books and related journal articles*

Research methodology

CourseID	*BIO61116*
Course name	*Research methodology*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Prof. Dr. Dahelmi* *Prof. Dr. Syamsuardi* *Dr. Nasir Nasir* *Dr. Djong Hon Tjong*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Introduction: the approach to obtaining the truth, requirements that must be possessed to become a researcher, various research in the exact field. 2. The steps of research, identification, selection and formulation problems, literature review, hypothesis formulation, preparation research design, sample determination, data processing and analysis with statistics, interpretation of results, preparation of reports. 3. Writing research proposals, writing thesis.
Content	*Research Methodology Course (BIO 4013) is a compulsory course (2 credits) in the Biology Study Program, Faculty of Mathematics and Natural Sciences, Andalas University. Course descriptions include: Introduction, literature study, Research Problems, hypothesis formulation, Experimental design, sampling techniques, data analysis and guidelines for writing reports/thesis*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. *Kothari, CR 2004. Research Methodology. Methods and Techniques. New Age International Publishers. New Delhi* 2. *Nazir, M. 2009. Research Methods. Indonesian Ghalia.* 3. *Sugiyono. 2011. Quantitative Qualitative Research Methods and R&D. Alphabet. Bandung* 4. *Supranto, J. 2009. Statistics. Theory and Application. Seventh edition. Erlangga Publisher. Jakarta.* 5. *Suryabrata, S. 2002. Research Methodology. Rajawali Press, Jakarta.*

Biodiversity Perspective

CourseID	*BIO61118*
Course name	*Biodiversity Perspective*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Mairawita, M.Sc* *Dr. Nurmiati* *Dr. Henny Herwina, M.Sc* *Silmi Yusri Rahmadani, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*45,33*
credit points	*1 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Utilization of biodiversity as an alternative food source 2. Utilization of biodiversity as a source of medicines 3. Utilization of biodiversity as a source of bioenergy 4. Utilization of biodiversity as a source of biofertilizer 5. Biodiversity and Bioremediation 6. Biological control
Content	*MK Biodiversity Perspective is a course that discusses the study of the application of biological sciences in the utilization of biodiversity as a source of functional food, medicine, bioenergy, and fertilizer. bioremediation and biological agents.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	-

Mycorrhiza Biology

CourseID	*BIO60222*
Course name	*Mycorrhiza Biology*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Zozy Aneloi Noli* *Dr. Feskarny Alamsjah*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*Plant Physiology*
Course objectives/intended learning outcomes	1. Linkage of mycorrhizal studies with other branches of biology, especially plant physiology, application and utilization of mycorhyza. 2. Basic concepts of mycorrhiza. 3. characteristics of endomycorrhizae, ectomycorrhizae, ectendomycorrhizae, ericoid mycorrhizae and mycorrhizal orchids. 4. Mycorrhizal association testing techniques. 5. mycorrhizal isolation techniques. 6. Inoculant propagation techniques. 7. Mycorrhiza application in the field. 8. Mycorrhizal synergism with rhizosphere microbes (bacteria group). 9. Relationship of mycorrhizae with soil-borne pathogens.
Content	*MK Biology of Mycorrhiza discusses the concept and scope of the association of fungi with plant roots that form mycorrhizae, the characteristics of endomycorrhizae, ectomycorrhizae and other mycorrhizal groups, the concept of using mycorrhizae as biofertilizers and environmental restoration agents as well as the interactions of mycorrhizae with other microorganisms.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Sieverding, E. 1991. Vesicular Arbuscular Mycorrhiza Management, GTZ GmbH, Eschborn, Germany.* *2. NC Schenck, 1982, Methods and principles of mycorrhizal research, The American Phytopathological Society Minnesota USA.The American Phytopathological Society* *3. Zaki A. S, Akhtar MS and K. Futai .2008. Mycorrhizae: Sustainable Agriculture and Forestry. Springer* *4. Brundrett. M, N. Bougher, B. Dell, T. Grove and N. Malajczuk, 1996, Working with Mycorrhizas in Forestry and Agriculture, eCenter for Internationale Agriculture Research. Canberra.*

	5. *Marks, GC 1973. Ectomycorrhizae. Their Ecology and Physiology. Academic Press* 6. *Rai, M., Ajit. V. 2011. Soil Biology. Diversity and Biotechnology of Ectomycorrhizae. Heidelberg:Springer* 7. *Qiang-Sheng Wu(editors). 2017. Arbuscular Mycorrhizae and Stress Tolerance of Plants. Springer Nature Singapore Pte Ltd.* 8. *Nusantara.AD, YH Bertham and I. Mansur. 2012. Working with arbuscular mycorrhizal fungi. SEAMEO BIOTROP. Bogor* *Supporters:* *1. Specific articles published in journals related to the subject matter that will be informed during lectures to deepen students' understanding of related topics.* *2. Website about mycorrhiza like https://invam.wvu.edu/*

Introduction Amdal

CourseID	*BIO60 2 71*
Course name	*Introduction Amdal*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Prof. Dr. Chairul, M.Sc* *Dr. Fuji Astuti Febria*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	a. Students have competency in the Introductory EIA course, that is able to explain and describe the meaning of Introduction EIA and supporting science branches. b. Students are able to explain the basics of Introduction to Amdall and apply it in everyday life. c. Students are able to discuss and work together in formulating and solve environmental problems. d. Students can understand and explain assignments sourced from scientific papers/journals. e. Students are able to work on experiments (practicum) in laboratory.
Content	*This MK studies the relationship between biology, physics-chemistry, social, economics, culture and public health and the environment and contains discussions about the meaning of EIA and supporting branches of knowledge. Cause of decline biodiversity which contains a discussion of the level of extinction of organisms.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	a. Suratmo, FG 2004. Impact Analysis Environment. Gadjah Mada UniversityPress. Yogyakarta b. Samin. 2006. Impact Analysis Environment. Muhammadiyah University Publisher. Poor. c. Fandeli. Chafid. 2001. Impact Analysis Environment, Basic Principles and Deep Establishment Development. Liberty Publishers. Yogyakarta d. Decree of the Minister of State for the Environment Number 11 of 2006, regarding Guidelines for Preparation EIA. e. Ministry of Environment, Legislation invitation, Volume I, (Government Regulation of the Republic of Indonesia No. 27 1999). f. Ministry of Environment, Legislation invitation, Volume II,

Conservation Areas Management

CourseID	*BIO60 2 47*
Course name	*CONSERVATION AREAS MANAGEMENT*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Wilson Novarino, M.Sc* *Dr. Aadrean, M.Sc* *Prof. Dr. Mansyurdin, MS*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	PI-7: Able to master the principles and concepts of conservation at the level of tropical ecosystems, species, and genetics sustainable development CPMk-1: able to describe the history and development of area-based conservation CPMk-2: able to explain laws and regulations related to conservation areas in Indonesia CPMk-3: able to describe and identify conservation area categories nationally (Republic of Indonesia), global (IUCN criteria and UNESCO) as well as the criteria used as the basis for determining conservation areas CPMk-4: able to describe and implement planning procedures and forms of activities that need to be carried out in manage conservation areas CPMk-5: able to implement an evaluation mechanism for the management of conservation areas CPMk-6: able to describe the forms of activities that need to be carried out to gain support for the region conservation CPMk-7: able to describe and identify various forms of conservation efforts in protected forest areas, forests production, cultivation area, residential area PI-5: Be able to analyze and manage conservation at the ecosystem, species and genetic level. CPP-1: Capable of collecting data and/or information about authentic cases from available sources be held accountable CPP-2: Able to analyze data and/or case information, and discuss it based on management theories and concepts Conservation area CPP-3: Able to find alternative solutions in handling cases based on: i) existing laws and regulations applicable; and ii) practices that have been applied to handle the same case. CPP-4: Able to present types of cases, results of data analysis and/or case information, and alternative solutions case handler in front of the class. CPP-5: Able to prepare a case assignment report, which includes: i) case background; ii) analysis of data and/or information; iii) discussion of alternative solutions for handling cases; and iv) references.

Content	*MK Conservation area management discusses the history and development of conservation area management in Indonesia and world. National conservation area management policies and their problems. How to plan a conservation area, monitor and evaluate area management, integrate management with spatial plans and resources funding for area management*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Directorate of Conservation Areas. 2015. Guidelines for Evaluating the Effectiveness of Conservation Area Management in Indonesia Management Effectiveness Tracking Tool. Directorate of Conservation Areas. Directorate General of Conservation of Biological Resources and The ecosystem. Jakarta 2. Directorate of Conservation Areas. 2014. Indonesian Biosphere Reserve, To Linkage Biological and Cultural Diversity for Sustainable Development. Directorate of Conservation Areas. Directorate General of Conservation of Biological Resources and Their Ecosystems. Jakarta 3. Dudley, N. (Editors) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp. WITH Stolton, S., P. Shadie and N. Dudley (2013). IUCN WCPA Best Practice Guidance on Recognizing Protected Areas and Assigning Management Categories and Governance Types, Best Practice Protected Area GuidelinesSeries No. 21, Gland, Switzerland: IUCN. xxpp. 4. The Indonesian HCV Toolkit Revision Consortium. 2008. Guidelines for Identification of High Conservation Value Areas in Indonesia. Tropenbos International Indonesia Programme 5. Law No. 5 of 1990 concerning Conservation of Living Natural Resources and Their Ecosystems 6. Law No. 41 of 1999 concerning Forestry 7. Regulations related to conservation area management (http://ksdae.menlhk.go.id/peraturan/post/120) 8. Wiratno, D. Indriyo, A. Syarifuddin and A. Kartikasari. 2004. Reflecting in a Cracked Mirror. Reflection on Conservation and Implications for National Park Management. Indonesian Center for Environmental Information. Bogor. 9. Yudhistira, P. 2014. The Pioneer, The Role of Dr. SH Coorders in History of Nature Protection in Indonesia. Regional Directorate Conservation. Directorate General of Conservation of Biological Resources and Their Ecosystems. Jakarta 10. Directorate of Environmental Services on Protected Areas. 2017. Nature Touristm of 54 National Parks in Indonesia, Exploring the Beauty of Panorama and The Uniqueness of Indonesia National Park. Directorate of Environmental Services on Protected Areas. Jakarta 11. Mardiastuti, A. 2018. Animal Ecology in Human-Dominated Landscapes. IPB Press Publisher. Bogor. 12. Supriatna, J. 2008. Preserving Indonesia's Nature. Indonesian Obor Foundation Publisher. Jakarta 13. Supriatna, J. 2018. Conservation of Biodiversity Theory and Practice in Indonesia. Indonesian Obor Foundation Publisher. Jakarta 14. Van der Ree, R, DJ Smith & C. Grilo. 2015. Handbook of Road Ecology. Wiley Blackwell.

Planktonology

CourseID	*BIO60 2 27*
Course name	*Planktonology*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Nofrita* *Dr. Jabang Nurdin* *Prof. Dr. Indra Junaidi Zakaria* *Izmiarti, MS*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology.* *1. CPMk-1: Be able to explain the scope, terminology and grouping of plankton organisms and the position of plankton in aquatic ecosystem.* *CPMk-2: Be able to explain spatial and temporal distribution patterns, population explosions, quantitative relationships between phytoplankton and zooplankton* *CPMk-3: Be able to describe the influence of physical, chemical and biological factors on plankton life* *CPMk-4: Be able to explain the adaptation of plankton to the environment* *CPMk-5: Be able to explain the role of plankton for life and the environment* *CPMk-6: Able to describe the diversity and characteristics of fresh water, estuarine and marine phytoplankton* *CPMk-7: Able to describe the diversity and characteristics of holoplankton and meroplankton* *CPMk-8: Be able to explain plankton culture techniques* *CPMk-9: Be able to explain the primary productivity of phytoplankton*
Content	*This course is a form of expansion and integration of animal ecology courses, animal taxonomy, plant taxonomy, biodiversity and biodiversity assessment. Through this course, students will be further introduced to aspects of biology and ecology and taxonomy of plankton groups. Besides that, students also practice sampling, enumeration and analysis techniques plankton data which is then useful in predicting the quality of the aquatic environment. Improved understanding and skills students in plankton bioecology, sampling techniques, identifying and analyzing data are expected to be provisions for graduates when entered the workforce in the fields of researchers, environmental*

	consultants, aquaculture, aquatic resource management, and staff function in environmental laboratories.
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Reynold, RE 1996. Ecology of freshwater phytoplankton. Pergaman Press. London 2. Rai, LC and JP Gaur (Eds.). 2001. Algal Adaptation to Environmental Stresses. Springer. New York 3. Romimohtarto, K & S. Juwana. 2004. Marine meroplankton. Djbatan Publisher, Jakarta 4. Raymont. J EG 1980 . Plankton and Productivity the Oceans. Pergamon Press. Toronto 5. Suthers. IM and D. Riskik. 2009. Plankton: A guide to their ecology and monitoring for water quality. Csiro Publishing. Australia 6. Seckbach, J and R. Gordon. 2019. Diatoms: Fundamentals and Applications. Scrivener Publishing

6TH SEMESTER

Scientific Article Writing

CourseID	*BIO60102*
Course name	*Scientific Article Writing*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Dr. Rizaldi, M.Sc* *Dr. Dewi Imelda Roesma, MS*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*45,33*
credit points	*1 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Understand the principles of scientific publications 2. Understand the process and stages of writing scientific articles 3. Able to write the results of scientific research 4. Able to write research results in the form of scientific articles in English language 5. Able to choose scientific publications (journals) that are appropriate to the field study. 6. Able to choose the appropriate rating of publications (ranking). yield quality study. 7. Able to prepare scientific presentations for international scientific meetings.
Content	*Scientific Article Writing is a compulsory Semester III subject. The learning objective of this course is to develop students' abilities and skills to write and publish their research results in English. In this course students learn about various forms of international scientific publications, techniques for writing scientific research articles using international languages (English). In this course you will learn about the criteria for international publications, the variety and ranking of publications, the scope of various scientific publications, instructions to the author(s). The lecture material is followed by writing techniques Introduction, Methods, Results, Discussion, Acknowledgments, References, Abstract. Students are also introduced to online submissions, cover letters and review processes. Besides that, students are also trained to prepare scientific presentations in English, both oral and poster.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-

reading list	*Main :* *1. McMillan VE 2001. Writing papers in the Biological Sciences. Bedford/St. Martins. New York.* *2. Day RA, 1998. How to write & publish a scientific paper. Oryx Press. Arizona* *Supporters:* *1. Hailman JP, Strier KB, 2006. Planning, Proposing, and Presenting Science Effectively, 2nd Edition. Cambridge UniversityPress. Cambridge.*

Biodiversity Perspective

CourseID	*BIO61118*
Course name	*Biodiversity Perspective*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Mairawita, M.Sc* *Dr. Nurmiati* *Dr. Henny Herwina, M.Sc* *Silmi Yusri Rahmadani, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*Compulsory*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*45,33*
credit points	*1 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Utilization of biodiversity as an alternative food source 2. Utilization of biodiversity as a source of medicines 3. Utilization of biodiversity as a source of bioenergy 4. Utilization of biodiversity as a source of biofertilizer 5. Biodiversity and Bioremediation 6. Biological control
Content	*MK Biodiversity Perspective is a course that discusses the study of the application of biological sciences in the utilization of biodiversity as a source of functional food, medicine, bioenergy, and fertilizer. bioremediation and biological agents.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	-

Ecotourism

CourseID	*BIO60274*
Course name	*ecotourism*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Prof. Dr. Erizal Mukhtar, MSc* *Dr. Wilson Novarino, MSc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*To take this course, students are required to have taken the Biology Perspective, Biprospection, Animal Systematics and Animal Ecology and Plant Ecology courses.*
Course objectives/intended learning outcomes	a. Students understand the basic understanding of ecotourism and its aspects supporters. b. Able to develop the benefits and various services of natural resources and environment c. Able to plan, develop and manage ecotourism; formulate programs, Standard operating procedures, Code of Conduct, risk assessments, and Contingency plans.
Content	*Ecotourism Course (BIO 4421) is an elective course in the Biology Study Program, Faculty of Mathematics and Natural Sciences, Andalas University. This course consists of 3 credits, and is given in semester VI (Even).*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Drumm A & A Moore. 2002. An Introduction to Ecotourism Planning Vol 1.The Nature Conservancy, Arlington, Virginia, USA* *2. Fennell, DA and Dowling, RK 2003. Ecotourism Policy and Planning. CABI Publishing. UK* *3. Weaver DB. 2001. The Encyclopedy of Ecotourism. CAB International* *4. Wood, ME. 2002. Ecotourism. Principles, Practices and Policy for Sustainability. UNEP* *5. UU no. 10 of 2009 concerning tourism.* *6. Related journals, reports, brochures*

Seed Physiology

CourseID	*BIO60224*
Course name	*Seed Physiology*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Drs. Suwirmen, MS* *Dr. M. Idris, M.Sc.*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*The students have previously completed the Fundamental Biology, Plant anatomy (Plant structure and development), Plant Physiology courses.*
Course objectives/intended learning outcomes	*- PI-1.2 Show an honest attitude in exams, report scientific data and information, and include sources of literacy that can be accounted for.* *- PI-1.3 Have a high curiosity about biology and other relevant sciences.* *- PI-3.4 Able to master the concepts, principles and application of biological knowledge in the fields of food, health, environment (biological), and biological resources in the management and utilization of biological and environmental resources.* *- PI-3.5 Able to master the concepts, principles and applications of biotechnology in studying, developing and conserving biological resources.* *- PI-5.1 Able to solve science and technology problems in the field of management and utilization of biological resources through the principles of systematic organizing, predicting, analyzing information and biological materials as well as modulating cell structure and function and applying relevant technology.* *- PI-7.1 Able to develop cooperation in carrying out group assignments in fulfilling learning outcomes.* *- PI-7.2 Able to apply creative, critical, analytical, logical, problem solving, case handling, and project thinking to get results in the context of the development or application of biology.* *- PI-8.1 Able to manage learning independently and in groups.*
Content	*- Sub-CPMK 1: Introduction to the basic concepts of seed physiology* *- Sub-CPMK 2: Seed growth and development* *- Sub-CPMK 3: Process of seed storage, physiology, and biochemistry of seed deterioration for germination process* *- Sub-CPMK 4: Phytohormones in seeds and metabolism of seed germination* *- Sub-CPMK 5: Seed dormancy and how to solve the problem related to seed dormancy* *- Sub-CPMK 6: Factors affecting seed germination and its metabolism* *- Sub-CPMK 7: Type of seed and its dispersal process in nature* *- Sub-CPMK 8: Parameters for observation in seed physiology research*

	- Sub-CPMK 9: State of the art and current development in the research of seed physiology *- Sub-CPMK 10: Small project - experiment in seed physiology.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	*-*
reading list	*1. Benech-Arnold & Sanchez (2004): Handbook of Seed Physiology: Applications to Agriculture* *2. Schmidt (2007): Tropical Forest Seed* *3. Bradford & Nanogaki (2007): Seed development, dormancy and germination* *4. Adkins, Navie & Ashmore (2007): Seeds: Biology, Development and Ecology* *5. Sabelli (2012): Seed Development: OMICS Technologies toward Improvement of Seed Quality and Crop Yield: OMICS in Seed Biology* *6. Bewley et al (2013): Seeds: Physiology of Development, Germination and Dormancy* *7. Scientific journals (national and international) related to seed physiology*

Phytohormone

CourseID	*BIO60225*
Course name	*Phytohormone*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Dr. Zozy Aneloi Noli* *M. Idris MSc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*To take this course, students are required to have taken the Biological Perspective, Biprospection, Biochemistry and Plant Physiology courses.*
Course objectives/intended learning outcomes	*a. Students understand the basic meaning of Phytohormones.* *b. Able to develop the benefits and various services of natural resources and the environment*
Content	*Phytohormones Course (BIO 4309) is an elective course in the Biology Study Program, Faculty of Mathematics and Natural Sciences, Andalas University. This course consists of 3 credits, and is given in semester VI (Even). To take this course, students are required to have taken the Biological Perspective, Biprospection, Biochemistry and Plant Physiology courses.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*-Davies PJ. 2004. Plant Hormones, Biosynthesis, Signal Transduction, Action. Kluwer Academic Publishers. Dordrecht/Boston/London.* *- Jackson, JF and HF Linsliens. 2002. Testing for genetic manipulation in Plants, Springer, Heidelberg* *- Salisbury. FB and CW Ross. 1995. Plant Physiology. ITB. Bandung* *- Related journals and reports*

Phytomicrobiology

CourseID	*BIO60237*
Course name	*Phytomicrobiology*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Dr. Feskaharny Alamsjah* *Dr. Anthony Agustin*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Introduction (Definitions and basic concepts of Phytomicrobiology and Phytomicrobiology supporting science)* *2. Indigenous microorganisms that are beneficial to plants* *3. Phosphate solubilizing, nitrogen fixing bacteria and fungi* *4. Bacteria, fungi and actinomycetes that have the potential to produce primary and secondary metabolites that are beneficial to plants* *5. Microorganisms that produce phytohormones, siderophores* *6. Endophytic microorganisms* *7. Harmful microorganisms (plant pathogens)* *8. Microorganisms that act as biological agents* *9. Microorganisms that act as biocontrol agents* *10. Methods for separating and studying microbes in plant tissues* *11. Techniques for inoculation of microorganisms that have the potential to be used for its application.* *12. State of the art*
Content	-
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*MAIN* *1. Madigan, MT, JM Martinko and J. Parker. 2000. Biology of Microorganisms. 9th Ed. Prentice Hall International, Inc., New Jersey.* *2. Paul, EA and EE Clark. 2007. Soil Microbiology, Ecology and Biochemistry. Academic Press. Elsivier Inc., Burlington.* *3. Metting, FB 1993. Soil Microbial Ecology. Applications in Agriculture and Environment Management. Marcel Decker. Inc. New York.* *SUPPORTERS* *1. Agrios GN 2005. Plant Pathology (fifth edition). Elsevier Pub. Amsterdam.* *2. Ainsworth GC 1981. Introduction to the History of Plant pathology. University of Cambridge.* *3. Semangun H. 1996. Introduction to Plant Diseases. GAMA Univ. press. Yogyakarta.* *4. Related journals and proceedings*

Plant Photobiology

CourseID	*BIO6 0226*
Course name	*Plant Photobiology*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Dr. _ Suwirmen MS* *Dr. M. Idris M.Si*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*2.67 ECTS* *1 credit = 100 minutes x 16 meetings* *= 1600 minutes = 26.66 hours* *3 credits = 3 x 26.66 hours = 79.98 hours* *Workload = 79.98 hours / 30 hours = 2.67 ECTS*
credit points	*3 credit points*
Required and recommended prerequisites for joining the course	*The students have previously completed the Fundamental Biology, Biophysics, Cell and Molecular Biology, Plant Physiology courses.*
Course objectives/intended learning outcomes	*Intended Learning Outcome (ILO) based on Bachelor of Biology Program curriculum for the course in Plant Photobiology:* *- ILO1: Having the University's values, ethical codes, and biological ethics* *- ILO3: Mastering and applying the concept and principle of biological theory along with its uniqueness in biodiversity and bio- conservation* *- ILO5: Being able in using instruments and related methods in observing and measuring biological objects* *- ILO7: Possessing domain of soft skills in team-work, communication, critical, creative, and analytical thinking* *- ILO 8: Being able to process learning sources into learning materials and scientific information.* *Performance Indicator (PI) based on Bachelor of Biology Program curriculum for the course in Plant Photobiology:* *- PI-1.2 Demonstrate honesty in exams, report data and scientific information, and include literacy sources who can be held accountable.* *- PI-1.3 Have a high curiosity about science biology and other relevant sciences.* *- PI-3.4 Able to master concepts, principles and application of biological knowledge in the field of food, health, environment (biological), and biological resources in the management and utilization of biological resources as well as the environment.* *- PI-3.5 Able to master the concepts, principles, and application of biotechnology in studying, developing and conserve biological resources.* *- PI-5.1 Able to solve science and technology problems in the field management and utilization of biological resources through systematic organizing principles, predicting, analyze information and biological materials as well as modulation cell structure and function as well as application of relevant technology*

	PI-7.1 Able to develop internal cooperation doing group assignments in fulfilling learning achievement. *- PI-7.2 Able to apply creative, critical, analytical thinking, logical, problem solving, case handling, and projects to get results in a development context or biology applications.* *- PI-8.1 Able to manage learning effectively independently and in groups.*
Content	*- Sub-CPMK 1: Introduction to the basic concepts of plant photobiology* *- Sub-CPMK 2: Photosynthesis, the basic and advanced concept, and its application* *- Sub-CPMK 3: Photomorphogenesis, the basic concepts in plants morphogenesis and photoreceptors* *- Sub-CPMK 4: Phototropism, the basic concept and application of phototropism in the study of plant responses to light environmental conditions* *- Sub-CPMK 5: Photoperiodism, flowering control in plants, short- and long-day plants* *- Sub-CPMK 6: Circadian rhythm and what is behind this plant response to the light condition.* *- Sub-CPMK 7: State of the arts in plant photobiology (artificial light controlling in improving crops production, manipulation of photoreceptors work in production of secondary metabolites in plants)* *- Sub-CPMK 8: Special topics for 2021 – Stomata movement, why it is happening and what its relation with light controlling plant growth and development*
Examination forms	*Lectures (student activity in group discussions, quizzes)* *Examination (middle-term exam, final exam)* *Independent studies (assignments)*
Study and examination requirements	-
reading list	*1. Singhal, Renger, Sopory, Irrgang & Govindjee (1999): Concept in Photobiology, Photosynthesis and Photomorphogenesis* *2. Wada, Shimazaki & Iino (2005): Light Sensing in Plants* *3. Whitelam & Halliday (2007): Light and Plant Development* *4. Gilroy & Masson (2008): Plant Tropisms* *5. Bjorn (2015): Photobiology the Science of Light and Life* *6. Lee & Smith: www.photobiology.info* *7. Scientific journals*

Radiobiology

CourseID	*BIO60 2 48*
Course name	*Radiobiology*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Prof. Dr. Dewi Imelda Roesma, M.Sc* *Dr. Tesri Maideliza, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-1: Able to master radiobiology concepts and their applications in other fields* *Practicum (CPP) CPMk-1: Able to explain and understand radiation sources and their utilization* *CPMk-2: Able to explain and understand the basics of radiation physics* *CPMk-3: Able to explain and understand the interaction of radiation with matter* *CPMk-4: Able to explain and understand Dosimetry and radiation measurement tools* *CPMk-5: Able to explain and understand how to control radiation and work with radioisotopes* *CPMk-6: Able to explain and understand the principle of the autoradiographic process* *CPMk-7: Able to explain and understand the dangers of radiation to humans* *CPMk-8: Able to explain and understand the effects of radiation on cells* *CPMk-9: Able to explain and understand the effects of radiation on nucleic acids, nucleoproteins and complexes* *proteins* *CPMk-10: Able to explain and understand the technique of transporting radioactive substances* *CPMk-11: Able to explain and understand the provisions for the use of radioactive substances* *CPMk-12: Able to explain and understand isotope applications in various fields* *CPMk-13: Able to explain and understand radiobiology science and technology from the latest references through special topics*
Content	*The Radiobiology course is designed so that students are able to understand, explain and utilize radioisotopes through lectures which include knowledge of radiation sources, basics of radiation physics, radiation interactions with materials, Dosimetry and radiation measuring devices, Ways of controlling radiation and working with radioisotopes, Principles of the process otoradiography, Radiation*

	hazard to humans, Techniques for transporting radioactive substances, Provisions for the use of radioactive substances and Applications of isotopes in various fields.
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Alatas Zubaidah, Rismiyanto, et al. 2000. Nuclear Smart Book. BATAN. Jakarta. 2. IAEA. 1973. Radiation Protection Procedures. Safety Series no. 38. International Atomic Energy Agency. Vienna. 3. Wang. CH, Willis, WD Loveland. 1975. Radiotracer Methodology in biological environmental and physical science. Prentice Hall 4. Vose. PB1980. Introduction to nuclear techniques in agronomy and plant biology. Pergamon-Oxford 5. Amsyari, F. 1989. Low-dose radiation and its effects on health. Airlangga-Surabaya. Supporters:

Biological Illustration Design

CourseID	*BIO60 2 85*
Course name	*BIOLOGICAL ILLUSTRATION DESIGN*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Prof. Syamsuardi* *Robby Jannatan, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-3.4: Able to master the concepts, principles, and application of biological knowledge in the fields of food, health, environment (biological), and biological resources in the management and utilization of biological resources and the environment.* *CPMk-1: Mastering the scope of biological illustrations and their use for scientific purposes* *CPMk-2: Able to identify and use tools and materials, as well as basic techniques in making biological illustrations* *CPMk-3: Able to illustrate plants and animals according to scientific standards with various illustration techniques* *CPMk-4: Able to illustrate parts of animal anatomy and histology according to scientific standards with various illustration techniques* *CPMk-5: Able to transform biological processes and descriptions in the form of illustrations for scientific purposes*
Content	*The Biology Illustration Design Course examines the preparation, process and application of illustrations of living things for scientific purposes commonly used for identification of living things, publication of scientific papers, etc.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Zweifel, FW (2007). A handbook of biological illustration. University of ChicagoPress. 2. Holmgren, NH, & Angell, B. (1986). Botanical illustration: preparation for publication 3. Young, RK (1989). Illustrating Science: Standards for Publication. JAMA, 262(14), 2022-2023. 4. Hodges, ER (Ed.). (2003). The guild handbook of scientific illustration. John Wiley & Sons. 5. Wood, P. (1994). Scientific illustration: A guide to biological, zoological, and medical rendering techniques, design, printing, and displays. John Wiley & Sons.

7TH SEMESTER
Forensic Biology

CourseID	*BIO60272*
Course name	*Forensic Biology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Syamsuardi, MSc.* *Dr. Tesri Maideliza, M.Sc.* *Dr. Nurainas, MSc.* *Dr. Feskarny Alamsyah* *Dr. Rest Rahayu* *Dr. Nofrita*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. Be able to define and limit forensic biology 2. Able to recognize macro and micro morphology characteristics supports forensic botany (Palinology) 3. Be able to describe the supporting potential anatomical characters forensic botany 4. Be able to identify psychotropic plants 5. Be able to recognize potential characteristics of supporting insects forensics 6. Assement of insects in forensic cases 7. Potential characteristics of forensic supporting microbes 8. Potential characteristics of forensic supporting diatoms 9. Assessment of diatoms in forensic cases 10. Molecular character supports forensic Biology 11. Case studies
Content	*Forensic Biology MK discusses the character of biology in supporting the diagnosis of forensic cases. This MK material includes macro and micro characteristics Morphology supports forensic botany (Palinology), ...*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	-

Soil Biology

CourseID	*BIO60201*
Course name	*Soil Biology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Jabang Nurdin, M.Sc* *Dr. Henny Herwina, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	1. Introduction which will include; History, Definition and Classification, Characteristics typical Animal 2. Soil animals and their environment (Soil animals, Habitat and Habitat, scope and environment). 3. Colembolla (Colembolla, Homoptera and Spring tail). 4. Arachnoidea, and Acarina (Arachnoidea, Acarina and classification, and Mites). 5. Earthworms, ecology and conservation (Earthworms, Worm ecology soil, earthworms as soil bioameliorant, role of ecosystem earthworms). 6. Soil animal from IBOY Trainung. 7. Key to soil animals. 8. Thermic and ants. 9. Collecting soil animals in the field.
Content	*In general, SOIL BIOLOGY material includes Introduction; Perrfective Soil Biology, Soil Ecology, Types and Classification of Soil Biota, Soil Biodiversity and Soil Organisms, Soil Animals, Interactions between Soil Animal Species, Soil Biological Factors and Soil Biology Management Strategies. This lecture is very useful for students in order to reflect on Soil Biology and its application to everyday life, and health and cultivation.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-

reading list	1. *Carter, A., EA Hayes and LM Laukulich. 1980. Earthworms as indicators of changes in heavy metal content in agricultural soil.* 2. *Esparza-Mascarus, M.A. 1988. Acetylene reduction and indole acetic acid production by azospirillum isolate from cactaceous plants. Plants and soil 106:91-95.* 3. *Foth. 1984. Fundamentals of soil science. John Wiley & Sons, New York. 478 p.m.* 4. *Hanafiah, KA, I. Anas, Napoleon, A. & N. Goffar. 2005. Soil biology: Ecology & soil microbiology. PT Raja Grafindo Persada. Jakarta.* 5. *Tate III, RL 1987. Soil organic matter: Biological and ecoligical effects. A Wiley-Intersci. Publ. John Wiley & Sons. New York. p: 291.* 6. *Tisdale, SLWL Nelson and JD Beaton. 1985. Soil Fertility and Fertilizers. 4th ed. MacMillan Publ. Co. New York.*

Honey Bee Cultivation

CourseID	*BIO60273*
Course name	*Honey Bee Cultivation*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Henny Herwina, M.Sc* *Prof. Dr. Dahelmi* *Dr. Mairawita*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-2: Demonstrate honesty in exams, report scientific data and information, and include sources* *responsible literacy.* *PI-4: Show full responsibility for assigned tasks* *PI-5: Have confidence in presenting theories and concepts as well as empirical facts in scientific forums.* *PI-6: Be polite in appearance and ways of communicating according to the student code of ethics* *PI-4: Able to master the concepts, principles and application of biological knowledge in the fields of food, health,* *environment (biological), and biological resources in the management and utilization of biological resources as well as* *environment.* *CPMk-1: Concept and introduction to Bees* *CPMk-2: Cultivation and Marketing Prospect Concepts* *CPMk-3: Site Preparation Concept and Vegetation* *CPMk-4: Basic Beekeeping Techniques* *CPMk-5: Colony placement, colony maintenance and propagation* *CPMk-6: Scope of Post-harvest Technology* *CPMk-7: Bee Product Downstreaming and Marketing Strategy* *PI-4: Able to master the concepts, principles and application of biological knowledge in the fields of food, health,* *environment (biological), and biological resources in the management and utilization of biological resources as well as* *environment.* *CPMk-1: Concept and introduction to Bees* *CPMk-2: Cultivation and Marketing Prospect Concepts* *CPMk-3: Site Preparation Concept and Vegetation* *CPMk-4: Basic Beekeeping Techniques* *CPMk-5: Colony placement, colony maintenance and propagation* *CPMk-6: Scope of Post-harvest Technology* *CPMk-7: Bee Product Downstreaming and Marketing Strategy* *PI-2: Able to apply creative thinking, critical thinking, analytical thinking, logical reasoning, solving*

	problem, case handling, and project to get results in the context of development or implementation *biology.* *PI-3: Play an active role both orally and in writing in assignments and subject group discussions.*
Content	*Honey Bee Cultivation MK discusses the concept of bee interests as one of the dominant pollinators and plays an important role in the balance of nature and its role for the welfare of human life, the concept of beekeeping management principles in accordance with national and international honey beekeeping standards, the principle of making Apis stup and Trigona which is oriented towards life skills, work skills and management for beekeeping from upstream to downstream.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main:* *1. Chapman, RF 1969. The Insects Structure and Function. Macmillan India Ltd. Bangalore. pp 919.* *2. Peterson, A. 1955. A Manual of Entomological Techniques. Ohio State University. Columbus, Ohio. pp. 360* *3. Ruttner, F. 1988. Biogeoraphy and taxonomy of honeybees. Springer-Verlag. Berlin, Heidelberg.* *4. Varley, 0. C., 0. R. Gradwell, and MP Hassell. 1978. Insect Population Ecology an Analytical Approach Black well Scientific Publications. Osney Mead, Oxford.* *Supporters:* *1. Borror, Triplehorn and Johnson. 1992. Introduction to Lessons Insect. Gadjah Mada UniversityPress. Yogyakarta. 1083 pp.* *2. HMS Kaban. 2008. Regulation of the Minister of Forestry concerning the direction of the national species conservation strategy 2008 – 2018.Minister of Forestry. Jakarta* *3. AJA Stewart, TR New and OT Lewis. Insect conservation biology. The Royal Entomological Society 2007. Oxford, UK.* *4. Richard BP, J. Supriana, M. Indrawan and K. Kramadibrata. 1998. Conservation biology. Indonesian Torch Foundation. Jakarta.* *5. Michener, CD 1974. The social behavior of the bees a comparative study. The Belknap Press of Harvard University. Cambridge. Massachusetts.* *6. Jasmi, Salmah S, Dahelmi, Syamsuardi. 2014a. The fluctuation of colony population Apis cerana Fabr. (Hymenoptera: Apidae) in polyculture plantations in West Sumatra. International Journal of Science and Research 3 (3):849-855.* *7. Physical. 2017. Diversity and blooming season of food sources plant of Apis cerana (Hymenoptera: Apidae) in polyculture plantation in West Sumatra, Indonesia. Biodiversity 18 (1): 34-40.* *8. Jasmi,, D. Putra, Syarifuddin. 2018. Apis cerana fabr honey bee breeding efforts. Wild in a coconut plantation in Padang Pariaman, West Sumatra. National seminar paper for the Indonesian Biodiversity Society in Bandung on 06 July 2018.* *9. Other related books and journals*

Animal Ecophysiology

CourseID	*BIO60217*
Course name	*Animal Ecophysiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Muhammad Syukri Fadil M.Sc* *Dr. Rest Rahayu*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-1: Able to master the theoretical concepts of animal ecophysiology* *CPMk-1: Be able to explain terms and concepts as well as the scope of animal ecophysiology* *CPMk-2: Able to explain the environment and environmental components* *CPMk-3: Able to explain ecotoxicology* *CPMk-4: Be able to explain about homeostasis* *CPMk-5: Able to explain about thermoregulation* *CPMk-6: Be able to explain osmoregulation* *CPMk-7: Able to explain stress and physiological adaptation* *CPMk-8: Able to explain the Ecophysiology of land animals* *CPMk-9: Able to explain the Ecophysiology of aquatic animals* *CPMk-10: Be able to explain techniques in animal ecophysiology*
Content	*Vertebrate Pathophysiology course, studies the physiological disorders that occur in the body of vertebrate animals, especially livestock and especially laboratory test animals used for animal physiology research*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	

Benthic Ecology

CourseID	*BIO60202*
Course name	*Benthic Ecology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*dr. Izmiarti, MS #* *Dr. Jabang Nurdin* *Dr. Nofrita*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works. Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Be able to explain benthic terminology, differences between zoobenthos and phytobenthos, the role of benthic in aquatic ecosystems, the potential of benthic for the benefit of aquaculture* *2. Be able to explain the Habitat and Bentos communities in Lotic waters* *3. Be able to explain benthic habitats and communities in tapering waters* *4. Be able to explain the habitat and benthic communities in the sea* *5. Be able to explain the morphological adaptation of benthic animals to aquatic habitats* *6. Be able to explain the physiological adaptation of benthic animals to aquatic habitats* *7. Be able to explain the behavioral adaptations of benthic animals to aquatic habitats.* *8. Be able to explain the food and eating mechanism of benthic animals* *9. Be able to explain the dynamics of the benthic population.* *10. Be able to explain benthic research techniques* *11. Be able to identify benthic animals* *12. Able to analyze benthic community* *13. Able to diagnose river health/determine river water quality by using specific index*
Content	*In the Benthic Ecology course, students learn the terminology of benthic, zoobenthos and phytobenthic, the role of benthic in aquatic ecosystems, benthic potential for aquaculture purposes, habitat and benthic communities in lotic, tapering and marine waters, adaptation of morphology, physiology and behavior of benthic animals to their habitat aquatic, food and feeding mechanisms of benthic animals, dynamics of benthic populations, taxonomy of benthic animals, benthic research techniques, analysis of benthic animal communities, diagnosis of river environmental health and determining river water quality with specific indexes.*

Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Cole, GA 1994. Textbook of Limnology. fourth ed. Waveland, Presh, Inc.* *2. Barnes, SSR and RN Hughes. 1999. An Introduction to Marine Ecology. Third ed. Blackwell Science. Ltd. Great Britain* *3. Giller, PS and B. Malmqvist. 2003. Biology of Streams and Rivers: Biology of habitat. Oxford UniversityPress. Great Britain.* *4. Rossano, EM 1966. Diagnosis of Stream Environmental with IBI-J (in Japanese and English). Museum of Streams and Lakes. Sankaido Publisher, Tokyo, Japan.* *5. Rosenberg, DM and VH Resh. 1993. Freshwater Biomonitoring and Benthic macroinvertebrates. Chapman & Hall. New York. London.* *6. Michael, P. 1986. Ecological Methods for Field and Laboratory Investigation. Tata MacGrawHIll Publishing Limited. New Delhi* *7. Scientific journals and other forms of publication*

Forest Ecology

CourseID	*BIO4414*
Course name	*Forest Ecology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Erizal Mukhtar* *Dr. Solfiyeni MS*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works. Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Students understand the basic understanding of forest ecology and its supporting aspects* *2. Able to develop the benefits and various services of natural resources and the environment* *3. Have the ability to consume thoughts and ideas orally and in writing*
Content	*Forest Ecology Course (BIO 4414) is an elective course in the Biology Study Program, Faculty of Mathematics and Natural Sciences, Andalas University. This course consists of 3 credits, and is given in semester VI (Even). To take this course, students are required to have taken Animal Ecology and Plant Ecology courses.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Barnes, BV; DR Zak; SR Denton and SHSpurr. 1998. Forest Ecology. John Wiley and Sons. 792p.* *2. Indriyanto. 2006. Forest Ecology. Script Earth. 210p.* *3. Jacobs, M. The tropical Rain Forest. A first encounter. Springer-Verlag. 285p 295.* *4. Kobayashi, S; JW Turnbull; T. Toma; T. Mori and NMNA Majid. 2001. Rehabilitation of Degradation Tropical Forest Ecosystems. 226p.* *5. Montagnini, F and CF Jordan. 2005. Tropical Forest Ecology. The Basic for Conservation and Management. Springer. 295p.* *6. Osborne, PL 2000. Tropical Ecosystems and Ecological Concept. Cambridge UniversityPress. 464p* *7. Shiver, BD and BE Borders. 1995. Sampling Technique for Forest Resource Inventory. John Wiley & sons. 368p.* *8. Sutherland, WJ 1996. Ecological Census Techniques. A Handbook. Cambridge UniversityPress. 336p* *9. Turner, IM 2005. The Ecology of Trees in the Tropical Rain Forest. Cambridge* *10. University Press. 290p 10. Valk, AG 2009. Forest Ecology. Recent Advances in Plant Ecology. Springer Science. USA.* *11. Whitmore, TC 1998. An Introduction to Tropical Rain Forests. Oxford UniversityPress. 282p.*

Fisheries Biology

CourseID	*BIO4404*
Course name	*Fisheries Biology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Ir. Indra Junaidi Zakaria, M.Sc* *Dr. Syaifullah* *Dr. Ir. Efrizal, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works, Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	1. *Students are able to understand and explain the basic concepts of fisheries biology and its relation to ichthyology* 2. *Students are able to understand and explain the concept of sexuality in fish* 3. *Students understand and are able to understand and explain the level of maturity of the gonads in fish* 4. *Students are able to understand and explain the concept of fecundity* 5. *Students are able to understand and explain the concept of ruaya Fish* 6. *Students are able to understand and explain the concept of spawning in fish* 7. *Students are able to understand and explain the beginning of the life cycle* 8. *Students are able to understand and explain the habits and ways of eating fish* 9. *Students are able to understand and explain competition and predation of fish* 10. *Students can understand explaining and understanding how to determine the age of fish* 11. *Students understand and understand the concept of fish population dynamics*
Content	*This is an elective course that discusses the history of fish life and the dynamics of fish populations. The life history of fish discussed includes physiological processes, reproduction and sexuality, growth, eating habits, fish behavior and an introduction to fish population dynamics.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	*-*
reading list	*Efendi, MI, 1997. Fisheries Biology. Nusatama Library Foundation* *Gulland, JA 1988. Fish Stock Assessment; A Maual of Basic Methods* *King, M. 1995. Fisheries Biology, Assessment and Management* *Purdom, CE 1973. Genetics and Fish Breeding* *Wotton, RJ and Potts, GW 1984. Fish Reproduction Strategies and Tactics*

Rural Ecology

CourseID	*BIO4418*
Course name	*Rural Ecology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Erizal Mukhtar, M.Sc* *Drs. Zuhri Syam, MP*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	1. *Students understand the basic understanding of rural ecology and its supporting aspects* 2. *Able to develop the benefits and various services of natural resources and the environment* 3. *Able to plan, develop and manage rural ecology; formulating programs, Standard operating procedures, Code of Conduct, Risk assessment, and Contingency plans.*
Content	*Rural Ecology Course (BIO 4418) is an elective course in the Biology Study Program, Faculty of Mathematics and Natural Sciences, Andalas University. This course consists of 3 credits, and is given in semester VI (Even). To take this course, students are required to have taken Animal Ecology and Plant Ecology courses.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. *Allison, SK 2012. Ecological Restoration and Environmental Change. Earthscan from Routledge. 252 pages* 2. *Kurtović, M. 2013. Rural Ecology. University of Sarajevo. 264 pages* 3. *Nuberg, I; B. George and R. Reid. 2009. Agroforestry for Natural Resource Management. CSIRO Publishing* 4. *Göltenboth, F; KH Timothy; PP Milan and J. Margraf. 2006. Ecology of Insular Southeast Asia. Elsevier.*

Freshwater Ecology

CourseID	*BIO60204*
Course name	*Freshwater Ecology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*dr. Izmiarti, M.S* *Dr. Nofrita M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n,Lab works, Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Be able to explain the terminology of freshwater ecology, the importance of freshwater ecology in managing aquatic systems and aquaculture of aquatic animals, the history of the development of freshwater ecology* *2. Be able to explain the typology of fresh waters and their physical characteristics and zoning* *3. Be able to explain lake morphometric parameters and their measurements* *4. Be able to explain the physical properties of water and the physical factors of waters* *5. Be able to explain the chemical factors of waters* *6. Be able to explain the types of aquatic organisms* *7. Be able to explain food chains and food webs in freshwater ecosystems* *8. Be able to explain research techniques in the field of Aquatic Ecology and be able to analyze ecological data* *9. Be able to explain fresh water pollution* *10. Be able to explain trophic state and eutrophication process* *11. Be able to explain monitoring of the aquatic environment* *12. Be able to explain the utilization and management of freshwater resources*
Content	*In the Freshwater Ecology course, students learn terminology, the importance of Freshwater Ecology in managing aquatic systems and aquaculture of aquatic animals, historical developments in Freshwater Ecology; fresh water types and zoning; lake morphometry; Physical, physical and chemical properties of water and their effects on aquatic biota; Freshwater Organisms; Food chains and webs in Freshwater ecosystems; Fresh water pollution; Trophic state and eutrophication; Monitoring of the aquatic environment as well as Utilization and management of aquatic resources*
Examination forms	*oral presentation, essay, written test .*

Study and examination requirements	-
reading list	*1. Allison, SK 2012. Ecological Restoration and Environmental Change. Earthscan from Routledge. 252 pages* *2. Kurtović, M. 2013. Rural Ecology. University of Sarajevo. 264 pages* *3. Nuberg, I; B. George and R. Reid. 2009. Agroforestry for Natural Resource Management. CSIRO Publishing* *4. Göltenboth, F; KH Timothy; PP Milan and J. Margraf. 2006. Ecology of Insular Southeast Asia. Elsevier.*

Invasive Plant Ecology

CourseID	*BIO4417*
Course name	*Invasive Plant Ecology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Solfiyeni MP* *Zuhri Syam MP*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1) Be able to explain the concepts of Weed Science* *2) Be able to explain about Weed Biology.* *3) Be able to explain Weed Ecology* *4) Able to explain the Physiology of Weeds.* *5) Be able to explain about Allelopathy* *6) Be able to explain the technique of releasing allelopathy compounds* *7) Be able to explain the concept of weeds and weeds and their management* *8) Be able to explain weed control techniques* *9) Able to explain herbicides*
Content	*In this course, students learn about the basic concepts and understanding of weed science material. In general, weed science material includes introduction, weed science concepts, weed biology, weed ecology, weed physiology, important weeds on agricultural land, invasive plants and their management, basic weed control, herbicides*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	*-*
reading list	*- Akobundu,IO 1987. Weed Science in The Tropics A Wiley. Interscience. New York.* *- Aldrich. RJ 1984. Weed Crop Ecology, Briton. Massachusetts.* *- Duke. SO 1987. Weed Physiology. Reproduction and Ecophysiology. CRC. Press. Florida.* *- - Moenandir. J. 1993. Weed Science in Agricultural Systems PT. Rajawali Grafindo. Jakarta.* *- Sukman Y. and Yakup 1991. Weeds and Control Techniques. Eagle. Jakarta.*

Applied Entomology

CourseID	*BIO60260*
Course name	*Applied Entomology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Dahelmi* *Dr. Henny Herwina* *Dr. Mairawita*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-4: Able to master the principles and concepts of conservation at the level of tropical ecosystems, species, and genetics sustainable development* *CPMk-1: able to describe the role of insects in forest ecosystems,* *CPMk-2: able to explain the role of insects in aquatic ecosystems* *CPMk-3: able to explain the role of insects in agricultural land* *CPMk-4: able to explain the role of insects in the livestock sector* *CPMk-5: able to explain roles in forensics* *CPMk-6: able to explain the role of insects in settlements* *CPMk-7: able to explain the use of insects for finance and ecotourism* *CPMk-8: able to explain techniques and methods of using insects for financial gain*
Content	*MK Applied Entomology discusses the role of insects in forest ecosystems, waters, agricultural land, the field of forensics. Insects as predators, parasitoids. Insects as decomposers, interests and insects in the field of animal husbandry. Techniques for controlling insect pests on agricultural land and settlements. Use of insects for ecotourism and finance.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Byrd, JH and Castner, JL (editors). 2001. FORENSIC ENTOMOLOGY. The Utility of Arthropods in Legal Investigations.* *CRC Press. Boca Raton London New York Washington, DC* *2. Gary R. Mullen., Lance A. Durden. 2019. Medical and Veterinary Entomology. Elsevier Inc* *3. JAPIR, R., DAMIT, F and CHUNG, AYC 2021. Diversity of Insects in the Tropical Rain Forest of Sabah Department of Forestry of Sabah.* *4. Michael R. Wagner, MR, Cobbinah JR and Bosu, PP 2008. Forest Entomology in West Tropical Africa: Forest Insects of* *Ghana. Springer. Netherlands* *5. Pfadt, ER 1985. Fundamentals of Applied Entomology, 4th Ed. The McMillan Co., New York*

Entomology

CourseID	*BIO522*
Course name	*Entomology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Dahelmi MS* *Dr. Mairawita, M.Sc* *Dr. Henny Herwina, MS* *Dr. Rest Rahayu*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*Given the link between basic science and its application, students who will take this course are required to have taken Invertebrate Animal Systematics, Animal Physiology, and Insect Ecology courses.*
Course objectives/intended learning outcomes	*1. Understand the meaning of entomology, about insects and their way of life* *2. Be able to explain the relationship between insects and humans* *3. Able to understand the morphology of insects* *4. Able to understand the shape and parts of the chest (thorax) and stomach (abdomen) of insects.* *5. Be able to explain the development and metamorphosis of insects* *6. Be able to explain the organ systems of insects* *7. Be able to explain the organ systems of insects*
Content	*Entomology course (BIO 522) is an elective course in the Biology Study Program, the Department of Biology, FMIPA, Andalas University. This course consists of 3 credits, and is given in odd and even semesters. To take this course, students are required to have taken the Systematics of Invertebrate Animals, Insect Ecology and other supporting courses.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	*-*
reading list	*1. Allison, SK 2012. Ecological Restoration and Environmental Change. Earthscan from Routledge. 252 pages* *2. Kurtović, M. 2013. Rural Ecology. University of Sarajevo. 264 pages* *3. Nuberg, I; B. George and R. Reid. 2009. Agroforestry for Natural Resource Management. CSIRO Publishing* *4. Göltenboth, F; KH Timothy; PP Milan and J. Margraf. 2006. Ecology of Insular Southeast Asia. Elsevier.*

Ethnobiology

CourseID	*BIO60276*
Course name	*Ethnobiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Dahelmi MS.* *Dr. Nurainas* *Dr. Wilson Novarino*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*90.66*
credit points	*2 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*Able to master the concept of ethnic/human interaction in the utilization and management of biodiversity, analyze it according to the development of science and technology*
Content	*This course is a compulsory MK in the Bachelor of Biology Study Program, Department of Biology, Andalas University FMIPA which consists of 2 credits given in odd semesters. The scope of this MK regarding concepts in Ethnobiology includes Ethnobotany, ethnozoology, ethnomycology, ethnoecology, ethnotaxonomy, ethnopharmacology/ethnomedicine; the relationship between ethnobiology and related sciences; utilization of plants for other purposes such as ritual purposes, symbolic and natural dyes; ethnobiology qualitative and quantitative approaches; techniques of data collection and analysis of ethnobiological data.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Albuquerque, UP et al., 2014, Methods and techniques in Ethnobiology and ethnoecology. Humane Press. Brazil* *2. Young, KJ, 2006. The Green World Ethnobotany. Chelsea house publishers, New york* *3. Cuningham, AB, 2001. Applied ethnobotany, People, wild plant uses and conseraution. Earthscan publications Ltd. London.* *4. Van Huis, A et al. 2013. Edible insects: Future prospects for food and feed security. FAO Fiat Panis* *Supporters:* *1. Heyne, K., 1987. Indonesian useful plants. Forestry Research and Development Agency, Ministry of Forestry, 2, pp.1188-1189.* *2. Arbain A, Bachtiar A, Putra PP and Nurainas. 2014. Review of Sumatran Medicinal Plants. UPT Biological Resources Andalas University*

Enzymology

CourseID	*BIO60275*
Course name	*Enzymology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Suwirmen, MS* *Dr. Anthony Agustien*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1 The relation of enzymology with other branches of biology especially plant physiology and microbiology, benefits and forms of application.* *2 Classification and nomenclature of enzymes.* *3 The chemical structure of enzymes; protein synthesis.* *4 Regulation of enzyme synthesis.* *5 Enzyme catalysis; enzyme inhibition.* *6 Enzyme production and strain quality improvement.* *7 Scale up enzyme production; enzyme isolation.* *8 Methods for determining enzyme activity.* *9 Concentration of enzymes.* *10 Enzyme purification and immobilized enzymes.*
Content	*It is necessary to study Plant Physiology, Animal Physiology and Microbiology, especially those related to metabolism. This course introduces a more in-depth study of enzymes as biocatalysts which are needed to accelerate biochemical reactions.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Palmer, T. and PL Bonner. 2007. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. Second Edition. Woodhead Publishing.* *2. Devasena, T. 2010. Enzymology. First Edition. Oxford UniversityPress.* *3. Hans. B. 2019. Practical Enzymology, 3rd Edition. Wiley VCH. Weinheim.* *4. Ngil. Y and R. Ubyaan. Enzymology; Properties, Mechanisms, Catalysis and Kinetics of Enzymes. Innoscience Publisher. Yogyakarta.*

Mammal Physiology

CourseID	*BIO60215*
Course name	*Mammal Physiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Santoso's son* *Muhammad Syukri Fadhil, M.Sc.*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*Animal Physiology, Animal Structure and Development, Biochemistry, Cell and Molecular Biology, Genetics*
Course objectives/intended learning outcomes	*PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology.* *CPMk-1: Be able to explain terms, concepts and application forms of mammalian physiology in the field of conservation and health* *CPMk-2: Be able to explain the digestive mechanism in herbivorous, carnivorous and omnivorous mammals* *CPMk-3: Be able to explain the mechanism of respiration in aquatic and terrestrial mammals* *CPMk-4: Be able to explain the circulatory system of aquatic and terrestrial mammals* *CPMk-5: Be able to explain the mammalian excretory system* *CPMk-6: Able to describe the mammalian immune system* *CPMk-7: Be able to explain the endocrine system of mammals* *CPMk-8: Be able to explain the reproductive system of mammals* *CPMk-9: Be able to describe the mammalian nervous system* *CPMk-10: Be able to explain the physiology of receptors and effectors in mammals* *CPMk-11: Be able to explain the physiology of aging in mammals* *CPMk-12: Be able to explain modeling of mammals in the development of medicine and health* *CPMk-13: Be able to explain basic concepts in the mammalian physiology observation method*
Content	*This course examines the physiological systems in mammals and is oriented towards the application of physiology in mammalian conservation and the health sector. The systems studied in the mammalian body include the digestive system, respiratory system, circulatory system, immune system, endocrine system, nervous system, receptor and effector performance, reproductive system, physiology of aging (aging), and disease modeling in mammals.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-

reading list	*Main :* *1. Sherwood L, Klandorph, Yancey PH. 2015. Animal Physiology: From Genes to Organisms, Second Edition. Brooks/Cole, Cengage Learning, USA.* *2. Sherwood L, Ward C. 2016. Human Physiology: From Cells to Systems (4th Canadian edition). Boston, Mass.: Cengage Learning.* *3. Moyes CD, Schulte P. 2014. Principles of Animal Physiology. Pearson, USA.* *4. Conn M. 2017. Animal Models for the Study of Human Disease. Academic Press, NY, USA* *Supporters:* *5. Santoso P. 2020. Animal Physiology: Basic Principles. Andalas University Press, Indonesia.* *6. Hill RW, Wyse GA, Anderson M. 2012. Animal physiology third edition. Sinauer Associates, USA*

Insect Physiology

CourseID	*BIO60216*
Course name	*Insect Physiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Rest Rahayu* *Robby Jannatan, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesson n, lab works*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*Entomology*
Course objectives/intended learning outcomes	*PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology.* *CPMk-1: Be able to explain terms and concepts in insect physiology* *CPMk-2: Be able to explain about the integumentary system of insects* *CPMk-3: Be able to explain the respiratory system of insects* *CPMk-4: Be able to explain about the insect circulation system* *CPMk-5: Be able to explain about the digestive system, nutrition and metabolism* *CPMk-6: Be able to explain the excretory system of insects* *CPMk-7: Able to explain the growth of insects* *CPMk-8: Be able to explain the insect nervous system* *CPMk-9: Be able to explain the insect endocrinology system* *CPMk-10: Able to explain Biochemical Defense in insects*
Content	*This course examines insect physiology and discusses the basic concepts of insect physiology, the functions and workings of basic insect physiological systems in the management of insect pests and the production of beneficial insects.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Wigglesworth VB (1972). The Principles of Insect Physiology (7th eds). Chapman and Hall.* *2. Blum MS. 1985. Fundamentals of Insect Physiology. New York. John Wiley and Sons.* *3. Gullan, PJ and PS Cranston. 2010. The Insects. An Outline of Entomology. Wiley-Blackwell. A John Wiley & Sons, Ltd.* *4. Chapman R.F. 1998. The Insect Structure and Function (4th eds). Cambridge. Harvard UniversityPress.*

	Supporters: *1. Gilbert LI, Iatrou K, Gill SS. 2005. Comprehensive Molecular Insect Science: Biochemistry and Molecular Biology. Vol 4. Oxford. Elsevier Ltd. Oxford.* *2. Kerkut GA, Gilbert LI. 1985. Comprehensive Insect Physiology Biochemistry and Pharmacology. Oxford. Pergamon Press.* *3. Mordue W, Goldsworthy GJ, Brady J, Blaney WM (1980). Insect Physiology. Blackwell.* *4. Nation JL. 2002. Insect Physiology and Biochemistry. London. CRC Press.* *5. Related journals*

Molecular Genetics

CourseID	*BIO6023 0*
Course name	*Molecular Genetics*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Imelda Roesma* *Dr. Djong Hon Tjong*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lecture, lesso n*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*ILO-1: Accepting the diversity of society and implementing academic values, core values and ethics* *ILO-3 Mastering and applying the concept and principle of biological theory along with its uniqueness in and bio-conservation* *ILO-7: Possessing domain of soft skills in team-work, communication, critical and creative thinking* *ILO -8 Being able to process learning materials and scientific information*
Content	*PI-1: Able to master the concept of molecular genetics, the scope of molecular genetics and the application of genetics molecules in various fields* *CPMk-1: Able to explain and understand the evidence of DNA as genetic material* *CPMk-2: Able to explain and understand the central concept of dogma* *CPMk-3: Able to explain and understand Cytoplasmic DNA* *CPMk-4: Able to explain and understand RNA processing* *CPMk-5: Able to explain and understand RNAi and Antisense* *CPMk-6: Able to explain and understand Knock Out gene* *CPMk-7: Able to explain and understand Plasmids and Transposable Elements* *CPMk-8: Able to explain and understand cancer genetics* *CPMk-9: Able to explain and understand Immunology Genetics* *CPMk-10: Able to explain and understand viral genetics* *CPMk-11: Able to explain and understand Bacteria and Agrobacterium* *CPMk-12: Able to explain and understand DNA isolation and gene cloning* *CPMk-13: Able to explain and understand DNA editing techniques* *CPMk-14: Able to explain and understand PCR and DNA sequencing applications*

	CPMk-15: Able to explain and understand Gene Expression Test and Data Interpretation
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*Main :* *1. Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and JD Watson. 1993. Molecular Biology of the Cell, 3rd edition, Garland Publishing, Inc., New York, London.* *2. Watson, JD, NH Hopkins, JW Roberts, JAS Steitz and AM Weiner. 1987. Molecular Biology of the Gene, Vol. I &II, 4th edition, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California.* *3. David Clark. 2005. Molecular Biology, Elsevier Academic Press, Amsterdam, Boston, Heidelberg, London, New York, Oxford , Paris, San Diego, San Francisco, Singapore, Sydney & Tokyo*

Herpetology

CourseID	*BIO 60258*
Course name	*herpetology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Djong Hon Tjong*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , and labs work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Students have competence in herpetology courses that are able to explain and apply the topics that have been studied.* *2. Students are able to master the basics and concepts in herpetology* *3. Students are able to discuss and work together in teams to understand herpetology.* *4. Students are able to understand the basic concepts that are practiced*
Content	*This course will discuss the concept of herpetology and its progress, diversity of amphibians, diversity of reptiles, ecology of amphibians, ecology of reptiles, reproduction of amphibians and reptiles, genetics of herpetofauna, conservation of amphibians and reptiles, and understanding the phylogenetics of herpetofauana.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Iskandar, DT 1998. Amphibian Java and Bali. Field Guide Series. Biology Research and Development Center LIPI.* *2. Zug, GR 1993. Herpetology; an Introduction to the Biology of Amphibians and Reptiles. Academic Press, Inc. San Diego.* *3. Berry, PY 1975. The Amphibian Fauna of Malay Peninsular. Tropical Press. Kuala Mud.* *4. Corn, P. S and RB Bury. 1990. Sampling Methods for Terrestrial Amphibians and Reptiles. Pacific Northwest Research Station, United United States Department of Agriculture, United State of America.*

Ichthyology

CourseID	*BIO 60259*
Course name	*Ichthyology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Syaifullah Zoelkiar* *Prof. Dr. Ir. Indra Juanaidi Zakaria M.Sc* *Prof. Dr. Dewi Imelda Roesma*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures , less on , labs work and Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Students have competence in the ichthyology course, namely being able to explain and describe the science of ichthyology* *2. Students are able to explain the basics of ichthyology and apply them in everyday life* *3. Students are able to discuss and cooperate in formulating and solving ichthyological problems* *4. Students can understand and explain assignments that originate from scientific work/journals* *5. Students are able to work on experiments (practicum) in the laboratory*
Content	*The ichthyology course given at the Faculty of Mathematics and Natural Sciences Biology Study Program is a course that emphasizes the systematics, anatomy and distribution of fish, coupled with knowledge about the impact of human activities on the aquatic environment such as the fields of ecology, physiology, behavior and evolution of fish through lectures and practicum activities or minor research.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Beaumont AR, and Hoare K., 2003. Biotechnology and Genetics in Fisheries and Aquaculture. Blackwell Science Ltd.* *2. Lutz, CG, 2001, Practical Genetics for Aquaculture. Blackwell Science Ltd.* *3. Moyle, PB, Cech, Jr., JJ, 2004. Fishes An Introduction to Ichtyology. 4th ed. Prentice Hall. Upper Sadlle River, NJ 07458*

Genetic Abnormalities

CourseID	*BIO 60232*
Course name	*Genetic Abnormalities*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Dewi Imelda Roesma* *Dr. Djong Hon Tjong*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures , less on , labs work and Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Students are able to master the concepts of genetic disorders in humans* *2. Students are able to explain and understand the inheritance of traits based on Mendel's laws* *3. Students are able to explain and understand the concepts of sex-linked genes* *4. Students are able to explain and understand the concept of pedigree analysis* *5. Able to explain and understand the concept of chromosomal abnormalities* *6. Able to explain and understand the concept of multifactorial inheritance* *7. Able to explain and understand metabolic disorders* *8. Able to explain and understand genetic screening and testing* *9. Able to explain and understand genomic imprinting : An epigentic* *10. Able to explain and understand mitochondrial disorders* *11. Able to explain and understand cancer disorders* *12. Able to explain and understand pharmacogenomics* *13. Able to explain and understand nutrigenomics* *14. Able to explain and understand genetic counseling*
Content	*Genetic disorders courses include Mendelian inheritance disorders, sex-linked genes, pedigree analysis concepts, chromosomal abnormalities, multifactorial inheritance, metabolic disorders, genetic screening and testing, genomic imprinting: an epigenetic, mitochondrial disorders, cancer disorders, pharmacogenomics, nurigenomics, and counseling genetics.*
Examination forms	*oral presentation, essay, written test .*

Study and examination requirements	-
reading list	*1. Schaefer, GB and JN Thompson, 2014 .Medical Genetics enetics an Integrated Approach. MC Graw Hill. New York. Chapter 6 pages 147-164* *2. Pasternak JJ 2005. An Introduction To Human Molecular .Genetics. John Wiley. Canada* *3. Savini, Isabella; Gasperi, Valeria; and Catani, Valeria M. 2016. Nutrigenetics. In: eLS. John Wiley & Sons, Ltd Chichester* *4. Padmanabhan. S., 2014. Handbook of Pharmacogenomics and Stratified Medicine. Elsevier. London*

Plant Tissue Culture

CourseID	*BIO 60227*
Course name	*Plant Tissue Culture*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Zozy Aneloi Noli* *Dr. M. Idris*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures , less on , labs work and Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	1. *ILO-1 Has the basic values of UNAND, Code of Ethics, and Biological Ethics* 2. *ILO-2 Fostering the spirit of entrepreneurship* 3. *ILO-3 Able to master the concepts, principles and application of biological knowledge in the fields of food, health, environment (biological) and biological resources in the management and utilization of biological and environmental resources.* *CPMk-1 : Concept and scope of plant tissue culture* *CPMk-2 : Concept and scope of utilization of tissue culture techniques* *CPMk-3 : Concept and scope of factors that determine the success of tissue culture techniques* *CPMk-4: concept and technique for making plant tissue culture planting media* *CPMk-5 : Concept and scope of sterilization technique: tool sterilization, medium sterilization, explant sterilization from the function of each growth hormone in growth and development* *CPMk-6 : Concept and scope of several plant tissue culture techniques* *CPMk-7 : Tissue culture technique on various kinds of plants* 4. *ILO-5 is capable of using related instruments and methodologies in observing and measuring biological objects* 5. *ILO-7 Able to work in a team, communicate actively, think critically, creatively and analytically in the learning process.* 6. *ILO-8 Able to process learning resources into teaching materials and scientific information*
Content	*The Plant Tissue Culture course discusses the concept and scope of plant tissue culture techniques in in vitro plant propagation and their utilization, including the understanding of tissue culture, factors that influence the success of plant propagation through plant tissue culture, plant tissue culture techniques, culture tissue for various types of plants and transformation of plants through Agrobacterium*
Examination forms	*oral presentation, essay, written test .*

Study and examination requirements	-
reading list	*1. Smith , RH, 2000, Plant Tissue Culture, Academic Press, San Diego, USA.* *2. Hartman HT, DE Kester, FT Davies Jr and RL Geneve, 2002, Plant Propagation, Principles and Practices, seventh edition, Pearson Education, Inc., New Jersey* *3. Salisbury. FB and CW Ross. 1995. Plant Physiology. ITB. Bandung* *4. Davies PJ. 2004. Plant Hormones, Biosynthesis, Signal Transduction, Action. Kluwer Academic Publishers. Dordrecht/Boston/London.* *5. Jackson, JF and HF Linsliens. 2002. Testing for genetic manipulation in Plants, Springer, Heidelberg*

Animal Cell Culture

CourseID	*BIO 60248*
Course name	*Animal Cell Culture*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Ir. Efrizal, M.Si, Ph.D* *Kurniadi Ilham, S.Si M.Si* *Robby Jannatan, S.Si M.Si*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures , less on , labs work and Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	1. *Able to develop the benefits of scientific biology to be applied to the scope of everyday life that is beneficial to society* 2. *Mastering biology as a basic science and technology by utilizing applied science in the field of biology to develop efforts to preserve and increase environmental productivity in an effort to encourage sustainable development in health* 3. *Able to explain basic concepts, history and development of the benefits and applications of animal tissue culture* 4. *Students are able to explain about organs, tissues, cells and behavior in culture* 5. *Be able to explain culture media including natural media and synthetic media and their preparations* 6. *Able to explain organ, tissue, primary cell culture and secondary cell culture techniques* 7. *Able to explain specific culture, blood cell culture, bone marrow and cancer cells* 8. *Be able to explain the maintenance of tissue and cell organ culture* 9. *Able to explain the characterization and transformation, selection and preservation of strains* 10. *Able to carry out tissue culture preparation in the laboratory and analyze the results*
Content	*The Animal Tissue Culture course discusses the basic concepts of culture and the benefits of culture and the benefits of tissue culture, tools, culture media and their manufacture, sterilization techniques, primary cultures and specific cell cultures, maintenance of cell cultures, tissues and organs, transformation characterization, selection and preservation*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	*-*
reading list	*1. Giovani, JB 1994. Animal Tissue Culture : Principles and Aproaches. John Wiley and Sons. New York.* *2. Chaundry, A. 2004. CellCulture. Lapsius Nivsum Co. ltd. Toronto.* *3. Anthonie, A. 1996. Protocol for Animal Tissue Culture. JJLipincort. Washington.*

Malacology

CourseID	*BIO 60206*
Course name	*Malacology*
Semester(s) in which the course is taught	*6th semester*
Person responsible for the course	*Dra. Izmiarti, MS* *Dr. Jabang Nurdin M.Sc* *Dr. Nofrita M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures , less on , labs work and Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Understand the subject matter, learning methods, assessment systems, academic norms and references* *2. Able to explain the historical development of malacology and its search* *3. Able to explain class Amphineura & class Monoplacoptera* *4. Able to analyze the potential of bivalves and application of modeling (field biology)* *5. Be able to explain malacology and its environment* *6. Able to analyze and explain Scaphopods* *7. Able to integrate and analyze in journal presentations related to bivalves and conservation* *8. Able to discuss journal field lectures* *9. Able to integrate and explain Gastropod class* *10. Able to analyze and explain cephalopods* *11. Able to analyze and explain Mollusca research applications* *12. Able to analyze and explain the concept of improvement of Mollusca improvement in the field and laboratory* *13. Able to integrate and analyze in journal presentations and reports in the form of journals from field lectures* *14. Able to develop Malakaology science and technology from the latest references through special conservation-oriented topics*
Content	*In the Malacology course, History, Definition and Classification of Mollusca Diversity, its potential, Geography, malacology and its environment are explained; Molluscs and their characteristics, Habit and Habitat; Distribution of Marine Molluscs, Distribution of Terrestrial Molluscs, Marine Mollusc Abnormalities, Marine Mollusc Abnormalities, Amphineura Class & Monoplacophora Class, Scaphopoda Class, Bivalvia Class and Modeling Applications: (Field Biology), Gastropod Class, Cephalopod Class, Sampling Methods and Mollusca Research Applications (Gastropods & Cephalopods), and the*

	concept of development of Mollusca culture (Gastropoda & Cephalopoda), special topics 1 and 2.
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Abbott RT The Pocket Guide to SEASHELLS OF THE NORTHERN HEMISPHERE. Singapore.* *2. Dharma B. 2005. Recent & Fossil' INDONESIAN SHELLS' . Jakarta.* *3. Dance, SP 1974. The Collector's Encyclopedia of SHELLS. McGraw-Hill Book cmpany. New York. TORONTO.* *4. Jutting, VB 1956. Treubia A Journal of Zoology Hidrobiology and Oceanography of The Indo-Australian Archipelago. Bogorience Zoologicum Museum, Botanical Gardens Indonesia Bogor-Java.* *5. Jutting VB 1931. Notes on Fresh Water Mollusca from the Malay Archipelago. Rep. Treubia.*

Mamalogy

CourseID	*BIO*
Course name	*Mamalogy*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Wilson Novarino* *Dr. Aadrean M.Sc* *Dr. Rizaldi*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures , less on , labs work and Project*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	***ILO-1: Accepting the diversity of society and implementing academic values, core values and ethics*** *PI-1: Showing an attitude of accepting differences in religion, ethnicity, race, culture and physical condition of other people.* *PI-2: Demonstrate honesty in exams, report scientific data and information, and list literacy sources.* *PI-3: Have a high curiosity about the science of learning materials and other relevant knowledge.* ***ILO-3: Mastering and applying the concept and principle of biological theory along with its uniqueness in biodiversity and bio-conservation*** *PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology.* *1. CPMk-1: Able to describe the development of Mamalogy science and its relation to other branches of science* *2. CPMk-2: Be able to explain the process of Evolution and forms of adaptation that take place in mammals* *3. CPMk-3: Be able to describe and explain the topographical parts of the mammalian body (homologous, analogous)* *4. CPMk-4: Able to describe, identify and explain the taxonomy and classification of mammals* *5. CPMk-5: Able to explain the diversity and distribution area of mammals globally and nationally* *6. CPMk-6: Be able to explain behavior patterns and community dynamics of mammals* *7. CPMk-7: Able to explain the role of mammals for the environment, human life and the various conservation efforts undertaken* *8. CPMk-8: Able to explain, apply and analyze diversity and other aspects of Mamalogy with survey techniques* *standard one*

	/ ***LO-5: Being able in using instruments and related methods in observing and measuring biological objects*** *PI-1: Able to solve science and technology problems in the field of management and utilization of biological resources through principles organizing systematics, predicting, analyzing information and biological materials as well as modulating cell structures and functions as well application of relevant technology.* *1. CPP-1: Be able to describe the body parts of mammals using scientific terminology, Indonesian and English* *2. CPP-2: Able to describe, measure and identify mammalian tracks and feces* *3. CPP-3: Able to make observations related to mammal behavior* *4. CPP-4: Able to make simple observations about the benefits of mammals for the environment and human life* *5. CPP-5: Able to carry out observations, data collection and simple analysis of the diversity of mammal species in several areas ecosystem type* ***ILO-7: Possessing domain of soft skills in team-work, communication, critical and creative thinking*** *PI-1: Able to develop cooperation in carrying out group assignments in fulfilling learning outcomes.* *PI-3: Play an active role both orally and in writing in assignments and subject group discussions* **.**
Content	*In this course the learning process is focused on*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Abbott RT The Pocket Guide to SEASHELLS OF THE NORTHERN HEMISPHERE. Singapore.* *2. Dharma B. 2005. Recent & Fossil' INDONESIAN SHELLS' . Jakarta.* *3. Dance, SP 1974. The Collector's Encyclopedia of SHELLS. McGraw-Hill Book cmpany. New York. TORONTO.* *4. Jutting, VB 1956. Treubia A Journal of Zoology Hidrobiology and Oceanography of The Indo-Australian Archipelago. Bogorience Zoologicum Museum, Botanical Gardens Indonesia Bogor-Java.* *5. Jutting VB 1931. Notes on Fresh Water Mollusca from the Malay Archipelago. Rep. Treubia.*

Laboratory Management

CourseID	*BIO60277*
Course name	*Laboratory Management*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Suwirmen, MS* *Dr. Rest Rahayu* *Dr. Feskarny Alamsjah* *Dr. Fuji Astuti Febria*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*1. Students are able to explain the meaning of Laboratory Management.* *2. Students are able to explain the importance of laboratory safety and security culture.* *3. Students are able to explain how to build a laboratory safety and security management system.* *4. Students are able to explain the emergency planning system.* *5. Students are able to explain how to implement regulations, programs, and laboratory safety and security policies.* *6. Students are able to explain laboratory facilities.* *7. Students are able to explain laboratory safety potatoes.* *8. Students are able to assess the hazards and risks in the Laboratory.* *9. Students are able to explain how to manage chemicals.* *10. Students are able to explain how to work with chemicals.* *11. Students are able to explain how to work with laboratory equipment.* *12. Students are able to explain how to manage chemical waste.* *13. Students are able to explain and can make Laboratory SOPs.*
Content	*Management is a process of using resources effectively to achieve a goal. Laboratory Management will include planning, organizing, actuating and controlling activities. Matters related to these activities include organizing and maintaining tools and materials, maintaining discipline in the Laboratory and laboratory safety and utilizing them. Laboratory Management (Laboratory Management) is an attempt to manage the Laboratory. How a laboratory can be managed properly is determined by several factors that are interrelated with one another. Some of the sophisticated laboratory equipment, with skilled professional staff, may not necessarily operate properly if it is not supported by good laboratory management. Therefore lab management is a part that cannot be separated from laboratory*

	activities. A good lab management has a good organizational system, clear job descriptions, effective, efficient, disciplined facility utilization, and good lab administration. *Laboratory Management can also be interpreted as the implementation of administration, maintenance, security, planning for its development effectively and efficiently in accordance with its objectives. In implementing it, it is always oriented towards fostering safety factors involved in the Laboratory and its environment.* *The implementation of laboratory management aims to be able to support teaching and learning activities in the laboratory as well as research activities so that they take place optimally. From the other side, laboratory knowledge is a business that is directed to facilities and infrastructure as well as personnel involved in their roles and activities.* *In Laboratory management, Laboratory components are categorized into two groups, namely the management group (as human resources), and the managed group, namely Laboratory buildings, Laboratory facilities, Laboratory equipment, and substances (chemicals).*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	
reading list	*1. Moedjadi, 1995. Safety and Work in the Laboratory in Science Laboratory Management. Depdikbud Director General of Basic Education. Jakarta.* *2. Refirman and Rosminar Suna. 1995. Design, Equipment and Layout of the Science Laboratory in the Management of the Science Laboratory. Depdikbud Director General of Basic Education. Jakarta.* *3. Sanusi Ibrahim. 1994. Laboratory Safety and Security. Andalas University. Padang* *4. Soleh Kosela. 1998. Laboratory Management. FMIPA UI. Jakarta* *5. Lisa Moran and Tina Masciangioli (Editors), 2010. Chemical Laboratory Safety and Security Guidelines for Prudent Chemical Management. The National Academies Press. Washington, D.C* *6. Soemanto Imamkhasani. 1994. Work Safety in Chemical Laboratories, Gramedia. Jakarta.* *7. References and related journals*

Industrial Microbiology

CourseID	*BIO60239*
Course name	*Industrial Microbiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. ANTHONI AGUSTIEN, MS* *Dr. Fuji Astuti Febria, MS* *Dr. Feskaharny Alamsjah, MS*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	1. *Able to explain the development and benefits of industrial microbiology for human welfare* 2. *Be able to explain the requirements of microorganisms in the industry* 3. *Able to explain important microorganisms that are often used in industry* 4. *Able to explain the isolation and screening of microorganisms from nature* 5. *Able to explain microorganism maintenance techniques* 6. *Able to explain the method and kinetics of fermentation* 7. *Be able to explain the production of primary and secondary metabolites of microorganisms on a laboratory scale* 8. *Be able to explain the optimization of the production of microorganisms* 9. *Be able to explain the increased production / "production scale up" of microorganisms* 10. *Be able to explain the overproduction of mutant microorganisms* 11. *Be able to explain the production of metabolites of microorganisms with cell immobilization techniques* 12. *Develop industrial microbiology science and technology from the latest references through 1 (one) special topic* 13. *Able to simulate 2 (two) special topics regarding the development of science and technology using isolates* 14. *thermophilic bacteria for industry*
Content	*In the Industrial Microbiology course, students study: the development and benefits of industrial microbiology for human welfare, the requirements of microorganisms in industry, important microorganisms that are often used in industry, isolation and screening of microorganisms from nature, techniques for maintaining and storing microorganisms, methods and kinetics of fermentation, production primary and secondary metabolites of microorganisms on a laboratory scale, optimizing the production of microorganisms, increasing the*

	production / production scale up of microorganisms, over-producing mutant microorganisms, and producing metabolites of microorganisms with cell immobilization techniques, developing industrial microbiology science and technology from the latest references through topics special 1 (one), simulating special topic 2 (two)) on the development of science and technology on the use of thermophilic bacterial isolates for industry
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	
reading list	*1. Okafor, N. 2007. Modern Industrial Microbiology and Biotechnology. Science Publishers, Clemson University. SouthCalifornia.* *2. Agustien, A. 2010. Thermophilic bacterial proteases. Unpad Press, Bandung, ISBN: 978-602- 8743-08-2.* ***3.** Purwoko, T. 2007. Microbial Physiology. Editor Junwinanto. Script Earth Publisher.Jakarta.*

Environmental Microbiology

CourseID	*BIO60240*
Course name	*Environmental Microbiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. phil. nat. Periadnadi* *Dr. Fuji Astuti Febria, MSi*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*-*
Course objectives/intended learning outcomes	*1. Students are able to understand the relationship between microorganisms* *2. Students are able to explain important aspects of the history of microbiology and its relation to the environment* *3. Students are able to classify microorganisms into each of the five groups based on their living temperature and the need for oxygen; explain the importance of pH, osmotic pressure; the use of elements (elements C, N, S and P) on the growth of microorganisms; Mention various methods and media for the growth of microorganisms* *4. Be able to define some terminology regarding the control of microorganism growth; explain the control of the growth of microorganisms both physically and chemically; Explain the mechanism of action and use of chemical disinfectants.*
Content	*The environmental microbiology course contains topics on the history of microbiology and its relationship to the environment; study of phylogenetic relationships, classification and identification of microorganisms; biological characteristics of microorganisms (bacteria, fungi, viruses and protozoa); growth and control of the growth of microorganisms, including the concept of Ecology; examines the relationship between microorganisms and the environment and, the influence of the environment on microorganisms and the role of microorganisms in the environment.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	
reading list	Madigan MT, JM Martinko, DA Stahl and DP Clark. 2012, Brock Biology of Microorganisms, 13th ed. Pearson Education Inc. San Francisco, USA Merck kgA. 2005. Microbiology Manual, 12th ed., Merck KGaA, Darmstadt, Germany Pommerville, JC 2007. Alcamo's fundamentals of microbiology. Jones and Bartlett Publishers, Inc. ont. Prescott, LM, JP Harley and DA Klein 2002. Microbiology, 5th Ed. The McGraw-Hill Companies

Medical Microbiology

CourseID	*BIO60241*
Course name	*Medical Microbiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr Nasir Nasir* *Dr. Anthony Agustien*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*-*
Course objectives/intended learning outcomes	
Content	*The Mycology course discusses the basic life of fungi and their role and position as microorganisms, calcification and biological, anatomical, morphological and physiological characteristics of fungi which include the classes Myxomycetes, Chytridiomycetes, Oomycetes, Zygomycetes, Deuteromycetes, Basidiomycetes and Ascomycetes.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	*A. Students understand the meaning of health microbiology and its supporting aspects.* *B. Able to analyze the causes of infectious diseases caused by microbes* *C. Able to plan, develop and apply control of human infectious diseases in the health sector.* *D. Applying logical and critical, systematic, and innovative thinking in the context of the development or implementation of science and/or technology* *E. Examine the implications of developing or implementing science or technology in accordance with their expertise based on scientific rules, procedures and ethics to produce solutions, ideas, designs or criticism.* *F. Make appropriate decisions in the context of problem solving based on the results of analysis of information and data* *G. Manage learning independently; and* *H. Develop and maintain a network of work.* *I. Develop intrapersonal skills and interpersonal skills to increase competitiveness.*
reading list	1. Baron, S. 1996. Medical Microbiology, 4th edition. University of Texas Medical Branch at Galveston, Galveston, Texas 2. Brogden, KA and JM Guthmiller. 2002. Polymicrobial diseases. ASM Press. Washington 3. Brook, GF, KC Carroll, and JS Butel. 2013. Medical Microbiology. EGC Emergence 4. Related journals and proceedings Journals, related proceedings.

Food Microbiology

CourseID	*BIO60242*
Course name	*Food microbiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. phil. nat. Nurmiati* *Dr. phil. nat. Periadnadi*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*1) Be able to analyze microbial activity and nutrition in food and Microbial Growth in Food* *2) Able to identify damage to food ingredients* *3) Able to formulate in detail about Damage to Meat, Milk and Eggs* *4) Able to identify methods of Food Preservation* *5) Be able to identify the Quality of Food Materials* *6) Able to formulate in detail the techniques and procedures for making medium* *7) Able to formulate in detail about the microbiological quality of animal food ingredients* *8) Able to formulate in detail about the microbiological quality of vegetable food ingredients* *9) Able to formulate in detail about the Utilization of Microbes in Fermentation Technology* *10) Able to formulate in detail about food preservatives* *11) Be able to explain in detail about fermented food ingredients* *12) Able to explain in detail about food additives*
Content	*The food microbiology course is an elective course in the biology study program majoring in FMIPA Andalas University biology. this course examines microbial activity in food ingredients, control and utilization of microbes in food processing*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	

Extremophilic Microorganisms

CourseID	*BIO6024 3*
Course name	*Extremophilic Microorganisms*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Anthony Agustien* *Dr. Feskarny Alamsjah*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*1. Able to understand the molecular evolution of microorganisms Extemophile* *2. Thermophilic Microorganisms (Cell Structure, Ecology, Diversity and Applications)* *3. Hyperthermic Microorganisms (Cell Structure, Ecology, Diversity and Applications)* *4. Psychrophylic Microorganisms (Cell Structure, Ecology, Diversity and Applications)* *5. Alkaliphilic Microorganisms (Cell Structure, Ecology, Diversity and Applications)* *6. Applications of Alkaphilic Microorganisms* *7. Applications of Halophilic Microorganisms*
Content	*The Extremophilic Microorganisms course is a form of extension and application of the course Microbiology. Through this course students get an expansion of material related to use extremophilic microorganisms to produce products that have economic value and become the basis the development of various industries such as; pharmaceutical industry, chemical industry.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	

Veterinary Microtechnics

CourseID	*BIO60 278*
Course name	*Veterinary Microtechnics*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Putra Santoso*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*1. Be able to explain the types of preparations and terms used in microtechnical* *2. Be able to explain the method of manufacture in general* *3. Be able to explain decalcification techniques and materials used* *4. Be able to explain about dyes.* *5. Be able to explain the making of incision preparations* *6. Be able to explain the manufacture of whole mounts* *7. Be able to explain the manufacture of smear preparations* *8. Be able to explain the methods and techniques of component observation (histochemistry),* *9. Be able to explain immunohistochemistry.*
Content	*In the Animal Development course, students study development of the ontogeny of organisms that begins with gametogenesis, fertilization, cleaveage. Gastrulation. Formation of organs primitives, and the development of several derivatives of the 3 layers of institutions, regeneration and metamorphosis as well as animal development applications.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	*1. Kiernan, JA 1981. Histological and histochemical methods. Perganon press theory and practice. Oxford.* *2. Parkin, JT 1993. Fixing and embedding specimens for Elementary Microscopy. Western University Training Centre.* *3. Suntoro, H. 1983. Staining Method (Histology and histochemistry). Bhratara Script. Jakarta.* *4. Junqueira, LC 2005. Basic Hystology: Text and Atlas. McGraw-Hill Book Company. New York.*

Pollen and spore morphology

CourseID	*BIO60 2 68*
Course name	*Pollen and spore morphology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*PROF. Dr. SYAMSUARDI Dr.* *TESRI MAIDELIZA, MS, MSc* *Dr. NURAINAS, MSc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*a. Be able to explain the types of pollen* *b. Be able to explain the character of pollen;* *c. Be able to explain the role of pollen;* *d. Be able to explain the grouping of pollen;* *e. Be able to explain the role of pollen in life* *F. Able to apply biological knowledge to benefit themselves and society in everyday life*
Content	*Students study and compare and contrast the functions and morphology of powders juice and spores. Describe and illustrate the modern spore and fossils and pollen. Recognize and identify 20 pollen genera of the species around campus .*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Brinkhuis, H., and others, 2006. Episodic fresh surface waters in the Eocoene Arctic Ocean. Nature 441: 606-609. 2. Broecker, WS, Peteet, DM, and Rind, D., 1985: Does the ocean-atmosphere system have more than one stable mode of operation? Nature 315: 21-26. 3. Brubaker, L., Anderson, PM, Edwards, ME, and Lozhkin, AV, 2005. Beringia as a glacial refugium for boreal trees and shrubs: new perspectives from mapped pollendata. Journal of Biogeography 32:833-848. 4. Cerling, T., Harris, JM, MacFadden, BJ, Leakey, MG, Quade, J., Eisenmann, V., and Ehleringer, JR, 1997. Global vegetation change through the Miocene/Pliocene boundaries. Nature 389: 153-158. 5. Elias, S., and Crocker, B., 2008. The Bering land bridge: A moisture barrier to the dispersal of steppe-tundra biota? Quaternary Science Reviews 27: 2473-2483.

	6. Engstrom, DR, Hansen, BCS, and Wright, HE, 1990. A possible Younger Dryas record in southeastern Alaska. Science 250: 1383-1385. 7. Fowell, SJ, Cornet, B., and Olsen, PE, 1994. Geologically rapid Late Triassic extinctions: Palynological evidence from the Newark Supergroup. In: Klein, GD, ed., Pangea: Paleoclimate, Tectonics and Sedimentation During Accretion, Zenith and Break-up of a Supercontinent. Geological Society of America Special Paper 288: 197-206. 8. Gastaldo, RA, DiMichele, WA, and Pfefferkorn, HW, 1996. Out of the icehouse into the greenhouse: A Late Paleozoic analog for modern global vegetational change. GSA Today 6 (10): 1-7. 9. Guthrie, RD, 2001. Origin and causes of the mammoth steppe: a story of cloud cover, woolly mammal tooth pits, buckles, and inside-out Beringia. Quaternary Science Reviews 20: 549-574. 10. Reinink-Smith, L., and Leopold, E., 2005. Warm climate in the Late Miocene of the south coast of Alaska and the occurrence of Podocarpaceae pollen. Palynology 29: 205- 262. 11. Sunderlin, D., Loope, G., Parker, N., and Williams, CJ, 2011. Paleoclimatic and paleoecological implications of a Paleocene-Eocene fossil leaf assemblage, Chickaloon Formation, Alaska. Palaios 26: 335-345. 12. Visscher, H., Brinkhuis, H., Dilcher, DL, Elsik, W., Eshet, Y., Looy, CV, Rampino, MR, and Traverse, A., 1996. The terminal Paleozoic fungal event: Evidence of terrestrial ecosystem destabilization and collapse. PNAS 93: 2155- 2158. 13. Wolfe, JA, and Upchurch, GR Jr., 1986. Vegetation, climatic and floral changes at the Cretaceous-Tertiary boundary. Nature 324: 148-152.

Morfometric

CourseID	*BIO60 279*
Course name	*Morfometric*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Syamsuardi, MSc.* *Dr. Nurainas, MSc* *Dr. Wilson Novarino, MSc.*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*1. Students have competence in the Morphometrics course, that is capable explain and describe the science of Higher Plant Taxonomy* *2. Students are able to explain the basics of Morphometrics and apply them in daily life.* *3. Students are able to discuss and cooperate in formulating and solving morphometric problems.* *4. Students can understand and explain tasks that originate from work independent.* *5. Students are able to do experiments (practicum) in the laboratory.*
Content	*The Morphometrics course is an elective course in the Program Biology Studies Department of Biology FMIPA Andalas University. This course consists of 3 Credits, and given in semester VI (Even). To take this course, students are required to have taken Plant Morphology courses and Plant systematics and biostatistics.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	Henderson, A. 2006. Traditional morphometrics in plant systematics and its role in palm systematic. Botanical Journal of the Linnean Society 151: 103–111. Lestrel, PE 2000. Morphometrics for the Life Sciences. World Scientific. Singapore. Singh, G. 2003. Plant Systematics an Integrated Approach. Science Publishers, Inc. Enfield, NH USA. India.- Related journals, reports, brochures

Plant Nutrition

CourseID	*BIO60 2 29*
Course name	*Plant Nutrition*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Suwirmen, MS* *Dr. Zozy Aneloi Noli* *Muhammad Idris, MSc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*a. Students have competency in the Plant Nutrition course, which is able to explain and describe the science of Plant Nutrition* *b. Students are able to explain the basics of Plant Nutrition science and apply it in everyday life.* *c. Students are able to discuss and cooperate in formulating and solving plant nutrition problems.* *d. Students can understand and explain assignments sourced from scientific papers/journals.* *e. Students are able to do experiments in the laboratory.*
Content	*Plant Nutrition is the study of how plants function: how do plants get and distribute nutrients and water, how plants respond to the availability of nutrients in the surrounding environment, how Plants react to a nutrient-scarce state. For that Plant Nutrition study the shape and arrangement of the parts of a plant that function for absorption and distribution of nutrients, processes and mechanisms of action of nutrient absorption, nutritional function. To explain it all, Plant Nutrition also requires assistance in structural science, physics, and chemistry, which in subsequent developments as well include thermodynamics and mathematics. So this course gives a lot contribution to competence or learning outcomes in the study program curriculum Biology.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	Marschnev, H. 1986. Mineral Nutrition of Higher Plant Academic Press. London Resh, HM 1989. Hydroponic Food Production Woodbridge Press Publishing company, California.

Ornithology

CourseID	*BIO60 261*
Course name	*Ornithology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Wilson Novarino* *Dr. Rizaldi* *M. Nazri Janra, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*a. Students have competencies in Ornithology courses, namely:* *- History of the development of Ornithology* *- Characteristics of birds and processes of evolution and adaptation* *- Classification of birds* *- Students can understand the concept of aviangeography, behavior, and related aspects of Ornithology.* *b. Students are able to explain and practice research techniques bird field. This point will be reached by applying Project Based Learning (PjBL) by conducting field lectures and activities directing students to make Ornithology as a topic of deep study student-level research competitions (PIMNAS, PKMI, etc.)* *c. Students are able to criticize and interpret scientific literature in ornithology*
Content	*Ornithology lectures are very useful for students in understanding national, regional and global biodiversity. Apart from that, students too expected to be able to understand and explain the formation process and patterns distribution of birds, as well as its application in field techniques and efforts conservation.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-

reading list	Bibby, C., Martin C, Stuart M. 2000. Expedition Field Survey Techniques Bird. BirdLife International Indonesia Programme. Bogor-Indonesia. BirdLife International. 2004. Saving Asia's Endangered Birds Punah: A Guide to Government and Civil Society. BirdLife International Indonesia Programme. Bogor-Indonesia. Howes, J.D, Baekewell and YR Noor. 2003. Shorebird Study Guide. Wetlands International Indonesia Programme. Bogor. MacKinnon, J, Karen P and Bas Van Balen. 2000. Birds of Sumatra, Java, Bali and Kalimantan. Putlisbang Biology LIPI. Jakarta. Novarino W., H. Kobayashi, A. Salsabila, Jarulis, MN Janra. 2008. Bird Ringing Field Guide in Sumatra. National Library Officer, OS, Jr. 1985. Ornithology in Laboratory and Field-Fifth Edition. Academic Press, Inc. Orlando. New York Sukmantoro W., M. Irham, W. Novarino, F. Hasudungan, N. Kemp, M. Muchtar. 2007. List of Indonesian Birds no. 2. Indonesian Ornithologists' Union. Bogor Welty, JC. 1982. The Life of Birds. Third Edition. Sounders College Publishing Philadelphia. New York.

Parasitology

CourseID	*BIO60 26 2*
Course name	*Parasitology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Mairawita, M.Sc* *Prof. Dr. Dahelmi, MS* *Dr. Henny Herwina, MS*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	-
Course objectives/intended learning outcomes	*a. Uphold human values in carrying out duties based on religion, morals, and ethics;* *b. Internalize academic values, norms and ethics;* *c. Contributing to improving the quality of life in society, nation, state, and progress of civilization based on Pancasila;* *d. Work together and have social sensitivity and concern for society and environment; Demonstrate a responsible attitude independent work in their field of expertise.* *e . Apply logical, critical, systematic and innovative thinking in context development or implementation of science and/or technology* *f . Examine the implications of the development or implementation of science or technology according to their expertise based on rules, procedures and ethics scientifically to generate solutions, ideas, designs or critiques.* *g . Make decisions appropriately in the context of problem solving based on the analysis of information and data;* *h . Manage learning independently; and* *i . Develop and maintain a network of work.* *j . Develop intrapersonal skills and interpersonal skills for increase competitiveness.*
Content	*The Parasitology course is an elective course in the Program Biology Studies Department of Biology FMIPA Andalas University. This course consists of 3 Credits, and given in odd and even semesters. To take courses In this case, students are required to have taken Entomology, Systematics courses Animals, Insect Ecology.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	Garcia S. L and Bruckner, DA 1996. Diagnostics of Medical Parasitology. Publisher EGC Medical Book. Jakarta. Zaman, V. 1989. Atlas of Medical Parasitology. Hippocratic Publishers. Jakarta.

Vetebrate topophysiology

CourseID	*BIO60 2 19*
Course name	*Vetebrate topophysiology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Muhammad Syukri Fadil, M.Sc* *Dr. Santoso's son*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	*Animal physiology and mammalian physiology*
Course objectives/intended learning outcomes	*PI-1: Able to master the theoretical concepts of Pathophysiology* *CPMk-1: Be able to explain the terms and concepts as well as the scope of Pathophysiology* *CPMk-2: Able to explain cell pathophysiology* *CPMk-3: Able to explain network pathophysiology* *CPMk-4: Be able to explain the pathophysiology of body fluids* *CPMk-5: Able to explain circulation pathophysiology* *CPMk-6: Be able to explain the pathophysiology of vertebrate digestion* *CPMk-7: Able to explain the pathophysiology of nerves* *CPMk-8: Be able to explain the pathophysiology of vertebrate respiration* *CPMk-9: Be able to explain the Pathophysiology of vertebrate excretion* *CPMk-10: Be able to explain vertebrate hormonal pathophysiology*
Content	*Vertebrate Pathophysiology Course, studying the physiological disorders that occur in the body of vertebrate animals, especially animals livestock and especially laboratory test animals used for animal physiology research*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	-

Biodiversity Mapping and Modeling

CourseID	*BIO60 2 80*
Course name	*Biodiversity Mapping and Modeling*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Aadrean* *Dr. Wilson Novarino* *Dr. Mahdhivan Syafwan*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-2: Able to master the basic principles of software for the analysis and synthesis of biological resources in a specific scope* *CPMK 1: Know the software commonly used in biodiversity mapping and modeling* *PI-3: Able to master the principles and concepts of measurement based on technology, instruments, and standard methods of "analysis and synthesis" biological resources* *CPMK-2: able to describe the scope of mapping (geographical information system) and biodiversity modeling* *CPMK-3: able to explain forms of utilization of maps and models in the field of biodiversity* *PI-1: Able to master the concepts of statistics, biophysics, organic chemistry and biochemistry that support biological systems* *CPMK-4 : Understand the concept of modeling and mapping from a mathematical point of view* *PI-4: Skilled in preparing, handling and managing biological resources in a specific scope such as taxonomy, ecology conservation* *CPP-1: Able to perform biodiversity mapping and modeling analysis with various methods and scope* *biodiversity* *CPP-2: Able to analyze data and/or information, and discuss it based on mapping and theory and concepts biodiversity modeling* *CPP-3: Able to design projects properly and correctly* *CPP-4: Able to make alternative forms of models and maps from the given project topic* *CPP-4: Able to present the results of data analysis and/or information about the project being carried out* *CPP-5: Able to prepare project task reports, which include: i) project background; ii) analysis of data and/or information; iii) results, discussion, evaluation and recommendations; and iv) references.*

Content	*MK Biodiversity Mapping and Modeling discusses the scope of biodiversity mapping and modeling, models and maps in a mathematical point of view, examples of application and utilization of biodiversity mapping and modeling, project management mapping and modeling, and practice of mapping (Geographical Information Systems) and modeling*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Murray, JD. 2001. Mathematical Biology. I. An Introduction. Springer-Verlag.. Berlin Heidelberg 2. Otto and Day. 2007. A biologit's guide to mathematical modeling in Ecology and Evolution. Princeton UniversityPress. Princexeton, New Jersey 3. QGIS Training Manual. https://docs.qgis.org/ 4. Insight Maker Manual. https://insightmaker.com/manual

Molecular Panda

CourseID	*BIO60 233*
Course name	*Molecular Panda*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Dewi Imelda, M.Sc* *Dr. Djong Hon Tjong* *Dr. Syaifullah*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*CPMk-1: Able to mention and explain the principles and applications of molecular markers* *CPMk-2: Able to name and explain molecular laboratory tools and their functions* *CPMk-3: Able to master and understand the concepts and principles of allozim* *CPMk-4: Able to mention and explain the concepts and principles of Microsatellite DNA applications* *CPMk-5: Able to explain and understand the principles and process Random Amplified Polymorphic DNA data (RAPD)* *CPMk-6: Able to explain and understand the application principles of RFLP (Restriction Fragment Length Polymorphism), CPMk-7: Able to explain and understand the principle of marker AFLP (Amplified fragment length polymorphism)* *CPMk-8: Able to explain and understand the principle of SNP (Single nucleotide polymorphism) markers. CPMk-9: Able to explain and understand the principles of mitochondrial DNA and chloroplast DNA markers (Barcoding)* *CPMk-10: Able to explain and understand the principles of NGS and e-DNA markers* *CPMk-11: Able to explain and understand metagenomic principles and the total genome* *CPMk-12: Able to explain and simulate molecular data analysis*
Content	*In this course, matters regarding the principles and applications of the molecular marker, Restriction Fragmnet Length, will be studied Polymorphism (RFLP), Random Amplified Polymorphic DNA (RAPD), Amplified Fragment Length Polymorphic (AFLP), Microsatellites, mitochondrial DNA and Single nucleic Polymorphism (SNP) in the fields of systematics, ecology, physiology, genetics and development*
Examination forms	*oral presentation, essay, written test .*

Study and examination requirements	-
reading list	1. Vicente, MC and Fulton T. (2003) Using Molecular Marker Technology in Studies on Plant Genetic Diversity. Illus. Nelly Giraldo. IPGRI, Rome, Italy and Institute for Genetic Diversity, Ithaca, New York, USA 2. Mahmut, C (2012) Analysis of Genetic Variation in Animals. InTech. Croatian 3. Henry, RJ (2013) Molecular Markers in Plants. A John Wiley & Sons, Inc., Publication

Conservation Areas Management

CourseID	*BIO60 2 47*
Course name	*CONSERVATION AREAS MANAGEMENT*
Semester(s) in which the course is taught	*5th semester*
Person responsible for the course	*Dr. Wilson Novarino, M.Sc* *Dr. Aadrean, M.Sc* *Prof. Dr. Mansyurdin, MS*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	PI-7: Able to master the principles and concepts of conservation at the level of tropical ecosystems, species, and genetics sustainable development CPMk-1: able to describe the history and development of area-based conservation CPMk-2: able to explain laws and regulations related to conservation areas in Indonesia CPMk-3: able to describe and identify conservation area categories nationally (Republic of Indonesia), global (IUCN criteria and UNESCO) as well as the criteria used as the basis for determining conservation areas CPMk-4: able to describe and implement planning procedures and forms of activities that need to be carried out in manage conservation areas CPMk-5: able to implement an evaluation mechanism for the management of conservation areas CPMk-6: able to describe the forms of activities that need to be carried out to gain support for the region conservation CPMk-7: able to describe and identify various forms of conservation efforts in protected forest areas, forests production, cultivation area, residential area PI-5: Be able to analyze and manage conservation at the ecosystem, species and genetic level. CPP-1: Capable of collecting data and/or information about authentic cases from available sources be held accountable CPP-2: Able to analyze data and/or case information, and discuss it based on management theories and concepts Conservation area CPP-3: Able to find alternative solutions in handling cases based on: i) existing laws and regulations applicable; and ii) practices that have been applied to handle the same case. CPP-4: Able to present types of cases, results of data analysis and/or case information, and alternative solutions case handler in front of the class. CPP-5: Able to prepare a case assignment report, which includes: i) case background; ii) analysis of data and/or information; iii) discussion of alternative solutions for handling cases; and iv) references.

Content	*MK Conservation area management discusses the history and development of conservation area management in Indonesia and world. National conservation area management policies and their problems. How to plan a conservation area, monitor and evaluate area management, integrate management with spatial plans and resources funding for area management*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Directorate of Conservation Areas. 2015. Guidelines for Evaluating the Effectiveness of Conservation Area Management in Indonesia Management Effectiveness Tracking Tool. Directorate of Conservation Areas. Directorate General of Conservation of Biological Resources and The ecosystem. Jakarta 2. Directorate of Conservation Areas. 2014. Indonesian Biosphere Reserve, To Linkage Biological and Cultural Diversity for Sustainable Development. Directorate of Conservation Areas. Directorate General of Conservation of Biological Resources and Their Ecosystems. Jakarta 3. Dudley, N. (Editors) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp. WITH Stolton, S., P. Shadie and N. Dudley (2013). IUCN WCPA Best Practice Guidance on Recognizing Protected Areas and Assigning Management Categories and Governance Types, Best Practice Protected Area GuidelinesSeries No. 21, Gland, Switzerland: IUCN. xxpp. 4. The Indonesian HCV Toolkit Revision Consortium. 2008. Guidelines for Identification of High Conservation Value Areas in Indonesia. Tropenbos International Indonesia Programme 5. Law No. 5 of 1990 concerning Conservation of Living Natural Resources and Their Ecosystems 6. Law No. 41 of 1999 concerning Forestry 7. Regulations related to conservation area management (http://ksdae.menlhk.go.id/peraturan/post/120) 8. Wiratno, D. Indriyo, A. Syarifuddin and A. Kartikasari. 2004. Reflecting in a Cracked Mirror. Reflection on Conservation and Implications for National Park Management. Indonesian Center for Environmental Information. Bogor. 9. Yudhistira, P. 2014. The Pioneer, The Role of Dr. SH Coorders in History of Nature Protection in Indonesia. Regional Directorate Conservation. Directorate General of Conservation of Biological Resources and Their Ecosystems. Jakarta 10. Directorate of Environmental Services on Protected Areas. 2017. Nature Touristm of 54 National Parks in Indonesia, Exploring the Beauty of Panorama and The Uniqueness of Indonesia National Park. Directorate of Environmental Services on Protected Areas. Jakarta 11. Mardiastuti, A. 2018. Animal Ecology in Human-Dominated Landscapes. IPB Press Publisher. Bogor. 12. Supriatna, J. 2008. Preserving Indonesia's Nature. Indonesian Obor Foundation Publisher. Jakarta 13. Supriatna, J. 2018. Conservation of Biodiversity Theory and Practice in Indonesia. Indonesian Obor Foundation Publisher. Jakarta 14. Van der Ree, R, DJ Smith & C. Grilo. 2015. Handbook of Road Ecology. Wiley Blackwell.

Pest Control

CourseID	*BIO60 283*
Course name	*Pest Control*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Rest Rahayu* *Dr. Henny Herwina* *Dr. Mairawita* *Prof. Dr. Dahelmi*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*a. Students are able to explain the meaning of integrated pest control (IPM) correctly as well as the supporting aspects and the important reasons for the need study of environmentally friendly pest control both in the agricultural sector as well as settlements.* *b. Have analytical skills in studying the phenomenon of pest attacks in field and can provide a simple solution to the problem based on IPM concepts and theories.*
Content	*Pest control course (BIO 4311) is a course choice in the Biology Study Program, Department of Biology, FMIP A , University Andalas. This course consists of 3 credits, and given in the semester (Even). Studies studied on This course is the understanding and principles of control and pest management. Types and types of pests, types and types pest targets, symptoms and causes of pest outbreaks. Aspect ecology in pest control, aspects in the economic threshold as well as factors that affect the economic threshold. Various ways pest control (chemical, biological and ecological) in space the scope of residential and settlement pests (urban pests) and integrated pest control (IPM).*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Metcalf, RL and Luckman, WH 1994. Introduction to Insect Pests Managemant. Wiley and Sons. New York. 2. Walter, GH 2003. Insect Pest Management And Ecological Research.. Cambridge Univ. press. 3. Robinson, WH 2005. Handbook of Urban Insects and Arachnids. Cambridge Univ. press. 4. Hone, J. 2007. Analysis of Vertebrate Pest Control. Series of Cambridge Studies in Applied Ecology and Resource Management. Cambridge Univ. press. 5. Related journals

Primatology

CourseID	*BIO60 2 08*
Course name	*Primatology*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Rizaldi, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Understand the position and role of Primatology in the Biology discipline wider.* *2. Understand the diversity of species, ecology and behavior of primates proportionally and scientifically.* *3. Know the distribution of primate species in Indonesia and their needs for the preservation of the species.* *4. Understand primates that live today (Living Primates) as a product of genetic evolution, morphology and behavior.* *5. Understand the important role of primates as components ecosystem in nature.* *6. Able to understand the forms of community interaction with animals primates in a scientific and balanced manner.*
Content	*Primatology is an elective course offered by the Undergraduate Study Program Biology, Faculty of Mathematics and Natural Sciences, Andalas University. This course is expansion of courses in the Megabiodiversity study material group.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Swindler, DR 1998. Introduction to the Primates. University of Washington Press, Seattle. 2. Rowe, N. 1996. The Pictorial Guide of the Living Primates. Pogonias Press. New York. 3. Strier, KB 2003. Primate Behavioral Ecology, 2nd edition. Allyn and Bacon. New York. 4. Smuts, BB, Cheney, DL, Seyfarth, RM, Wrangham, RW & Struhsaker, TT 1987. Primate Societies. The University of Chicago. Chicago.. 5. Shumaker RW, Beck, BB 2003. Primates in questions. Smithsonian Books. Washington. 6. Rowe, N. and Myers, M. 2016. All the World's Primates (edited). Pogonias Press. Charlestown Rhode Island.

Pollinating Insects

CourseID	*BIO60 264*
Course name	*Pollinating Insects*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Syamsuardi* *Robby Jannatan, M.Sc*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*a. Students understand the basic understanding of pollinating insects and aspects supporters.* *b. Able to develop the benefits and various services of natural resources and environment* *c. Able to plan, develop and manage diversity pollinating insect life*
Content	*The Insect Pollinator course is an elective course in Biology Study Program, Department of Biology, Faculty of Mathematics and Natural Sciences, Andalas University. this course consists of 3 credits, and is given in the even semester. To take the eye In this course, students are required to have taken the Biological Perspective course, Animal Systematics, Entomology and Insect Ecology.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	Faegri Kaand L. Van der Pijl.. 1979. The principles of pollination ecology. Pergamum, Oxford. Kearns, CA 1997. Pollinators, Flowering Plants, and Conservation Biology. BioScience 47(5): 297-306 Faheem, M., M. Aslam and M. Razaq. 2004. Pollnation Ecology with special reference to insects. A Reviews. Journal of Research (Science), Bahauddin Zakariya University, Multan, Pakistan. Vol.15, No.4: 395-409 Cooley, AM, G. Carvallo and H. Willis. 2008. Is Floral Diversification Associated with Pollinator Divergence? Flower Color and Pollinator Preference

Sitogenetics

CourseID	*BIO60 2 86*
Course name	*Sitogenetics*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Manshurdin* *Prof. Dr. Dewi Imelda Roesma*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-1: Able to master the concept of cytogenetics and the scope of cytogenetics and its use in other fields of science. CPMk-1: Be able to name and explain chromosomes, chromosome structure, stages and general principles* *CPMk-2: Able to explain and understand methods in analyzing chromosomes* *CPMk-3: Able to explain and understand the technique of making and observing chromosomes* *CPMk-4: Able to explain and understand techniques for making and observing chromosomes (karyotypes)* *CPMk-5: Able to explain and understand chromosome mapping techniques* *CPMk-6: Able to mention and explain the concept of polyploidy* *CPMk-7: Able to explain and analyze mutations of genetic disorders* *CPMk-8: Able to explain and analyze mutations in the structure and number of chromosomes* *CPMk-9: Able to explain and analyze point mutations and repair* *CPMk-10: Be able to explain and understand DNA repair due to mutations* *CPMk-11: Able to explain and understand maternal inheritance* *CPMk-12: Able to name and explain the application of cytogenetics in the field of taxonomy and evolution* *CPMk-13: Able to mention and explain the application of cytogenetics in the clinical field*
Content	*Cytogenetics is the study of inheritance by using a combination of cytological and genetic techniques and prioritizing genetic aspects that are closely related to cells. The basis of cytogenetics is the knowledge of chromosome structure, chromosome behavior, changes in the structure and number of chromosomes as well as chromosome evolution*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-

reading list	1. Klug, WS and NR Cummings. 1994. Concepts of Genetics. Prentice Hall Inc. New Jersey. 2. Sang, JH 1984. Genetics and Development. Longmen Inc. New York. 3. Strickberger, J. 1985. Genetics. Macmillan Publishing Co. New york & Callier MacMillan Publishers. London. 4. Sinha, U. and S. Sinha. 1976. Cytogenetics, Plant Breeding and Evaluation. Vikas Publishing House PVP Ltd. 5. Steven L. Gersen and Martha B. Keagle. 2005. The Principles of Clinical Cytogenetics. Second Edition. Human Press Inc. Totowa, New Jersey

Genetic Resources And Breeding

CourseID	*BIO60 2 34*
Course name	*GENETIC RESOURCES AND BREEDING*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Mansyurdin, MS* *Dr. Syaifullah*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-4: Able to master the concepts, principles and application of biological knowledge in the fields of food, health, environment (biological), and biological resources in the management and utilization of biological resources as well as environment.* *CPMk-1: The concept and scope of genetic resources* *CPMk-2: The concept of a central of origin, a center for genetic diversity and germplasm* *CPMk-3: Plant breeding concept and space* *CPMk-4: Basic plant breeding techniques* *CPMk-5: Plant breeding: self pollinating, cross pollinating, vegetative propagation and special techniques* *CPMk-6: The scope of animal breeding* *CPMk-7: Special technical animal breeding*
Content	*MK Genetic Resources and Breeding discusses the concept and space of genetic resources, the concept of Central of origin, center for genetic diversity and germplasm, concept and scope of breeding, basic breeding techniques, plant breeding and animal breeding.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. lutz. GC, 2001. Practical Genetics for Aquaculture. Blackwell Science. A Blackwell Publishing Company. 2. Beaumont, AR and Hoare, K., 2003. Biotechnology and Genetics in Fisheries and Aquaculture. Blackwell Science Ltd.

Taxonomy of Selected Taxa

CourseID	*Bio6 0269 _*
Course name	*Taxonomy of Selected Taxa*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Prof. Dr. Syamsuardi, MSc.* *Dr. Nurainas, MSc.*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*1. Students have competence in the subject of Taxonomy of Plants and Taxa Selected, that is able to explain and describe the science of Plant Taxonomy High level* *2. Students are able to explain the basics of Taxonomy of Plant Taxa Selected and apply it in everyday life.* *3. Students are able to discuss and cooperate in formulating and solve the problem of Plant Taxonomy of Selected Taxa.* *4. Students can understand and explain tasks that originate from work independent.* *5. Students are able to see the economic potential of plant biodiversity and carry out project analysis of Selected Taxa Plant Taxa in the field.*
Content	*The Plant Taxonomy Course of Selected Taxa is elective course in the Biology Study Program, Department of Biology, University of Mathematics and Natural Sciences Andalas. This course consists of 3 credits, and is given in odd semesters. For To take this course, students are required to have taken the course Perspective of Biology, Plant Morphology, and Plant Systematics.*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	Holingsworth, PMRM Bateman and RJ Gornal. 2005. Molecular Systematics and Plant Evolution. Systematics Association Publication. London-New York Porter, CL 1967. Taxonomy of Flowering Plants. Second Edition. WH Freeman and Company. San Francisco. p.471. Radford, AE 1986. Fundamentals of Plant Systematics. Harper & Row, Publishers, Inc. New York. p. 477. Woodland, DW 1997. Contemporary Plant Systematics. Second Edition. Andrews University Press. Michigan. p. 619. Related journals, reports, brochures

Biological Analysis Techniques Of Halal Products

CourseID	*Bio6 0288 _*
Course name	*BIOLOGICAL ANALYSIS TECHNIQUES OF HALAL PRODUCTS*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Syaifullah Zoelkiar* *Dr. Periadnadi* *Prof. Dr. Safni M.Eng*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-4: Able to understand the concepts, principles and application of biological knowledge in the fields of food, health and biological resources in the management and utilization of biological resources* *CPMK-1: Concept and scope of Biological Resources and their utilization* *CPMK-2: Knowing potential biological resources for Halal products* *CPMK-3 : Development of Biological Resources as Halal Products*
Content	*This course discusses the concepts of biological resources, biotechnology, and bioprocessing of biological resources in producing halal products*
Examination forms	*oral presentation, essay, written test .*
Study and examination requirements	-
reading list	1. Global Biodiversity Status of The Earth's Living Resources. World Conservation Monitoring Centre. Editor Brian Groombridge. Chapman & Hall. 1992. 2. Law on Halal Product Guarantee No. 33 of 2014 3. Collection of MUI Fatwas in the Field of Food, Drugs, Cosmetics, Science and Technology, LPPOM

Vertebrates Hematological Techniques

CourseID	*BIO 602 20*
Course name	*VERTEBRATES HEMATOLOGICAL TECHNIQUES*
Semester(s) in which the course is taught	*7th semester*
Person responsible for the course	*Dr. Santoso's son* *Muhammad Syukri Fadhil, M.Sc.*
language	*Indonesian Language or English*
Relationship to curriculum	*elective*
Teaching methods	*lectures, lessons , lab work*
Workload (incl. contact hours, self-study hours)	*135.99*
credit points	*3 credits*
Required and recommended prerequisites for joining the course	
Course objectives/intended learning outcomes	*PI-1: Able to master the theoretical concepts of cell and molecular biology, organismal biology, evolution and ecology.* *CPMk-1: Be able to explain the Basic Principles of Hematology* *CPMk-2: Able to explain the principles and procedures for collecting vertebrate blood samples* *CPMk-3: Able to explain the Principles and procedures for Storage and Preservation of Blood Samples* *CPMk-4: Be able to explain the Principles and procedures for Separation of Blood Components* *CPMk-5: Be able to explain the Principles and procedures for Quantification of Blood Values* *CPMk-6: Be able to explain the principles and procedures for the Absolute Blood Index* *CPMk-7: Be able to explain the principles and procedures for making blood and bone marrow smears* *CPMk-8: Able to explain the Principles and procedures of Blood Plasma Biochemical Analysis* *CPMk-9: Able to explain the Principles and procedures of Blood Donation and Transfusion*
Content	*This course examines the basic principles and techniques in haematological analysis of vertebrate animals. Main study covers techniques in blood sampling in vertebrate animals, selection and use of anticoagulants, techniques storage of blood samples, techniques for separating blood components, making blood film smears, techniques for counting blood cells (erythrocytes, platelets, total leukocytes), leukocyte differential quantification technique, blood index calculation, technique for measuring Hb levels, technique measurement of blood sedimentation rate, and blood screening procedures in the process of blood donation and transfusion.*
Examination forms	*oral presentation, essay, written test .*

Study and examination requirements	-
reading list	1. Hoffman R et al. 2018. Hematology, Basic Principles and Practice. Seventh Edition. Elsevier, Inc. Philadelphia, USA. 2. Saxena R and Pati H. 2008. Laboratory Techniques in Hematology. JP Medical Ltd., New Delhi, India. 3. McKenzie SB, Williams JL, Landis-Piwowar K. 2015. Clinical Laboratory Hematology. Pearson Education, Inc. New Jersey, USA.