EDUCATIONAL GUIDE

UNDERGRADUATE BIOLOGY

CURRICULUM 2021-2026

DEPARTEMENT OF BIOLOGY
FACULTY OF SCIENCE AND TECHNOLOGY
UNIVERSITAS AIRLANGGA

2021

PREFACE

Thanks to the grace of the Almighty God, the Curriculum Document of the Biology Bachelor Degree Study Program, Faculty of Science and Technology for the 2021-2026 MBKM curriculum can be completed. This book contains various curriculum information for the Biology Bachelor Degree Study Program, namely its vision, mission, graduate profile, description of KKNI qualification levels, learning outcomes, learning sub-achievements, material organization, curriculum structure, curriculum content, learning strategies, and evaluation systems. Rules regarding the education system, proposal and thesis guidance, guardian lecturers, education administration and others follow the Education Guidelines of the Faculty of Science and Technology.

This 2021 curriculum is the improved results from the 2015-2020 curriculum. The review was carried out through a Curriculum Redesign Workshop that brought in informants, took into accounts of community needs, referred to guidelines suggested from the Indonesian Biology Consortium (KOBI) and feedback from ASIIN, as well as based on the results of questionnaires from Stakeholders, alumni, active students, and also the results of workshops of all staff of the Department of Biology. These improvements include the addition of courses for the future (Bioinformatics, Biological Conservation, Conservation and modeling, and Bioethics), as well as course mapping by considering the depth order of material and the difficulty level of a course

The preparation of this book is a series of curriculum workshop activities held at the Department of Biology starting from 2018-2021. This curriculum has adjusted to the Airlangga Smart Education book about MBKM.

To all parties involved in the preparation of this curriculum document book, we express our deepest gratitude. Hopefully this book can be used as a reference in the implementation of education and can support a better academic life in the era of generation 4.0 industrialization in the Biology Bachelor Degree Study Program, Department of Biology, Faculty of Science and Technology, Universitas Airlangga.

Surabaya, 15 Juni 2021
Coordinator of the Biology Bachelor Degree Study Program

Prof. Dr. Sri Puji Astuti Wahyuningsih, M.Si.
NIP.196602211992032001

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VISION, MISSION, EDUCATIONAL OBJECTIVES, GRADUATE PROFILES, AND LEARNING OUTCOMES

VISION

The vision of the Bachelor's degree in biology is to become an excellent and outstanding study program in the field of biology, and its application on a national and international level to harmoniously support human survival and welfare, based on religious morals.

MISSION

1. Organize effective and efficient teaching of Biology related to the fields of health, food, renewable energy, and the environment.
2. Carry out Biology research related to the health and environmental fields.
3. Provide guidance, counseling and empowerment to the community related to health and the environmental fields.
4. Establish cooperation with various parties both at the national and international levels in developing science, institutions and resources.
5. Equip students for lifelong learning.
6. Educate students to have a spirit in entrepreneurship.

PURPOSES

1. Have graduates who are able to solve community problems in health, food, renewable energy, and the environmental fields.
2. Produce research related to the health and environmental fields.
3. Carry out community service related to health and the environment fields as a result of teaching and research in a sustainable manner to resolve problems in society.
4. Provide provision for graduates who are able to learn throughout life.
5. Create entrepreneurial spirit in graduates.

GRADUATE PROFILE

Roles that can be carried out by graduates in certain areas of expertise or work after completing the study program. Graduates of the Bachelor of Biology study program have roles as:

1) A health and environmental biology analyst.

   Graduates can carry out their duties, including preparing operational technical processes, conducting analytical tests on specimens and reagents, developing procedures for collecting and processing specimens, operating and maintaining instruments in the laboratory, maintain work safety in the laboratory environment, and evaluate laboratory data to ensure quality control procedures and accuracy.

2) Research Assistant in biology.

   As a research assistant, Biology Bachelor Degree graduates can become young researchers in research institutions. Biology Bachelor Degree graduates are expected to be able to evaluate problems in the field of biology and professional practice through research to produce innovative and tested work, be able to analyze problems in the field of Biology through an interdisciplinary approach, be able to design and conduct research in the field of Biology based on the principles of scientific methods, and be able to write scientific papers in national or international journals and communicate research results orally in national or international seminars.

3) Entrepreneur in biology fields

As entrepreneurs, Biology Bachelor Degree graduates can be entrepreneurs so that they are talented in organizing and managing a business related to the field of biology that is being run. Graduates are expected to have the ability to think creatively, imaginatively, and empower themselves for the benefit and good of their surroundings.

Graduate Learning Outcome (GLOs)

The formulation of GLOs must refer to the KKNI qualification level, especially in the elements of Knowledge and Special Skills. Meanwhile, the elements of Attitude and General Skills elements are taken from the Annex to PERMENDIKBUD No. 3 of 2020.

A. Attitude

1. Demonstrate a religious attitude and be devoted to the Almighty God;/or technology in accordance with their field of expertise;
2. Able to uphold human values in carrying out duties based on religion, morals, and ethics;
3. Able to internalize academic values, norms, and ethics;
4. Able to act as citizens who are proud and love the country, have nationalism and responsibility to the state and nation;
5. Able to appreciate the diversity of cultures, views, religions, and beliefs, as well as the original opinions or findings of others;
6. Able to contribute to improving the quality of life in society, nation, state, and the advancement of civilization based on Pancasila;
7. Able to work together and have social sensitivity and concern for society and the environment;
8. Able to obey the law and discipline in social and state life;
9. Able to internalize the spirit of independence, struggle, and entrepreneurship;
10. Able to show an attitude of responsibility for work in their field of expertise independently.
11. Able to realize excellence based on religious morality (excellence with morality)

B. Common Skills

1. Able to apply logical, critical, systematic and innovative thinking in the context of the development or implementation of science and/or technology in accordance with their field of expertise;
2. Ability to analyze implications of the development or implementation of science, technology, or art within their area of expertise, based on scientific principles, procedures, and ethics, allowing to develop solutions, ideas, designs, or art criticism and form a thesis or final project report by compiling scientific descriptions of their study results.
3. Able to make appropriate decisions in the context of problem solving in the area of biological expertise, based on the results of analysis of information and data;
4. Ability to independently manage learning;
5. Ability to develop and maintain working networks with supervisors, colleagues, and peers within and outside the institution.

C. Specific Skills

1. Able to present alternative solutions in solving problems related to the management of biological resources and the environment in a sustainable manner through the application of relevant knowledge, biological methods and technologies as the basis for making appropriate decisions.
2. Able to apply biology to daily life in ways that benefit society, with an emphasis on health and the environment.
3. Able to manage biological resources and the environment in a specific field.
4. Able to conduct independent research in the laboratory and in the field, as well as adept at handling organisms.

D. Knowledge

1. Able to evaluate biodiversity in Indonesia according to the determination key correctly
2. Able to describe natural phenomena based on biological principles (universality, evolution, diversity, continuity, homeostasis, interaction) correctly.
3. Able to connect phenomena that occur in organisms and interactions with the environment based on the principles and studies of MIPA (mathematics, physics and chemistry) correctly.
4. Able to provide a strong knowledge base of Mathematics and Natural Sciences in relation to life sciences
5. Able to provide knowledge of the basics of molecular, cellular and organism
6. Able to provide relevant knowledge on safety and environmental issues, including the fundamental laws related to the related laws
7. Able to provide arguments of biological science and related technologies from the cellular to molecular level in accordance with the development of science.
8. Able to integrate biological principles (botany, ecology, microbiology, zoology) in accordance with the correct scientific principles
9. Able to use laboratory equipment in accordance with the SOP properly and correctly

CURRICULUM MATRIX AND MAPPING

The curriculum structure of the Biology Bachelor Degree Study Program, Faculty of Science and Technology, Universitas Airlangga contains the following elements:

a. Character Strengthening Courses;
b. Related Study Program Field Courses;
c. Cross-field courses in 1 (one) science group;
d. Cross-field courses across groups;

	Course		Credits in Activities			Category of Elements (a.b.c.d)
	Code	Name	Lecture	Practicum	Total	
(1)	(2)	(3)	(4)	(5)	(6)	
Semester 1						
Compulsory						
1	BIS101	Cell Biology	2		2	b
2	BID101	Basic Biology	2		2	c
3	BID102	Basic Biology (Practicum)		1	1	c
4	KID105	Basic Chemistry	2		2	c
5	KID106	Basic Chemistry (Practicum)		1	1	c
6	SIP107	Data and Literature	2		2	a
7	NOP104	Civics	2		2	a
8	NOP103	Pancasila	2		2	a
9	AGI101	Islam	2		2	a
	AGK101	Catholic Religion				
	AGP101	Protestant Religion				
	AGH101	Hinduism Religion				
	AGB101	Buddhism Religion				
	AGC101	Confucianism Religion				
10	BAI101	Indonesian Language	2		2	a
		Subtotal	**16**	**2**	**18**	
Elective						
-	-	-	-	-	-	
		Subtotal	**0**	**0**	**0**	
Semester 2						
Compulsory						
11	BIB108	Plant Structure	3		3	b
12	BIB109	Plant Structure (Practicum)		1	1	b
13	BIG302	Genetics	2		2	b
14	FID113	Basic Physics	2		2	c
15	MAA101	Calculus	3		3	c
16	PHP103	Logical and Critical Thinking	2		2	a
17	MNM107	Introduction to Scholarly Collaboration	2		2	a
18	MNM106	Communication and Self-Development	2		2	a

19	BIZ204	Comparative Vertebrate Anatomy	2		2	b
20	BIZ205	Comparative Vertebrate Anatomy (Practicum)		1	1	b
		Subtotal	**18**	**2**	**20**	
Elective						
-	-	-	-	-	-	
		Subtotal	**0**	**0**	**0**	
Semester 3						
Compulsory						
21	LKB201	General Ecology	2		2	b
22	LKB203	General Ecology (Practicum)		1	1	b
23	BIB211	Plant Physiology	2		2	b
24	BIB212	Plant Physiology (Practicum)		1	1	b
25	BIG201	Molecular Genetics	2		2	b
26	BIK201	Biochemical Science	2		2	c
27	BIU201	Microtechnics	2		2	b
28	BIZ206	Animal Histology	2		2	b
29	BIZ207	Animal Histology (Practicum)		1	1	b
30	BIM201	General Microbiology	2		2	b
31	BIM203	General Microbiology (Practicum)		1	1	b
32	BAE110	English Language	2		2	d
		Subtotal	**16**	**4**	**20**	
Elective						
33	BIL302	Abiotic Environment	2		2	b
34	MNW201	Entrepreneurship	2		2	d
35	BIU302	Microtechnics (Practicum)		2	2	b
36	BIU301	Marine Biology	2		2	b
37	BIZ203	Carcinology	2		2	b
		Subtotal	**8**	**2**	**10**	
Semester 4						
Compulsory						
38	BIE201	Conservative Biology	2		2	b
39	BIE202	Behavioral Biology	2		2	b
40	BIB301	Plant Embryology	2		2	b
41	BIB302	Plant Embryology (Practicum)		1	1	b
42	BIU202	Molecular Analysis Methods	1		1	b
43	BIU203	Molecular Analysis Methods (Practicum)		1	1	b
44	BIU204	Taxonomy	2		2	b
45	BIU205	Taxonomy (Practicum)		1	1	b
46	BIU206	Monera, Protista, and Fungi Biodiversity	2		2	b
47	BIZ211	Animal Physiology	2		2	b
48	BIZ212	Animal Physiology (Practicum)		1	1	b
49	MAS104	Statistical Methods	2		2	c
		Subtotal	**15**	**4**	**19**	

Elective						
50	BIZ202	Entomology	2		2	b
51	BIE201	Terrestrial Ecology	2		2	b
52	BIE202	Terrestrial Ecology (Practicum)		1	1	b
53	BIM103	Bacteriology	2		2	bb
54	BIM104	Bacteriology (Practicum)		1	1	
55	BIB104	Botanical Economics	2		2	b
		Subtotal	**8**	**2**	**10**	
Semester 5						
Compulsory						
56	BIE302	Ecosystem Biodiversity	2		2	b
57	BIB305	Plant Biodiversity	2		2	b
58	BIB306	Plant Diversity (Practicum)		1	1	b
59	BIK308	Bioinformatics	2		2	b
60	BIK309	Bioinformatics (Practicum)		1	1	b
61	BIU300	Capita Selecta of Specialized Fields	2		2	b
62	PNT497	Research Methodology	2		2	b
63	BIZ302	Animal Biodiversity	2		2	b
64	BIZ303	Animal Biodiversity (Practicum)		1	1	b
65	BIR306	Vertebrate Embryology	2		2	b
66	BIR307	Vertebrate Embryology (Practicum)		1	1	b
		Subtotal	**14**	**4**	**18**	
Elective						
67	LKB301	Aquatic Ecology	2		2	b
68	LKB303	Aquatic Ecology (Practicum)		1	1	b
69	BIB202	Mycology	2		2	b
70	BIB203	Mycology (Practicum)		1	1	b
71	BII201	Immunobiology	2		2	b
72	BIT304	Plant Tissue Culture	2		2	b
73	BIT305	Plant Tissue Culture (Practicum)		1	1	b
		Subtotal	**8**	**3**	**11**	
Semester 6						
Compulsory						
74	KLT302	Field Work Practice (MBKM with non-Higher Education Institutions)		4	4	d
75	MBKM Higher Education Partners / non-Higher Education institutions, among others:		6		6	d
	BIU311	Industrial Knowledge	4			
	BIU312	Information Technology Knowledge	4			
76	BIU309	Evolution	2		2	b
77	BIU101	Biosystematics	2		2	b
78	BIU102	Biosystematics (Practicum)		1	1	b
79	AGI401	Islam Religion				
	AGK401	Catholic Religion				
	AGP401	Protestant Religion				

	AGH401	Hinduism Religion	2		2	d
	AGB401	Buddhism Religion				
	AGC401	Confucianism Religion				
		Subtotal	**12**	**5**	**17**	
Elective						
80	BIT307	Genetic Engineering	2		2	b
81	BIE301	Endocrinology	2		2	b
82	BIR303	Spermatology	1		1	b
83	BIS308	Spermatology (Practicum)		1	1	b
84	BIM301	Applied Microbiology	2		2	b
85	BIM302	Applied Microbiology (Practicum)		1	1	b
		Subtotal	**7**	**2**	**9**	
Semester 7						
Compulsory						
86	PNT491	Seminar	2		2	b
87	KKN401	Community Service Program (MBKM with Non-Higher Education Institutions)	3		3	d
88	MBKM Higher Education Partners/Non-Higher Education Institutions, including:		7		7	d
	BIU401	Educational Technology (MBKM)	4			
	BIU402	Independent Study (MBKM)	4			
	BIU403	Current Knowledge of Biology (MBKM)	4			
		Subtotal	**12**	**0**	**12**	
Elective						
89	BIR302	Animal Reproduction	2		2	b
90	BIZ401	Animal Cell Culture	2		2	b
91	BIU302	Teratology	2		2	b
92	BIZ210	Animal Tissue Adaptation	2		2	b
93	LKB606	Environmental Management	2		2	b
94	BIE230	Spermatophyta Reproduction	2		2	b
95	BIE231	Spermatophyta Reproduction (Practicum)		1	1	b
96	BIM303	Environmental Microbiology	2		2	b
97	BIB103	Orchidology	2		2	b
98	BIB401	Tropical Plant Biotechnology	2		2	b
		Subtotal	**18**	**1**	**19**	
Semester 8						
Compulsory						
99	PNT499	Undergraduate Thesis	6		6	b
		Subtotal	**6**		**6**	
Elective						
-	-	-	-	-	-	
		Subtotal	**0**		**0**	
Total credits of compulsory program courses (A)			**90**			
Total credits of PDB courses (B)			**20**			
Minimal total credits of MBKM courses (C)			**20**			

Total credits of elective courses (D)	**14**		
Total credits of elective courses offered	**59**		
Total credits of courses taken (A + B + C + D)	**144**		

CURRICULUM CONTENT (COURSE DESCRIPTION)

1. CELL BIOLOGY

Course Code: BIS101

Credits: 2

Learning Outcomes imposed in this course

Students are able to associate, verify, and show the structure of cells and their components with their typical functions correctly (C4, A3, P3).

Course Description/Syllabus

In this course, students will learn about: the extracellular environment, membrane structure, cross-membrane transport, cell surface components, inner membrane structure and function, lysosomes, intracellular digestion, modification, and export, intracellular information, ribosomes, protein synthesis, energy conversion and transduction, the cytoskeleton and molecular movement, cell signaling, and aging and cell death.

Lecturers: Prof. Dr. Alfiah Hayati, Dr. Dwi Winarni, M.Si., Prof. Drs. Hery Purnobasuki, M.Si., Ph.D., Prof. Dr. Sri Puji Astuti Wahyuningsih, M.Si.

References:

1. Alberts B., A. Johnson, J. Lewis, D. Morgan, M. Raff, K. Roberts, and P. Walter. 2015. Molecular Biology of The Cell. 6th. Ed. Garland Science.
2. Bolsover S., J. Hyams, E. Shephard, and H. White. 2012. Cell Biology, third edition, Wiley Blackwell.

2. BASIC BIOLOGY

Course Code: BID101

Credits: 2

Learning Goals imposed in this course:

1. Ability to correctly explain the principles of biology.
2. Ability to explain life phenomena based on Biologycal principles.

Course Description /Syllabus:

Introduction to biology, cell as the unit of life, cell metabolism, protein synthesis and replication, structure and function of plants and the relationship between plant structure and function, structure and function of animals and the relationship between animal structure and function, homeostasis at the cellular level, homeostasis at the organismal level, classification of organisms and conservation of Biologycal resources, interaction of organisms and their environment, reproduction of cells and organisms, evolution at the level of genes, cells and organisms; modern biotechnology, Biologycal information database, review of cases in the field of biology in the last 1 year.

Lecturers: Hari Soepriandono, S.Si., M.Si.

References:

1. Campbell, N.A., Reece J.B., and Mitchell, L.G., 2010. *Biology,* 9th edition. Pearson Education Inc. Toronto.
2. Campbell, N.A. &J.B. Reece, 2012. *Biology,* 8th edition. Benjamin Cummings, San Francisco.
3. Freeman. S. 2012. Biologycal Science: volume 2. Evolution, Diversity and Ecology, Prentice Hall Inc,

New Jersey.
4. Jones, M. & G. Jones. 2016. Advanced Biology, 10th Edition. Cambridge University Press Cambridge.
5. Claverie, J. 2011. Bioinformatic For Dummies, 2th edition. For Dummies.
6. Fatchiyah. 2015. Prinsip Dasar Bioinformatika. Penerbit UB Press. Malang.

3. BASIC BIOLOGY PRACTICUM

Course Code: BID102

Credits: 1

Learning Goals imposed in this course:

Students are able to explain basic biology 1 lecture material and can apply Biologycal principles to living things.

Course Description /Syllabus:

Introduction to microscopy, universality (cells as the basic unit of life, tissues composed of cells, and cell chemistry), evolution and biodiversity (key to plant and animal identification), cell reproduction (mitosis and meiosis), organism reproduction, inheritance of traits based on Mendel's law, homeostasis (diffusion and osmosis), ecophysiology in animals, and physiology of homeostasis in animals and plants.

Lecturers: Basic Biology Team

References:

1. Anonimus. 2013. *Petunjuk Practicum Biology Dasar 1*. Laboratorium Biology Dasar, Universitas Airlangga.
2. Campbell, N.A., Reece J.B., and Mitbhell, L.G., 2010. *Biology*, 9th edition. Pearson Education Inc. Toronto.
3. Eroschenko, V.P., di Fiore, M.S. 2012, diFiore's *Atlas of Histology*: with Functional Correlations. Lippincott Williams &Wilkins
4. Crang, R.F.A., Lyons-Sobaski, S, Wise, R. 2018. *Plant Anatomy*: A Concept-Based Approach to the Structure of Seed Plants.Springer Copyright.
5. Hayati, A.2010, *Reproduksi Hewan*. Departemen Biology, Universitas Airlangga Surabaya.
6. Irawan, B., 2010. *Genetika, Penjelasan Mekanisme Pewarisan sifat*, Airlangga University Press (AUP), Surabaya.
7. Moyes, C.D. and P.M. Schulte. 2016. *Principles of Animal Physiology 3rd edition.* San Fransisco: Pearson Education Inc.Anonimus.
8. Madigan, M.T., Bender, K. S., Buckley, D.H., Stahl, D.A., 2014. *Brock Biology Mikroorganisme*. Alih Bahasa Siti Meliah. Penerbit Buku Kedokteran EGC.
9. Tjitrosoepomo, G., 1994. *Morfologi Tumbuhan*, Gadjah Mada Universty Press.Yogyakarta.

4. BASIC CHEMISTRY

Course Code: KID105

Credits: 2

Learning Goals imposed in this course:

After taking this course, students are expected to be able to identify carbon compound describe the composition of matters, and can calculate quantitatively between reactants and products in chemical reactions.

Course Description /Syllabus:

Atomic structure and periodic system; Chemical bonding: ionic bonding, covalent bonds, coordination bonds, hydrogen bonds; Stoichiometry; Redox and Thermochemistry; Reaction Rates; Reaction Equilibrium; Solutions: types and concentrations, colligative properties of solutions; Introduction to Organic Chemistry: Aliphatic Hydrocarbons (alkanes and cycloalkanes, alkyl halides) alkenes and alkynes, Aromatic Compounds; Alcohols and Ether

Lecturers: Basic Chemistry 1 Teaching Team

References:

1. Timberlake, K.C., 2011, Chemistry: An Introduction to General,Organic and Biologycal Chemistry, 11thed., Prentice Hall.
2. Whitten. K. D., Davis, R.E., Gailey, K.D., 1992.General Chemistry with Qualitative Analysis, Ed. 4th, Saunders College Publ., USA.
3. Brown, W.H., Poon, T. 2016, Introduction to Organic Chemistry, 6th ed., John Wiley and Sons, New York
4. Wilbraham, A.C., Matta M.S., 1992, Pengantar Kimia Organik and Hayati (terjemahan Suminar Achmad), Penerbit ITB

5. BASIC CHEMISTRY (PRACTICUM)

Course Code: BID102

Credits: 1

Learning Goals imposed in this course:

Students are able to explain the basic concepts of chemistry which include organic and inorganic compounds correctly.

Course Description /Syllabus:

Chemical bonding experiments, reaction speed, molar volume, reduction and oxidation, equivalent weight determination, introduction of elements (Hg_2^{2+}, Ag^+, Pb^{2+}, K^+, Na^+, NH_4^+, and Mg^{2+}), colligative properties, alcohols, phenols, ketones and aldehydes, ethene, ethene ethuna, and carboxylic acids.

Lecturers: Alfa Akustia Widati, S.Si., M.Si., Dr. Handoko Darmokoesoemo, DEA

References:

1. Beran, J.A. 2013. Laboratory Manual forPrinciple of *General Chemistry 10th*ed., Wiley.
2. Raymond Chang., 2004, *Kimia Dasar (Konsep- Konsep Inti)*, Edisi Ketiga, Erlangga, Jakarta.
3. Vogel, A.I., 1979, *Textbook of Macro and Semimicro Qualitative Inorganic Analysis*, 5th Ed, Longman Group, Ltd., London.
4. Smith, J. 2011, *Principle of General, Organic, Biologycal Chemistry*, 1st Ed, Mc. Graw-Hill Science.

6. DATA AND LITERATURE

Course Code: SIP107

Credits: 2

Learning Goals imposed in this course:

Students are able to use data and scientific references to make decisions and persuade.

Course Description /Syllabus:

This course aims to encourage students to learn to understand how to interpret and use data properly and responsibly, so that students can develop strong and coherent arguments, and equip students with the ability to evaluate the quality of other people's arguments. Not everyone will be a scientist who has to plan a research design, collect data, analyze it and draw conclusions, but data literacy will help students to make decisions in everyday life that are guided by data. In addition, students are encouraged to practice searching, reading, evaluating and sorting out claims or information contained in scientific literature. In this course, students are also given the opportunity to practice organizing scientific references with the help of reference management applications

Lecturers: PDB team

References:

Bailey, J. (2008). First step in qualitative data analysis: transcribing. Family Practice, 25(2), 127-131.

7. CIVICS

Course Code: NOP104

Credits: 2

Learning Goals imposed in this course:

At the end of this lecture, students are expected to be able to analyze contextual issues of nationality, by developing a positive attitude and displaying behavior as a reflection of: (i) national spirit and love for the country, (ii) democracy with dignity, and (iii) awareness of law and diversity by utilizing the integrated MKWU UNAIR module through written and online media via AULA (elearning.unair.ac.id).

Course Description /Syllabus:

This course discusses: (i) Civics Education as an orientation for strengthening (and stabilizing) the character of the Indonesian Nation; (ii) national identity, Identity Politics, and Indonesian Nationalism; (iii) the State and the Constitution, the Relationship between the State and Citizens; (iv) Indonesian Democracy and Civics Education; and Citizens; (iv) Indonesian Democracy and Democracy Education in Indonesia, the Rule of Law and Human Rights; (v) Archipelago Concept as Indonesian Geopolitics and National Resilience as Indonesian Geopolitics and National Resilience as Geostrategy of Indonesia in the realm of globalization; (vi) Regional Autonomy (Law on Villages). State Defense, and World Peace world; (vii) National Integration; (viii) Anti-Corruption Education; and (ix) tax compliance.

Lecturers: Civics Education (PKN) Team

References:

1. Adib, Mohammad, Listiyono Santoso, and Ajar Triharso. 2013. Pendidikan Pancasila and Kewarganegaraan: Sebuah Pengantar Membangun Karakter Bangsa. Surabaya: Airlangga University Press.
2. Adib, Mohammad. 2016 (Cet. Kedua). Bangunlah Jiwanya, Bangunlah Bangsanya: Penguatan Karakter Bangsa dalam Pembelajaran Pendidikan Kewarganegaraan. Surabaya: Saga and Direktorat Pendidikan Universitas Airalanga.
3. Kemenristek Dikti, Ditjen Pembelajaran and Kemahasiswaan. 2016. Pendidikan Kewarganegaraan untuk Perguruan Tinggi. (Cet. I). Dirjen Dikti.

4. Kemendikbud, Dirjen Dikti, 2010, Pendidikan Anti-Korupsi untuk Perguruan Tinggi, Jakarta: Kemendikbud.
5. Listiyono Santoso, dkk. 2019. *Modul Terintegrasi MKWU Universitas Airlangga*. MKWU-Univeritas Airlangga Tasks uploaded in AULA (elearning.unair.ic.id): Individual Assignments Summary, Papers, Scientific Article, Projects on a specific theme. Group Assignments Discuss, compose papers, make powerpoints, present, discuss in front of the class.

8. PANCASILA

Course Code: NOP103

Credits: 2

Learning Goals imposed in this course:

Students are able to build a new paradigm in themselves based on the values of Pancasila through the ability to explain the historical process, position and nature of the Pancasila principles, respond to the actual problems of the nation and state, and apply the values of Pancasila in the life of the nation and society with the final achievement of students being able:

1. solve (C4) national problems related to Pancasila,
2. design (C6) nationality projects as a contribution to improving the quality of life in society, nation, state, and the advancement of civilization based on Pancasila

Course Description /Syllabus:

This lecture will discuss: (1) Pancasila in the study of the nation's history, Pancasila as the basis of the state, (2) Pancasila as a state ideology, (3) Pancasila as a system of philosophy, (4) Pancasila as a system of ethics, (5) Pancasila values as the basis for science development, (6) Interpretation of the Pancasila Precepts, and examples of application in the life of the nation and society.

Lecturers: PDB Team

References:

1. Latif, Yudi, 2009, *Negara Paripurna, Aktualitas and Historisitas Pancasila*, Jakarta: Gramedia

2. Latif, Yudi, 2014, *Mata Air Ketelaandan, Pancasila dalam Perbuatan*, Bandung: Mizan

3. Tim Dikti, 2016, *Modul Pendidikan Pancasila untuk Perguruan Tinggi*, Jakarta: Kemenristekdikti

4. Tim MKWU, 2020, *Modul Terintegrasi MKWU*

9. RELIGION (Islam, Catholic, Protestant, Hinduism, Buddhism, Confucianism)

Course Code: AGI401, AGK401, AGP401, AGH401, AGB401, AGC401

Credits: 2

Learning Goals imposed in this course:

Course Description /Syllabus:

Lecturers:

References:

10. INDONESIAN LANGUAGE

Course Code: BAI101

Credits: 2

Learning Goals imposed in this course:

After participating in this study, students are able to apply the imposed in this course use of good Indonesian language and correct lectures, both in oral and written communication based on scientific rules and ethics by utilizing the integrated MKWU UNAIR module and written and online media via AULA (elearning.unair.ac.id).

Course Description /Syllabus:

This course discusses materials which includes: a) History, position, and function of Indonesian language, as well as integrated MKWU UNAIR modules, b) language varieties, c) spelling according to the General Guidelines for Indonesian Spelling (PUEBI), effective sentences, and paragraph development d) scientific essay writing (scientific essay systematics, citation techniques, bibliography techniques, and appearance in scientific essays), e) scientific presentations.

Lecturers: Bahasa Indonesia Course Team

References:

1. Badan Pengembangan and PembinaanBahasa. Kementerian Pendidikan and Kebudayaan. 2011. *Unandg- Unandg Republik Indonesia Nomor 24 Tahun 2009 tentang Bendera, Bahasa, and Lambang Negara, Serta Lagu Kebangsaan*.
2. Direktorat Jenderal Pembelajaran and Kemahasiswaan Kementerian Riset, Teknologi, and Pendidikan Tinggi Republik Indonesia. 2016. *Buku Ajar Mata Kuliah Wajib Umum BahasaIndonesia*.
3. Listiyono Santoso, dkk. 2019. *Modul terintegrasi MKWU Universitas Airlangga*. MKWU-UniveritasAirlangga
4. *Pedoman Umum Ejaan Bahasa Indonesia*. http://www.kemdikbud.go.id/main/blog/2016/01/salinan-permendikbud- nomor-50-tahun-2015. https://kbbi.kemdikbud.go.id/

11. PLANT STRUCTURE

Course Code: BIB108

Credits: 2

Learning Goals imposed in this course:

After this lesson, students are able to explain the morphological and anatomical plant structure of the organ parts of leaves, flowers, roots, stems, fruits, and seeds in Tracheophyta plants correctly.

Course Description /Syllabus:

This course explains and discuss: leaf, flower, root, stem, fruit, and seed organs in plants, general structure of plants, general structure of plant cells, meristem tissue, parenchyma, collenchyma, and sclerenchyma tissue, xylem tissue, cambium and periderm tissue, phloem tissue and secretion structure, root tissue, stem tissue, leaf tissue, flower tissue, fruit, and seed tissue.

Lecturers: Dr. Hamidah, M. Kes., Prof. Heri Purnobasuki, Ph.D., Prof. Dr.
Edy Setiti WU., SU., Dr. Junariah, M.Si.,

References:

1. Gembong Tjitrosoepomo. 2006, Morfologi Tumbuhan, Penerbit Gajah Mada University Press.
2. Rosanti Dewi, 2013, Morfologi Tumbuhan, Penerbit Erlangga, Jakarta
3. Netty Demak H. Sitanggang, Fitri Damayanti, 2016, Anatumi Tumbuhan. UNINDRA PRES Jakarta

Selatan12530.
4. Hidayat. E. B.1995. Anatomi Tumbuhan Berbiji. Penerbit ITB, Bandung
5. Fahn, A. 1982. Plant Anatomy. 3rd. Pergamon Press Ltd. England

12. PLANT STRUCTURE (PRACTICUM)

Course Code: BIB109

Credits: 1

Learning Goals imposed in this course:

After this lesson, students are able to explain the morphological and anatomical plant structure of the organ parts of leaves, flowers, roots, stems, fruits, and seeds in Tracheophyta plants correctly.

Course Description /Syllabus:

This practicum course explains and discuss: leaf, flower, root, stem, fruit, and seed organs in plants, general structure of plants, general structure of plant cells, meristem tissue, parenchyma, collenchyma, and sclerenchyma tissue, xylem tissue, cambium and periderm tissue, phloem tissue and secretion structures, root tissue, stem tissue, leaf tissue, flower tissue, fruit and seed tissue.

Lecturers: Dr. Hamidah, M. Kes., Dr. Junariah, M.Si., Anjar Tri Wibowo, M.Sc., Ph.D., Dra. Tri Nurhayati, M. Kes., Manikya, S.Si., M.Si.

References:

1. Gembong Tjitrosoepomo. 2006, Morfologi Tumbuhan, Penerbit Gajah mada UniversityPress
2. Rosanti Dewii, 2013, Morfologi Tumbuhan, Penerbit Erlangga, Jakarta
3. Netty Demak H. Sitanggang, Fitri Damayanti, 2016, Anatumi Tumbuhan. UNINDRA Pres, Jakarta Selatan12530.
4. Hidayat. E. B.1995. Anatomi Tumbuhan Berbiji. Penerbit ITB, Bandung
5. Fahn, A. 1982. Plant Anatomy. 3rd. Pergamon Press Ltd. England

13. GENETICS

Course Code: BIG302

Credits: 2

Learning Goals imposed in this course:

Biology Universitas Airlangga students are able to describe the mechanism of inheritance of traits based on the principles of Biology (C4).

Course Description /Syllabus:

Terms in genetics especially alleles, loci, genes, mutations, multiple alleles, and polygenes. Probability theory and its use in genetic risk analysis. Homogeneity test. Mechanisms of inheritance of traits according to Mendel and his modifications, including inheritance in the presence of multiple alleles and inheritance in the event of genes assembled on one chromosome, genes affected by sex, and genomic imprinting. How to make a chromosome map. Fundamentals of population genetics and changes in allele frequencies. The mate matching system. Definition of quantitative genetics: mean score and ripitability. Discussion of genetics in society.

Lecturers: Dr. Sugiharto, S.Si.M.Si.

References:

1. Avise, J.C. 2014. Conceptual Breakthroughs in Evolutinary Genetics; a brief history of shifting

paradigms. Elsevier; 164hal.
2. Griffith, A.J., Wessler, S.R., Carrol, S.B., and Doebly, J. 2015. Introduction to Genetic Analysis. W.H. Freena & Company; 868 hal.
3. Irawan, B. 2010. Genetika; penjelasan mekanisme pewarisan sifat. AUP. 318hal.

14. BASIC PHYSICS

Course Code: FID113

Credits: 2

Learning Goals imposed in this course:

After taking the Basic Physics course, students are able to calculate (C6) various simple physical phenomena (mechanics, mechanical waves and thermodynamics) using Physics concepts.

Course Description /Syllabus:

Magnitude, Measurement, and Units. Particle Kinematics (1-dimensional, 2 and 3-dimensional motion), Particle Dynamics (Newton's Laws I, II and III), Effort and Energy, Particle Systems and the law of conservation of momentum, Dynamics of Rigid Bodies (rotation and equilibrium of rigid bodies), Fluid Mechanics, Oscillations, Mechanical Waves (waves on ropes and sound waves), Heat and Temperature, and the Laws of Thermodynamics.

Lecturers: Basic Physics team

References:

1. Tipler, 1991, *Fisika untuk Sains and Teknik*, Vol. 1, Edisi terjemah dalam bahasa Indonesia, Penerbit Erlangga, Jakarta.
2. Halliday, D., Resnick, R., 2013, *Fundamental of Physics Extended*, 10th Ed,
3. Halliday and Resnick, 1994, *Fisika*, Edisi ke-3, terjemah oleh Silaban & E. Sucipto, Penerbit Erlangga, Jakarta.
4. Coletta, V.P. 2010. Physics Fundamentals. Willey.
5. Jewet, J.W. and Serway, R. A., 2012*, Serway's Principles of Physics, A Calculus Based Text,* 5th Edition, Thomson & Brooks/Cole, Australia.
6. Jewet, J.W. and Serway, R.A., 2018, *Physics for Scientists and Engineers with Modern Physics,* Vol. 1., 10th Edition, Thomson & Brooks/Cole, Australia.

15. CALCULUS

Course Code: MAA101

Credits: 3

Learning Goals imposed in this course:

Students are able to solve equations and inequalities

1. Students are able to draw a graph of the given function.
2. Students are able to calculate the limit of a given function and determine the continuity of a given function
3. Students are able to use function derivatives to solve given problems
4. Students are able to determine the indefinite integral of a given function

5. Students are able to use simple difference equations
6. Students are able to use integrals to calculate land area

Course Description /Syllabus:

Equations and inequalities (polynomials of degree up to three, rational, and absolute), functions (polynomials less than three, rational roots, trigonometric, cyclometric, exponents, logarithms, staircases, implicit, and parametric), operations of functions, composition of functions and reciprocals of functions. Limits, continuity and its applications, definition and properties of derivatives, derivatives of functions (special functions, chain rule, implicit, parameter, and second derivatives) and their uses (limit of infinite forms, rate, approximation, mean value theorem, L'hospital's rule, Maximum-minimum, drawing graphs, Taylor and Mac Laurin series), Indeterminate integrals (indeterminate integrals as anti- derivatives, simple substitution, partial integrals, simple rational splits), Introduction to differential equations (definition, types of PD to exact PD), Definite integrals and their applications (Fundamental Theorem of Calculus, area, improper integrals).

Lecturers: Calculus Team

References:

1. Larson, R., Edwards, B.H. 2017. *Calculus 11th Ed*. Cengage Learning
2. Stewart, J. 2015. *Calculus 8th Ed*. Cengage Learning

16. LOGICAL AND CRITICAL THINKING

Course Code: PHP103

Credits: 2

Learning Goals imposed in this course:

Able to conduct a critical review of the development and problems of modern science

Course Description /Syllabus:

Logical and critical thinking is a course that examines major philosophical questions regarding the nature of science, how science works, the methods of acquiring science, and the implications of the development of modern science. The course also seeks to examine the position of science in the universe of philosophy as well as the role of philosophy in debating the basic rules of modern science. This course is directed at three main themes; first, exploring the difference between science and common sense, including its characteristics and methods of acquisition which are the subject of study in the philosophy of science. Second, it examines major transitions in the tradition of philosophy of science, namely falsification (Karl Raimund Popper) and paradigm shift/scientific revolution (Thomas Kuhn). Third, it examines classic debates in the philosophy of science, including the question of whether reality can be fully explained by science? How does historical contextuality influence the development of science? What are the successes (and failures) of science in transforming human civilization? Finally, students are invited to appreciate the practical implications that philosophy of science brings to a variety of modern research methodologies.

Lecturers: PDB Team

References:

1. Bird, A. (2018). Thomas Kuhn. The Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/thomas-kuhn
2. Burns, P.B., Rohrich, R.J. & Chung, K.C. (2011). The levels of evidence and their role in Evidence-

Based Medicine. Plastic Reconstruction Surgery, 128(1), 305-310. doi:10.1097/PRS.0b013e318219c171

3. Chakravartty, A. (2017). Scientific Realism. The Stanford Encyclopedia of Philosophy. Diakses darihttps://plato.stanford.edu/entries/scientific-realism
4. Fidler, F. (2018). Reproducibility of scientific result. The Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/scientific-reproducibility/
5. Gaarder, J. (2014). Dunia Sophie: Sebuah Novel Filsafat. (Terj. Astuti, R.) Bandung: Penerbit Mizan.
6. Glanzberg, M. (2018). Truth. The Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/truth
7. Hitchcock, D. (2018). Critical Thinking. The Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/critical-thinking/
8. Iaccarino, M. (2001). Science and Ethics. EMBO Reports, 15, 2(9), 747-750. doi:10.1093/embo-reports/kve191
9. Jones, E.A. (2021). Formal Logic. https://community.plu.edu/~jonesea/Logic.html
10. Knachel, M. (2021). What is logic? Introduction to Philosophy: Logic. https://press.rebus.community/intro-to-phil- logic/chapter/chapter-1/
11. Schurz, G. (2014). Philosophy of Science: A unified approach. London: Routledge.
12. Smith, D.W. (2013). Phenomenology. The Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/phenomenology/
13. Strevens, M. (2021). Why Aristotle didn't invent modern science. Big Think. https://bigthink. com/ surprising-science/aristotle- didnt-invent-modern-science
14. Sugiharto (2014). Filsafat and pengalaman. In J. Gaarder, Dunia Sophie: Sebuah Novel Filsafat (hal. 13-18). Bandung: Penerbit Mizan.
15. Thornton, S. (2021). Karl Popper. The Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/popper
16. Merton's Norm and Scientific Ethos. https://www.bitss.org/mertons-norms-and-the-scientific-ethos/

17. INTRODUCTION TO SCHOLARLY COLLABORATION

Course Code: MNM107

Credits: 2

Learning Goals Imposed in This Course:

After taking this course, Universitas Airlangga second semester students are able to apply interdisciplinary cooperation and collaboration, fostering cooperation based on competence in solving problems in community life in the form of health, social and humanities problems.

Course Description /Syllabus:

1) motivation to build the character of cooperation and collaboration; (2) The concept of collaboration interprofessional education; (3) Basic concepts of leadership and decision making; (4) interdisciplinary communication and cooperation; (5) collaboration communication; (6) The concept of community; (7) Implementation of collaboration in the community; (8) Project base learning IPE; (9) Community Project base learning IPE.

Lecturers: IPE Unair Team

References:

1. Hammick, M, Freeth, D, Koppel, I, Reeves, S & Barr, H, 2007. A Best evidence systematic review of inter-professional education: BEME Guide no 9 Med Teach, 29(8): 735 – 51. Doi10.1080 /01421590701682576
2. Word Health Organization. 2010 Framework for action on inter-professional Education & Collaborative Practice. whqlibdoc.who.int/hq/2010/WHO_HRH_HPN_10.3_eng.pdf
3. Bosh, B. and Mansell, H, 2015. Interprofessional collaboration in health care Lesson to be leared from competitive sport. Can Pharm J (Ott), vol 148, no 4 pp. 176-179
4. Interprofessional Education Collaborative Expert Panel, 2011 Core Competencies for interprofessional collaborative practice: Report of an expert panel. Wangsinton, DC: Inter-professional Education Collaborative.
5. Thistlethwaite J., Moran M, 2010 Learning Outcome for Interprofessional Care, 24(5), 503-515.http://dx.dol.org/10.3109/13561820.2010.483366.

18. COMMUNICATION AND SELF-DEVELOPMENT

Course Code: MNM106

Credits: 2

Learning Goals imposed in this course:

1. Able to develop themselves and increase their learning capacity.
2. Able to lead and cooperate in teams.
3. Able to improve the quality of resources owned for organizational development, work networks and be responsible for work according to professional ethics.
4. Able to internalize values, norms, academic ethics, the spirit of independence, struggle, and entrepreneurship according to the basic principles of the UNAIR HEBAT academic community and Excellence with Morality.

Course Description /Syllabus:

This course provides insights and opportunities for students to be able to explore their potential in order to develop and improve their capacity through synergy with coaching activities in the Student Activity Unit and other student organization activities.

Lecturers: Communication and Self-Development Team

References:

19. COMPARATIVE VERTEBRATE ANATOMY

Course Code: BIZ204

Credits: 2

Learning Goals imposed in this course:

Students are able to compare members of vertebrate groups based on their body structure correctly (C2; A2)

Course Description /Syllabus:

Comparison of muscular, integumentary, skeletal, nervous, sensory, digestive, hormonal, excretory, reproductive, circulatory, and respiratory systems in members of vertebrate groups.

Lecturers: Prof. Win Darmanto, Ph.D., Drs. Hari Soepriandono, M. Si.

References:

1. Kenneth V. Kardong. 2012. Vertebrates Comparative: Anatomy, Function, Evolution 6th ed. McGraw Hill.
2. Rui Diogo and Virginia Abdala. 2010. Muscles of Vertebrates: Comparative Anatomy, Evolution, Homologies and Development. CRC Press.
3. Kirk N. Gelatt. 2014. Essentials of Veterinary Ophthalmology. John Wiley & Sons, Inc.
4. David O. Norris and James A. Carr. 2013. Vertebrate Endocrinology. Academic Press
5. Diogio, R., Abdala, V. 2010. *Muscles of Vertebrates: Comparative Anatomy, Evolution, Homologies and Development.* CRC Press
6. Fishbeck, D.W. 2015. *Comparative Anatomy: Manual of Vertebrate Dissection.* Morton Publishing Company.

20. COMPARATIVE VERTEBRATE ANATOMY (PRACTICUM)

Course Code: BIZ205

Credits: 1

Learning Goals imposed in this course:

Students are able to show the function of vertebrate body, evaluate the biodiversity of vertebrate animals based on their body structure, and compare vertebrates based on their body structure correctly (C5; A3; P4).

Course Description /Syllabus:

Comparison of muscular, integumentary, skeletal, nervous, sensory, digestive, hormonal, excretory, reproductive, circulatory, and respiratory systems in five Vertebrate classes

Lecturers: M. Hilman Fu'adil Amin, S.Si., M.Si., Ph. D., Drs. Hari Soepriandono, M.Si., Dr. Sugiharto, S. Si., M.Si., Dr. Listijani Suhargo, M. Si.

References:

1. Kenneth V. Kardong. 2012. Vertebrates Comparative: Anatomy, Function, Evolution 6th ed. McGraw Hill.
2. Fishbeck, D.W. 2015. *Comparative Anatomy: Manual of Vertebrate Dissection.* Morton Publishing Company
3. Geza Zboray, Zsolt Kovacs, Gyorgy Kriska, Kinga Molnar, Zsolt Palfia. 2010. Atlas of Comparative Sectional Anatomy of 6 invertebrates and 5 vertebrates. Springer.
4. Piper M. Treuting, Suzanne M. Dintzis, Kathleen S. Montine. 2017. Comparative Anatomy and Histology: A Mouse, Rat, and Human Atlas. Academic Press.

21. GENERAL ECOLOGY

Course Code: LKB201

Credits: 2

Learning Goals imposed in this course:

Able to explain the philosophy, principles and basic concepts of ecology and able to develop interest in the application of ecology both for scientific development and for practical purposes.

Course Description /Syllabus:

The scope of ecological studies and its role in human life. The concept of the organizational structure of life, principles and concepts of ecosystems and communities, principles and concepts of

population. Types of interactions in ecology. Principles of limiting factors. Growth/change of components in the ecosystem. Energy flow, material cycles, and ecological pyramids. Environmental carrying capacity.

Lecturers: Prof. Dr. Sucipto Hariyanto, DEA., Dra. Thin Soedarti, CESA

References:

1. `Bowman, W.D., Hacker, S.D. and Cain, M.L. 2017. Ecology 4th Edition, Oxford University Press. London.
2. Hariyanto, S., Irawan, B., & Soedarti, T. 2008. Teori and Praktik Ekologi, Airlangga University Press.Surabaya.
3. Molles, M.C., Sher, A 2018. Ecology: Concepts and Applications, 8th. ed., McGraw-Hill, Boston.

22. GENERAL ECOLOGY (PRACTICUM)

Course Code: LKB203

Credits: 1

Learning Goals imposed in this course:

Able to conduct sampling of organisms in nature, can report the results of observations scientifically, Have the skills to collect, process, and analyze ecological data, have skills in solving ecological problems.

Course Description /Syllabus:

Determine the homon genity of samples, find and calculate the correlation between two related variables, recognize equipment for ecological studies, population growth and environmental carrying capacity; conduct sampling of terrestrial and aquatic organisms, calculate the level of species diversity; predict the number of individuals in a population.

Lecturers: Prof**.** Dr. Sucipto Hariyanto, DEA., Prof. Dr. Bambang Irawan, M.Sc., Dra. Thin Soedarti, CESA. Dr. Moch. Affandi, M.Si., Intan Ayu Pratiwi, S.Si., M.Si.

References:

1. Hariyanto, S., Soedarti, T., and Irawan, B. 2008.Teori and Praktek ekologi, Airlangga University Press.
2. Young, L.J., and Young, J. 2013. Statistical Ecology, Springer Science & Business Media, NewYork.
3. Begon, M., Townsend, C.R. 2021. *Ecology: From Individuals to Ecosystem* 5^{th} *Ed.* Wiley
4. Wheater, C.P., Bell, J.R. and Cook, P.A.2011. Practical Field Ecology: A Project Guide, Wiley- Backwell. Oxford.

23. PLANT PHYSIOLOGY

Course Code: BIB211

Credits: 2

Learning Goals imposed in this course:

After taking this course, students are expected to be able to explain the mechanism of physiology in plants, the metabolism of nutrients in plants and the mechanism of growth and development influenced by hormones and plant responses to stimuli and ecophysiology.

Course Description /Syllabus:

Plant physiology scope, role and concept, cell organelle structures and functions, cell relationships with their environment, water, transpiration, plant nutrients, nutrient absorption and transport, respiration,

photosynthesis, nitrogen metabolism, lipid metabolism and other products, plant hormones, plant morphogenesis, plant responses to stimuli, ecophysiology.

Lecturers: Dr. Edy Setiti Wida Utami, M.S., Prof. Hery Purnobasuki, PhD., Prof. Y. Sri Wulan Manuhara, M.Si.

References:

1. Salisbury, F.B. and C.W. Ross (1995). Fisiologi Tumbuhan. Jilid 1, *Terjemahan* Diah R. Lukman and Sumaryono. Penerbit ITB Bandung.
2. Taiz, L. Zeiger, E. 2018. *Fundamental of Plant Physiology.* Sinauer Associates is an imprint of Oxford UniversityPress
3. Kochhar, S.L.M Gujral, S.K. 2021. *Plant Physiology: Theory and Application.* Cambridge University Press.

24. PLANT PHYSIOLOGY (PRACTICUM)

Course Code: BIB212

Credits: 1

Learning Goals imposed in this course:

Able to explain the principles of plant fauna, especially higher plants, able to observe, analyze and report the results of observations scientifically, able to live together.

Course Description /Syllabus:

Diffusion, osmosis, imbibition, osmotic potential, transpiration, stomatal activity, respiration, growth, tropism, seed dormancy, the effect of elemental deficiency on plants, plant hormones, senescence.

Lecturers: Dr. Junairiah, S.Si., M. Kes., Prof. Dr. Edy Setiti Wida Utami, M.S., Prof. Y. Sri Wulan Manuhara, M.Si., Prof. Hery Purnobasuki, M.Si., Ph.D.

References:

1. Taiz, L. Zeiger, E. 2018. *Fundamental of Plant Physiology.* Sinauer Associates is an imprint of Oxford UniversityPress
2. Purnobasuki, H., Manuhara, YSW., Utami, E.S.W., Junairiah., Kusuma, D.K. 2018. Panduan PRAktikum Fisiologi Tumbuhan, Departemen Biology, Fakultas Sains and Teknologi, UniversitasAirlangga.

25. MOLECULER GENETICS

Course Code: BIG201

Credits: 2

Learning Goals imposed in this course:

1. Able to explain molecular structure and bahangenetic function
2. Able to explain the expression mechanism
3. Able to link gene expression and genetic traits of a phenotype
4. Able to explain the mechanism of protein synthesis

Course Description /Syllabus:

Introduction to molecular genetics, chromosome structure, genetic material structure, nucleic acid structure and function, gene structure and organization, RNA structure, gene expression mechanism, gene

expression control, gene expression (dominant, recessive, and codominant), DNA replication mechanism, mutation or change in genetic material, DNA repair and damage, and genome.

Lecturers: Prof. Dr. Sri Puji Astuti W, M.Si., Prof. Bambang Irawan, M.Sc., Prof. Win Darmanto, M.Si., Ph.D., Firli Rahmah PD., M.Si., Ph.D.

References:

1. William S. Klug, Michael R. Cummings, Charlotte A. Spencer, Michael A. Palladino, Darrell Killian. 2018. Concepts of Genetics, 12th Edition.Pearson.
2. Irawan B. 2008. Buku Ajar GenetikaMolekuler. AUP, Surabaya.
3. Klug W.S., and Cummings, M.R. 2003. Genetics; a Molecular Perspective. Pearson Education, Inc. Upper Saddle River, NJ.
4. Gurbachan S. Miglani. 2014. Essentials of Molecular Genetics, First Edition Alpha Science International Ltd.

26. BIOCHEMISTRY

Course Code: BIK201

Credits: 2

Learning Goals imposed in this course:

Students are able to make connections

Course Description /Syllabus:

Amino acid structures and types; primary, secondary, tertiary and quaternary structure of protein molecules; connective tissue proteins; biomembrane proteins; O_2-transport proteins: myoglobin, hemoglobin, enzyme proteins, Active side of enzymes, formation of enzyme-substrate complexes; Classification and structure of carbohydrates, Biodiversity and role of carbohydrates in life; stages of energy extraction from carbohydrates; lipids, Fatty acids, Triacylglycerols, Phospholipid bilayer, Sterol compounds and vitamins; stages of energy extraction from lipids and fatty acids; DNA structure and function as genetic material, mRNA structure and function; genetic information flow; Transformation of DNA information into functional molecules.

Lecturers: Prof. Dr. Afaf Baktir, MS., Prof. Dr. Ni Nyoman Tri Puspaningsih, M. Si., Dr. Sri Sumarsih, M.Si., Dr. Purkan, M. Si

References:

1. Berg, J.M., Tymoczko, J.L., Stryer, L., 2012, Biochemistry, 7thEd., W.H., Freeman and Co., NewYork
2. Nelson, D.L., Coc, M.M., 2021, Lehninger Principle of Biochemistry, 8thEd., W.H. Freeman and Co., New York.

27. MICROTECHNIQUE

Course Code: BIU201

Credits: 2

Learning Goals imposed in this course:

Students are able to understand, compare various methods of making preservation preparations

Course Description /Syllabus:

Introduction, slide preparations, techniques for making permanent slide preparations, making slide

preparations using the paraffin method, processing permanent slide preparations, techniques for overcoming errors in making animal and plant slide preparations, staining animal and plant tissues by histochemistry, staining tissues by immunohistochemistry and lectin methods.

Lecturers: Prof. Win Darmanto, MS. Ph.D., Prof. Hery Purnobasuki, M.Si. Ph.D.

References:

1. Mondal, S.K. 2019. Manual of Histological Techniques 2ndEd. Jaypee Brothers Medical Publishers (P) Ltd
2. Gunarso W. 1998. Mikroteknik, Bahan Ajar Pusat Aqntar Universitas Ilmu Hayati. IPB. Bogor.
3. Kiernan. J. A .2015. Histological and Histochemical Methode: Theory and Practice 5th Ed. Scion Publishing, Ltd.
4. Marimuthu, R. 2019. Microscopy and Microtechnique. MJP Publishers; 1st edition Pound, J. 2014. Immunochemical Protocols (Methods in Molecular Biology) 2nd Ed. Humana Press.

28. ANIMAL HISTOLOGY

Course Code: BIZ206

Credits: 2

Learning Goals imposed in this course:

After taking this course, students are able to correctly determine the type and function of tissues/organs based on the microanatomical/histological structure of typical tissues/organs (C3).

Course Description /Syllabus:

Introduction, Epithelial Tissue, Connective Tissues I (Actual Connective Tissue and Fat Tissue), Connective Tissues II (Bone and Blood Tissue), Nerve Tissues, Muscle Tissues, Transportation System Tissues, Respiration System Tissues, Digestive System Tissues, Male and Female Reproductive System Tissues, Urinary System Tissues, Immune System Tissues.

Lecturers: Dr. Dwi Winarni, M.Si., Dr. Listyani Suhargo, M.Si.

References:

Mescher, Anthony L. 2010. Junqueira's Basic Histology. 12th Edition. The McGraw-Hill Companies.

29. ANIMAL HISTOLOGY (PRACTICUM)

Course Code: BIZ207

Credits: 1

Learning Goals imposed in this course:

Students are able to observe the characteristics of histological structures, report, and plan (P4, A2, C5) research in the field of zoology by connecting the structure of microanatomy or histology of tissues/organs with their functions.

Course Description /Syllabus:

In this course students learn to do a practicum on: Epithelial Tissue, Connective Tissues I (Actual Connective Tissue and Fat Tissue), Connective Tissues II (Bone and Blood Tissue), Nerve Tissues, Muscle Tissues, Transportation System Tissues, Respiration System Tissues, Digestive System Tissues, Male and Female Reproductive System Tissues, Urinary System Tissues, Immune System Tissues.

Lecturers: Dr. Listijani Suhargo, M.Si., Dr. Soegiharto, S.Si., M.Si., M. Hilman Fu'adil Amin, S.Si., M.Si., Ph.D.

References:

1. Luiz, C. Junqueira, et. al. 2012. Basic Histology. 15th ed. McGraw-Hill Companies.
2. Eroschenko V.P. 2014. Atlas Histologi di Fiore dengan korelasi fungsional. Terjemahan EGC, Penerbitbuku.

30. GENERAL MICROBIOLOGY

Course Code: BIM201

Credits: 2

Learning Goals imposed in this course:

Able to explain the basic concepts of microbiology (C2)

Course Description /Syllabus:

Microbiology history and benefits, overview of microbes, microbial media and growth, sterilization and disinfectants, microbial metabolism and microbial genetics, morphology and anatomical structure of bacterial cells; fungi and viruses.

Lecturers: Tri Nurhariyati, SSi., M. Kes., Drs. Salamun, M. Kes., Dr. Fatimah

References:

1. Madigan, M.T., Bender, K.S., Buckley, D.H., Stahl, D.A., 2014. Brock Biology Mikroorganisme. Alih bahasa Siti Meliah. Penerbit Buku KedokteranEGC.
2. Moore, D., Robson, G.D., and Trinci. A.P., 2011. 21st Century Guide book to Fungi. Cambridge University Press.
3. Hogg.S., 2013. *Essensial Microbiology* 2nd Ed. John Wiley & Sons Ltd, England.
4. Betsy.T., and Keogh. J, 2012. *Microbiology Demystified 2nd Ed*. The McGraw- Hill Companies. Inc.

31. GENERAL MICROBIOLOGY (PRACTICUM)

Course Code: BIM203

Credits: 1

Learning Goals imposed in this course:

Able to do and practice laboratory preparation, cultivation and quantification methods as well as microbial identification and characterization (A2 and P3)

Course Description /Syllabus:

Sterilization techniques, media and how to make media, aseptic transfer of microbial cultures, isolation of microbes from a mixture, microbial characteristics, staining techniques, microscopic determination of the number and size of microbes, microbial growth curves, environmental influences on microbial growth, microbial physiological tests, fermentation, microbial identification.

Lecturers: Prof. Dr. Ni'matuzahroh, Drs. Agus Supriyanto, M. Kes., Tri Nurhariyati, S.Si., M. Kes., Dr. Fatimah S.Si., M. Kes

References:

1. Ni'matuzaroh, Surtiningsih, Supriyanto, A., Nurhariyati. T., 2018. Petunjuk Practicum MikroBiology Umum. FST Universitas Airlangga.Surabaya.

2. Madigan, M.T., Bender, K.S., Buckley, D.H., Stahl, D.A., 2014. Brock Biology Mikroorganisme. Alih bahasa Siti Meliah. Penerbit Buku Kedokteran EGC.

32. ENGLISH LANGUAGE

Course Code: BAE110

Credits: 2

Learning Goals imposed in this course:

Students are able to communicate and write in English

Course Description /Syllabus:

This course teaches about how to interpret text (reading comprehension), communicate orally (speaking) and writing (grammar) in English based on the applicable rules.

Lecturers: English Language Team

References:

33. ABIOTIC ENVIRONMENT

Course Code: BIL302

Credits: 2

Learning Goals imposed in this course:

Describe a habitat based on lithosphere and climate parameters, explain the hydrological cycle, explain the interplay of biotic and non-biotic factors and describe the the use of geologic time.

Course Description /Syllabus:

Historical geology: understanding the lithosphere and atmosphere: rocks, minerals and water: movement of the earth's crust. Climate and weather changes. Interaction of biotic and non-biotic factors. Geologic ages. Biogeography. Evolution and supporting theories.

Lecturers: Prof. Dr. Bambang Irawan, M.Sc.

References:

1. Gabler, R.E., Petersen, J.F., Trapasso, L.M., and Savack, D. 2009. Physical Geography, 2th ed. Brooks/Cole, Cenage Learning.
2. Monroe, J.S., and Wicander, R. 2009. The Canging Earth; exploring geology and evolution, thed. Brooks/Cole, Cenage Learning.
3. Tarbuck, E.D., and Lutgens, F.K. 2011. Earth; an introduction to physical geology, 10 thed. Prentice Hall, Pearson.

34. ENTREPRENEURSHIP

Course Code: MNW201

Credits: 2

Learning Goals imposed in this course:

After taking this course, students in the 4th semester of the Biology Study Program will be able to understand and carry out entrepreneurial activities independently or in groups.

Course Description /Syllabus:

Introduction, Concept and characteristics of entrepreneurship, Development of creativity, Achievieng success, Courage to start, Taking risks and responsibilities, Preparation of business plans, Development of business ideas, Entrepreneurial leadership and entrepreneurial practices.

Lecturers: Dra. Agus Supriyanto, M.Kes

References:

1. Anonim. 2010. **Buku-3. Konsep Dasar Kewirausahaan**. Direktorat Pembinaan Kursus and Kelembagaan. Direktorat Jenderal Pendidikan Non-Formal and Informal. Kementerian Pendidikan Nasional
2. Kasali, R. 2010. Wirausaha Muda Mandiri. PTGramedia.Jakarta
3. Purnobasuki, H. 2010. **Kepemimpinan Berwawasan Kewirausahaan**. Airlangga University Press.Surabaya
4. Anonim. 2010. **Buku-1. Panduan Pelatihan Kewirausahaan**. Direktorat Pembinaan Kursus and Kelembagaan. Direktorat Jenderal Pendidikan Non-Formal and Informal. Kementerian Pendidikan Nasional.

35. MICROTECHNIQUE (PRACTICUM)

Course Code: BIU302

Credits: 2

Learning Goals imposed in this course:

Students are able to develop interest in the field of making preservation preparations, work in groups, and make various types of preservation preparations correctly.

Course Description /Syllabus:

Introduction to the laboratory, making smear slide preparations, whole mount preparations, and paraffin method preparations.

Lecturers: Dr. Dwi Winarni, M.Si., Prof. HeryPurnobasuki, M.Si., Ph.D.

References:

1. Mondal, S.K. 2019. *Manual of Histological Techniques 2nd Ed.* Jaypee Brothers Medical Publishers (P) Ltd.
2. Kiernan. J. A .2015. *Histological and Histochemical Methode: Theory and Practice 5th Ed*. Scion Publishing, Ltd.
3. Pound, J. 2014. *Immunochemical Protocols (Methods in Molecular Biology) 2nd Ed.* Humana Press.

36. MARINE BIOLOGY

Course Code: BIU301

Credits: 2

Learning Goals imposed in this course:

Students are able to explain the relationship between environmental physico-chemical factors and the distribution and zoning patterns of marine organisms, compare the adaptive values of various life forms of marine organisms, evaluate the interconnectedness and regularity of marine life systems and the prospects and threats of various marine resources, detail certain requirements in the selection of marine biota commodities for aquaculture purposes, and express opinions on the prospects for the development

of marine biotechnology appropriately

Course Description /Syllabus:

Introduction to Marine Biology; marine environment; marine life forms; marine plants; marine animals; marine and coastal ecosystems; marine resources; mariculture and marine biotechnology.

Lecturers: Prof. Dr. Agoes Soegianto, DEA.

References:

1. Karleskint, G., Turner, R., Small, J. 2012. *Introduction to Marine Biology 4thEd.* Cengage Learning
2. Morissey, J., Sumich, J.L., Pinkard-Meier, D.R. 2016. *An Introduction to the Biology of Marine Life 11th Ed.* Jones & Bartlett Learning.
3. Norse, E.A. 2013. *Global Marine Biologycal Diversity: strategy for building conservation into decision making*. Island Press. Washington, D.C.

37. CARSINOLOGY

Course Code: BIZ203

Credits: 2

Learning Goals imposed in this course:

Biology students of Universitas Airlangga can describe the diversity of Crustacea based on body structure, adaptation to the environment, classification, and its role in human life. (C4).

Course Description /Syllabus:

The role of Crustaceans in human life. Body structure and life cycle of Crustacea. Differences between the subphylum Crustacea and other subphylums in the Phylum Arthropoda. Embryology and physiology of Crustacea. Ecology of Crustacea. Evolution and classification of Crustacean subphylum. Cultivation and utilization of Crustacea by humans. Crustacea. Preservation methods for Crustacea.

Lecturers: Prof. Dr. Bambang Irawan, M.Sc.

References:

1. Anger K., Harzsch, S., Thiel, M. 2020. *Developmental Biology and Larval Ecology: The Natural History of the Crustacea.* Oxford UniversityPress
2. Irawan, B. 2013. Karsinologi dengan penjelasan deskriptif and fungsional. Airlangga University Press; 520hal.
3. Ruppert, E.E., Fox, R.S., andBarnes, R.D. 2004. Invertebrate Zoology; a functional evolutionary approach. Thompson/Brooks/Cole; hal.: 517 – 750.

38. CONSERVATIVE BIOLOGY

Course Code: BIE201

Credits: 2

Learning Goals imposed in this course:

Biology students are able to work on bioconservation activities, both in real life and by using models (C6).

Course Description /Syllabus:

Bioconservation boundaries, statistical model boundaries, Introduction to R statistics. Conservation objectives. Types of conservation based on their objectives. Activities that include bioconservation. Habitat management for conservation purposes. Determination of the types of organisms that are worth

conserving. Statistical model for conservation biology.
Conservation education for the community.

Lecturers: Lecturers Ecology team

References:

1. Ausdien, M. 2010. Habitat Management for Conservation: A Handbook of Technique; Techniques in Ecology & Conservation Series. Oxford University Press; 411 hal.
2. Allensdorf, F.W. and Luikart, G. 2012 Conservation and the Genetics of Populations 2nd Ed. Blackwell Publishing;642.
3. Boitani, L., and Powell R.A. 2012. Carnivore Ecology and Conservation: A Handbook of Technique; Techniques in Ecology and Conservation. Oxford University Press; 411hal.
4. Jacobson, S.K., McDuff, M.D., and Monroe, M.C. 2015. Conservation Education and Outreach Techniques. Techniques in Ecology and Conservation Series. Oxford. Hal.: 1 – 80, 356 –387.
5. Maslo, B., and Lockwood, J. (Ed) 2014. *Coastal Conservation; Conservation Biology* 19. Cambridge; 382hal.
6. Mills. 2012 *Conservation of Wildlife Populations: Demography Management 2nd Ed.* Wiley-Blackwell
7. White, T.L., Adams, W.T., and Neale, D.B. 2009. Forest Genetics. FSC, Mixed Sources. 682 hal.

39. BEHAVIORAL ECOLOGY

Course Code: BIE202

Credits: 2

Learning Goals imposed in this course:

1. Can compare the control mechanisms control mechanisms of the nervous system to certain behavioral patterns among between groups of invertebrate and vertebrate animals (C6)

2. Can combine between certain types of certain types of animals with certain forms of certain abilities and intelligence that possessed by the animal in question (C6)

Course Description /Syllabus:

Introduction to animal behavior, behavioral genetics, evolution and social behavior, animal perception, animals and environment, learning in animals, instinctive behavior, decision making in animals, animal mentality.

Lecturers: Dr. Moch. Affandi, M.Si.

References:

1. Sodhi N.S. & Ehrlich P.H. 2010. ***Conservation Biology for All***. Oxford University Press Inc, New York Biologi.
2. Meffe G.K., Carroll C.R., and Contributors 1994. ***Principles of Conservation Biology***. Sinauer Associates, Inc., Publishers. Sunderland, Massachusetts.
3. Indrawan, M., Primack, R.B. dan Supriantna J. 2007. ***Biologi Konservasi*** (Edisi Revisi). kerjasama antara Yayasan Obor Indonesia-Conservation International Indonesia-PILI-Yayasan WWF Indonesia-Uni Eropa dan YABSHI.

40. PLANT EMBRIOLOGY

Course Code: BIB301

Credits: 2

Learning Goals imposed in this course:

After taking this course, students are expected to be able to discuss the mechanism of embryo formation and development in plants.

Course Description /Syllabus:

Structure of reproductive organs, sporogenesis, microsporogenesis, megasporogenesis, microgametogenesis, megagametogenesis, pollination, fertilization, endosperm, apomixis

Lecturers: Prof. Dr. Edy Setiti Wida Utami, M.S., Prof. Hery Purnobasuki, Ph.D.

References:

1. Bhojwani, S.S., Soh, W.Y. 2001. *Current Trends in the Embriology of Angiosperm.* Springer; 2001st edition
2. Batygina, T.B. 2002. *Embriology of Flowering Plants: Terminology and Concepts Vol 1: Generative Organs of Flowers.* CRC Press; 1stedition
3. Wardlaw, C.W. 2015. *Embryogenesis in Plants*. SagwanPress.
4. Loveless, A.R. 1983. *Prinsip-prinsip Biology Tumbuhan Untuk Daerah Tropik*. Penerbit PT Gramedia, Jakarta,
5. Germana, M.A., Lambardi, M. 2016. *In Vitro Embryogenesis in Higher Plant.* Humana; 1st ed

41. PLANT EMBRIOLOGY PRACTICUM

Course Code: BIB302

Credits: 1

Learning Goals imposed in this course:

Able to explain the principles of plant embryo development, able to describe, identify, and classify plant embryos, have the ability to follow the development of Plant Embryology and related technologies, able to live together.

Course Description /Syllabus:

Reproductive organs structure, gamete formation stages, embryo development stages in Angiosperms, Gymnosperms, Pteridophyta, and Bryophyta, endosperm type, seed constituent tissue structure, seed germination types; fruit constituent tissue structure

Lecturers: Prof. Dr. Edy Setiti Wida Utami, MS., Prof. Hery Purnobasuki, PhD., Dr. Junairiah, S.Si., M. Kes.

References:

1. Bhojwani, S.S., Soh, W.Y. 2001. *Current Trendsin the Embriology of Angiosperm.* Springer; 2001st edition
2. Batygina, T.B. 2002. *Embriology of Flowering Plants: Terminology and Concepts Vol 1: Generative Organs of Flowers.* CRC Press; 1st edition
3. Wardlaw, C.W. 2015. *Embryogenesis in Plants*. Sagwan Press.
4. Hery Purnobasuki, Fatimah, Junairiah. 2010. Petunjuk Practicum Plant Embriology. Departemen Biology, FST, UNAIR.
6. Loveless, A.R. 1983. *Prinsip-prinsip Biology Tumbuhan Untuk Daerah Tropik.* Penerbit PTGramedia, Jakarta.
7. Suradinata, T.S. 2002. *Plant Embriology*. Pusat Penerbitan Universitas Terbuka, Jakarta.

42. MOLECULAR ANALYSIS METHODS

Course Code: BIU202

Credits: 1

Learning Goals imposed in this course:

Students are able to diagnose DNA and protein molecular analysis techniques correctly in a scientific paper and explain their basic principles. (C4, A3)

Course Description /Syllabus:

Safety from the use of hazardous and toxic chemicals, basic principles of DNA isolation/extraction, evaluation of DNA purity and concentration, agarose gel electrophoresis, further analysis of DNA molecules and their applications, basic principles of protein isolation/extraction, quantification of protein levels, SDS- PAGE gel electrophoresis for proteins, further analysis of protein molecules and their applications.

Lecturers: Prof. Dr. Sri Puji Astuti W., M.Si., Dr. Sugiharto, S.Si, M.Si., Firly Rahmah PD, S.Si.Ph.D., Almando Geraldi, S.Si.Ph.D.

References:

1. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey C. Martin. 2016. Molecular Cell Biology. W. H. Freeman.
2. Gerald Karp, Janet Iwasa, Wallace Marshall. 2016. Karp's Cell and Molecular Biology. Wiley.
3. Green, M.R. and Joe Sambrook. 2012. Molecular Cloning: A Laboratory Manual 4thEd. Cold Spring Harbor Laboratory Press.
4. Zaheer Khan (auth.), andiel J. Park (eds.). 2011. PCR Protocols. Series: Methods in Molecular Biology 687. Humana Press.
5. Wolfgang Mann, Thomas Haaf(auth.), Nicola King (eds.). 2010. RT-PCR Protocols: Second Edition. Series: Methods in Molecular Biology 630. Humana Press.
6. A. Munshi. 2012. DNA Sequencing - Methods and Applications.Intech.
7. R. Paul Schaudies. 2014. Biologycal Identification. DNA Amplification and Sequencing, Optical Sensing, Lab-On-chip and Portable Systems. Woodhead Publishing.
8. Ulrich Matthiesen. 2010. DNA Fingerprinting, Sequencing, and Chips. Nova BiomedicalBooks.
9. Wong, T.S. and Tee, K.L. 2020. A Practical Guide to Protein Engineering (Learning Materials in Bioscience). Springer; 1sted
10. David F. Keren. 2012. Protein Electrophoresis in Clinical Diagnosis. American Society of Clinical Pathologists Press
11. Richard Smith (auth.), Raymond Tyther, David Sheehan (eds.). 2009. Two- Dimensional Electrophoresis Protocols. Series: Methods in molecular biology 519. HumanaPress.
12. Antonio Alonso. 2011. DNA Electrophoresis Protocols for Forensic Genetics. Series: Methods in Molecular Biology.Springer.
13. Jonathan S. Minden (auth.), Rainer Cramer, Reiner Westermeier (eds.). 2012. Difference Gel Electrophoresis (DIGE): Methods and Protocols. Series: Methods in Molecular Biology 854. HumanaPress.
14. Biji T. Kurien, R. Hal Scofield (eds.). 2015. Western Blotting: Methods and Protocols. Series: Methods in Molecular Biology 1312. HumanaPress.
15. Hoxhaj, Gerta; Najafov, Ayaz. 2017. Western blotting guru. AcademicPress.
16. Lee, Mike S. 2017. Protein Analysis using Mass Spectrometry. Series: Wiley Series on Pharmaceutical Science andBiotechnology: Practices Applications and Methods.Wiley.
17. Bryan John Smith. 2010. Protein Sequencing Protocols. Series: Methods in Molecular Biology. Humana Press.

43. MOLECULAR ANALYSIS METHODS (PRACTICUM)

Course Code: BIU203

Credits: 1

Learning Goals imposed in this course:

Students are able to carry out practicum activities in the molecular genetics laboratory by paying attention to work ethics and safety in the laboratory, explaining how DNA and protein isolation works, and evaluating the results of DNA and protein isolation correctly (C5, A4, P4).

Course Description /Syllabus:

Ethics of working in the Molecular Genetics laboratory, work safety from the use of hazardous and toxic chemicals, introduction to pipettes in the molecular genetic laboratory, isolation/extraction of DNA and protein, agarose gel electrophoresis and SDS-PAGE, measurement of the concentration of DNA and protein molecules, DNA amplification.

Lecturers: Dr. Sugiharto, S.Si., M.Si., Prof. Dr. Sri Puji Astuti W., M.Si., Firly Rahmah PD, S.Si.Ph.D., Almando Geraldi, S.Si.Ph.D.

References:

1. Joe Sambrook. 2001. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press.
2. Zaheer Khan (auth.), andiel J. Park (eds.). 2011. PCR Protocols. Series: Methods in Molecular Biology 687. HumanaPress.
3. R. Paul Schaudies. 2014. Biologycal Identification. DNA Amplification and Sequencing, Optical Sensing, Lab-On-chip and Portable Systems. Woodhea Publishing.
4. Ulrich Matthiesen. 2010. DNA Fingerprinting.

44. TAXONOMY

Course Code: BIU204

Credits: 2

Learning Goals imposed in this course:

Biology students of Universitas Airlangga are able to plan taxonomic activities in the form of: building taxonomic collections, making taxonomic descriptions, conducting specimen identification, and compiling taxonomic determination keys (C6).

1. Able to explain the history, limitations, principles of taxonomy (C2).
2. Able to detail taxonomic activities (C4).
3. Able to change words in Latin based on Latin grammar rules in relation to taxonomic names (C4).
4. Able to compile a taxonomic description of an organism based on taxonomic rules (C6).
5. Able to describe the rules for giving scientific names to an organism (C4).
6. Able to compile a classification of organisms based on taxonomic rules (C6).

Course Description /Syllabus:

Introduction to Taxonomy: history, boundaries, taxonomic activities, differences with biosystematics. Latin basics for taxonomy. Taxonomic collections: Collection techniques including: preservation, storage systems and coding. Taxonomic description: Developing taxonomic identification keys. Taxon placement in a classification system. Taxonomic data. Taxonomic publications: introduction of new species and taxonomic revisions.

Lecturers: Prof. Dr. Bambang Irawan., M. Sc., Manikya Pramudya, S.Si., M.Si., Firly Rahmah PD, S.Si.Ph.D.

References:

1. Bulletin of Zoological Nomenclature
2. International Commission on Zoological Nomenclature. 2012. INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE. The Natural History Museum, Cromwell Road, London SW7 5BD, U.K. (e-mail: iczn@nhm.ac.uk)
3. Prent, K., Adisubrata, J., Poerwadarminta, W.J.S. 1969. Kamus Latin-Indonesia. Penerbit Jajasan Kanisius, Semarang; 943 hal.
4. Tondowidjoyo, J.V.S. 1975. Pelajaran Dasar Bahasa latin Praktis, jilid 1. Dedika Bina Pustaka, Surabaya; 79 hal.
5. Tondowidjoyo, J.V.S. 1975. Pelajaran Dasar Bahasa latin Praktis, jilid 2. Dedika Bina Pustaka, Surabaya; 83 hal.
6. Turland, N. J., Wiersema, J. H., Barrie, F. R., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T. W., McNeill, J., Monro, A. M., Prado, J., Price, M. J. & Smith, G. F. (eds.) 2018: *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017*. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books. DOI https://doi.org/10.12705/Code.2018
7. Winston, J.E. 1999. Describing Species: Practical Taxonomic Procedure for Biologists. Columbia University Press; 518 h

45. TAXONOMY (PRACTICUM)

Course Code: BIU205

Credits: 1

Learning Goals imposed in this course:

Biology Universitas Airlangga students are able to manage taxonomy activities carefully according to objectives (P5). Biology Universitas Airlangga students are able to plan taxonomic activities such as: building taxonomic collections, making taxonomic descriptions, identifying specimens, and compiling taxonomic determination keys (C6).

1 Able to plan taxonomic activitiesi (C6).
2 Able to coordinate taxonomic activities especially taxonomic specimen collection (P4).
3 Able to manage taxonomic collections (P5).

Course Description /Syllabus:

Collection techniques including: preservation, storage and coding systems. Making collections of plants and fungi: making herbarium: plants and fungi; making descriptions and determination keys for plants and fungi; making specimen codes. Making animal taxonomy collections: making wet and dry specimens; making determination keys; making specimen codes for animal taxonomy collections. Isolate plant and animal ADNs for taxonomic purposes. Operate taxonomic analysis software.

Lecturers: Prof. Dr. Bambang Irawan., M.Sc., Manikya Pramudya, S.Si., M.Si., Firly Rahmah PD, S.Si.Ph.D.

References:

1. Buku Petunjuk Praktikum Taksonomi topik hewan, Prodi Biologi, FST, Universitas Airlang
2. Iskandar, D.T. 1998. Amfibi Jawa dan Bali. Puslitbang Biologi LIPI
3. Kottelat, M., Whitten, A.J., Kartikasari, S.N., dan Wirjoatmodjo, S. 1993. Ikan Air Tawar Indonesia Bagian Barat dan Sulawesi. Periplus Editions.
4. Nelson, J.S., Grande, T.C., Wilson, M.V.H. 2016. Fishes of the World Fifth Edition. John Wiley & Sons New York

46. MONERA, PROTISTA, AND FUNGI BIODIVERSITY

Course Code: BIU206

Credits: 2

Learning Goals imposed in this course:

Able to describe the diversity of monera, protists, fungi, as well as their habitat and role in life (C4).

Course Description /Syllabus:

Introduction to the biodiversity of monera, protists, and fungi. Bacteria group, (alpha, beta, gama) proteobacteria, archaeobacteria, habitat of each bacteria group and the role of bacteria; algae group (cyanophyceae, myxophyceae, phicophyceae, rhodophyceae,) habitat of each algae group and the role of algae; protozoan groups (cyanophyceae, myxophyceae, phicophyceae, rhodophyceae,) the habitat of each protozoan group and the role of protozoa; fungi groups (yeasts, molds, macrofungi), the habitat of each fungi group and the role of fungi.

Lecturers: Prof. Dr. Ni'matuzahroh, Drs. Agus Supriyanto, M. Kes., Dr. Moch. Affandi, M.Si., Dr. Salamun, M. Kes., Intan Pratiwi, S.Si., M. Kes.

References:

1. Harold C. Bold, Constantine J. Alexopoulos, Theodore Delevoryas.1980. Morphology of Plants and Fungi. Harper & Row Publishers, NewYork.
2. B.R. Vashishta, A.K. Sinha., V.P. Singh. 2002. Botany for degree students Algae. S. Chand & Company Ltd., Ram Nagar, New Delhi -110055.
3. D.L. Hawksworth. 1990. The Biodiversity of Microorganisms and Invertebrates: Its role in Sustainable Agriculture. CAB International.
4. Bergey's Manual of Systematic Bacteriology. 2012.
5. John Dighton. 2016. Fungi in Ecosystem Processes: Second Edition. CRC Press Taylor.

47. ANIMAL PHYSIOLOGY

Course Code: BIZ211

Credits: 2

Learning Goals imposed in this course:

Students are able to show the relationship between certain physiological control mechanisms in animals and the internal and external environmental factors that affect them (C4).

Course Description /Syllabus:

Introduction; Cell Biophysics; Coordination System; Motion and Movement System; Transport and Cardiovascular; Respiration; Digestion and Food Absorption; Physiology of Male Reproductive System and Female Reproduction; Excretion and Osmoregulation.

Lecturers: Prof. Dr. Alfiah Hayati, Dr. Sugiharto, S.Si., M.Si.

References:

1. Barret, KE., S.M. Barman, S. Boitano, H.L. Brooks. 2015. Ganong's Review of Medical Physiology. 25 th ed. Lange Mc. Graw Hill. Co.
2. Butler, P.J., Brown, J.A. 2020. *Animal Physiology: An Environmental Perspective.* Oxford UniversityPress
3. Hill, R.W., Wyse, G.A. 2016. *Animal Physiology.* Sinauer Associates is an imprint of Oxford University Press; 4thedition.
4. Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter. 2015. Molecular Biology of The Cell. 6th. Ed. Garland Science.

48. ANIMAL PHYSIOLOGY (PRACTICUM)

Course Code: BIZ212

Credits: 1

Learning Goals imposed in this course:

Students are able to relate, maintain, and use physiological principles, operate related tools, and work in groups and coordinate in groups (C4 - A4 -P4).

Course Description /Syllabus:

Students are able to explain the working principle of the sphygmomanometer and factors affecting blood pressure, determine Hb levels, measure blood sugar levels, count the number of erythrocytes, and leukocytes, and how to count with the Improved Neubauer counting chamber; explain the working principle of antigen - antibody reactions and agglutination reactions in determining blood groups; determine blood coagulation time; determine oxygen consumption and factors affecting oxygen consumption of experimental animals; determine the location and time of sensation of taste receptors, determine the sex determination of fish, identify the menstrual cycle.

Lecturers: Dr. Sugiharto, S.Si., M.Si., Prof. Dr. Alfiah Hayati, M. Kes., Dr. Listiyani Suhargo, M.Si., Prof. Dr. Sri Puji Astuti W., M.Si.

References:

1. Gordon Betts, Peter Desaix, Eddie Johnson, Jody E. Johnson, Oksana Korol, Dean Kruse, Brandon Poe, James A. Wise, Mark Womble, Kelly A. Young, 2013, Anatomy & Physiology, OpenStax College Rice University, Houston, Texas
2. Sugiharto, Dwi Winarni, Anjar Tri Wibowo, Ufairanisa Islamatasya, Idqa Nurtri Bhakti, Nabilatun Nisa, Boon Chin Tan, Yosephine Sri Wulan Manuhara, 2022. Gynura procumbens adventitious root extract altered expression of antioxidant genes and exert hepatoprotective effects against cadmium-induced oxidative stress in mice, Hayati Journal of Biosciences, 29(4): 479-486. https://doi.org/10.4308/hjb.29.4.479-486
3. Sugiharto, Yosephine Sri Wulan Manuhara, Anjar Tri Wibowo, Dwi Winarni, Ufairanisa Islamatasya, and Us Watun Nurul Khasanah, 2020. The comparison toxicity effects of lead and cadmium exposure on hematological parameters and organs of mice, Eco. Env. & Cons., 26(4): pp. 1842-1846. http://www.envirobiotechjournals.com/article_abstract.php?aid=11041&iid=322&jid=3

4. Sugiharto, Anjar Tri Wibowo, Ummi Zubaidah, Annisa Dwi Savitri, Muhammad Sidqon Faukib, Navy Safira Salsabila, Yosephine Sri Wulan Manuhara, 2022. Biological properties of Gynura procumbens leaves extract to MDA levels and antioxidant activities in liver of mice, Res. J. Pharm. Technol., 15(12): 5829 – 5834. https://www.rjptonline.org/AbstractView.aspx?PID=2022-15-12-78 dan https://doi.org/10.52711/0974-360X.2022.00984

49. STATISTICAL METHODS

Course Code: MAS104

Credits: 2

Learning Goals imposed in this course:

Students are able to use existing methods in basic statistics to perform simple data analysis according to the related biology correctly.

Course Description /Syllabus:

This course discusses probability distribution, sampling distribution, inference based on 1 sample and 2 samples (parameter estimation and hypothesis testing), Chi-Square test, one-way and two-way analysis of variance, correlation analysis, and linear regression, and some nonparametric tests.

Lecturers: Sediono, drs., M.Si.

References:

1. Walpole, RE, 1995, *Pengantar Statistika, Edisi III*, Gramedia, Jakarta.
2. Chance, B.I., Rossman, A.J. 2018. *Investigating Statistical Concepts, Applications, and Methods 3rd ed.*
3. McClave, James T., and Terry Sincich, 2000, *Statistics, Eighth Edition*, Prentice Hall, NewJersey.
4. Rosner, Bernard, 2015, *Fundamentals of Biostatistics, 8th Edition*, Cengage Learning.

50. ENTOMOLOGY

Course Code: BIZ202

Credits: 2

Learning Goals imposed in this course:

Students are able to make descriptions of Insect animals, identify Insect animals, explain insect ecology, and distinguish important orders in health, forestry, agriculture, and as indicators of water pollution correctly.

Course Description /Syllabus:

Body structure and functions of insect organs; describe Insecta animals; identify Insecta animals; classify animals from the Insecta class, distinguish important orders in health, forestry, agriculture, and as indicators of water pollution.

Lecturers: Manikya Pramudya, S.Si., M.Si., Dr. Salamun, M. Kes.

References:

1. Beutel. R.G. 2013. *Insect Morphology and Phylogeny: A Textbook for Student of Entomology.* De Gruyter; 1stedition
2. Gullan, P.J., Cranston, P.S. 2014. *The Insects: An Outline of Entomology.* Wiley-Blackwell; 5th edition

3. Mullen, G.R., Durden, L.A. 2018. *Medical and Veterinary Entomology.* Academic Press; 3rd edition.

51. TERRESTRIAL ECOLOGY

Course Code: BIE201

Credits: 2

Learning Goals imposed in this course:

Students can:

1) Develop associative thinking so as to apply knowledge of terrestrial ecology for the welfare of society, the environment, and living things found on the earth's natural landscape.
2) Able to express opinions about the results of analysis of the ecology of teresterial (A3)

Course Description /Syllabus:

Boundaries and scope of plant ecology.

Ecological principles of ecosystems, plant and animal communities and populations, as well as the structure and function of ecosystems, the environment as an ecological factor and limiting factor; its effect on plant and animal communities, and on plant and animal communities, as well as population dynamics, and their succession, various biomes and forest vegetation, vegetation and animal analysis. Adaptation, structure and function of plant and animal bodies, and their influence on abundance and distribution patterns, plants as bioindicators, and some aspects of the influence of environmental pollution on plants and animals, conservation of natural resources.

Lecturers: Dra. Thin Soedarti, CESA., Prof. Dr. Sucipto Hariyanto, DEA.

References:

1. Schulze, E.D., Beck, E. 2019. *Plant Ecology.* Springer; 2nd ed.
2. Gurevitch, J., Scheiner, S.M. 2020. *The Ecology of Plant.*
3. Chapin III, F.S., Matson, P.A., and Vitousek, P.M. 2012, Principles of Terrestrial Ecosystem Ecology, 2nd Edition, Springer, New York-Dordrecht-Heidelberg-London.
4. Agren, G.I. and Anderson, F.O, 2012, Terrestrial Ecosystem Ecology: Principles and Applications, Cambridge University Press, New York.
5. Shukla, R.S. and P.S. Chandel, 1985. *Plant Ecology*. S. Chan & Co. Ltd.
6. Hariyanto, S., Irawan, B., dan Soedarti, T., 2008, Teori dan Praktik Ekologi, Airlangga University Press (AUP), Surabaya

52. TERRESTRIAL ECOLOGY PRACTICUM

Course Code: BIE202

Credits: 1

Learning Goals imposed in this course:

Students can:

1. Develop associative thinking so as to apply knowledge of terrestrial ecology for the welfare of society, the environment, and living things found on the earth's natural landscape.
2. Able to express opinions about the results of analysis of terrestrial ecology(A3)

Course Description /Syllabus:

Boundaries and scope of plant ecology. Ecological principles of ecosystems, plant and animal communities and populations, as well as the structure and function of ecosystems, the environment as an ecological factor and limiting factor; its effect on plant and animal communities, and on plant and animal communities, as well as population dynamics, and their succession, various biomes and forest vegetation, vegetation and animal analysis. Adaptation, structure and function of plant and animal bodies, and their influence on abundance and distribution patterns, plants as bioindicators, and some aspects of the influence of environmental pollution on plants and animals, conservation of natural resources.

Lecturers: Dra. Thin Soedarti, CESA., Prof. Dr. Sucipto Hariyanto, DEA.

References:

1. Schulze, E.D., Beck, E. 2019. Plant Ecology. Springer; 2nd ed
2. Gurevitch, J., Scheiner, S.M. 2020 The Ecology of Plant. Sinauer Associates is an imprint of Oxford University Press
3. Hariyanto, S. 2011. Diktat Ekologi Tumbuhan Jilid 1, Departemen Biology Fakultas Sains and Teknologi Universitas Airlangga. Surabaya.

53. BACTERIOLOGY

Course Code: BIM103

Credits: 2

Learning Goals imposed in this course:

Able to compare bacterial diversity and its biological aspects (C4)

Course Description /Syllabus:

Classification of bacteria, distribution and role of bacteria, structure and function of bacterial cells, bacterial nutrition, bacterial growth and development, bacterial metabolism, bacterial genetics, isolation and identification of bacteria, characterization of Enterobacteriaceae, Gram negative and non fermentative bacteria, Gram positive rod and cocci bacteria, Actinomycetes, nitrogen fixing bacteria, and spiral bacteria.

Lecturers: Prof. Dr. Ni'matuzahroh, Drs. Agus Supriyanto, M. Kes., Tri Nurhariyati, S.Si., M. Kes.

References:

1. Lehmann, K.B., Neumann, R.O. 2016. *Atlas and Principles of Bacteiology, Vol.2.* Palala Press
2. Delost, M.D. 2020. *Introductionto Diagnostic Microbiology for the Laboratory Science.* Jones & Bartlett Learning; 2nd edition.
3. Holt, J.G. 1994. *Bergeys Manual of Determinatif Bacteriology*. William & Wilkins Baltimore.
4. Salle, A.J.1961. *Fundamental Principles of Bacteriology*, Mc. Graw Hill Book Company. Inc. New York, Toronto, London.
5. Koneman, E.W. 1988. *Diagnosis Microbiology.* J.B. Lippincott Company.
6. Geraldi, A., Tay, C. C., Ni'matuzahroh, Fatimah & Hanafi, W. N. W., 2021. "Unraveling the Bacterial Diversity of Cangar Hot Spring, Indonesia by next generation sequencing of 16s rRNA gene", Sept 2021, In: Biodiversitas. 22, 9, p. 4060-4066 (Luaran penelitian: "Microbiome analysis using next generation sequencing to unravel the presence of commercially potential and pathogenic microbes in hot spring ecosystem")

7. Chasanah, Febriani Sukma Maghfirotul., 2011. "Isolasi dan Identifikasi Bakteri yang Berpotensi Mendegradasi Antibiotik Ciprofloxacin dan Instalasi Pengolahan Air Limbah Rumah Sakit." (Skripsi, Prodi S1 Biologi, Fakultas Sains dan Teknologi, Universitas Airlangga: Surabaya)
8. Fatimah, Suroiyah, F., Solikha N., Rahayuningtyas ND., Surtiningsih T., Nurhariyati T., Ni'matuzahroh., Affandi M., Geraldi A., Thontowi A. Antimicrobial activity of actinomycetes isolated from mangrove soil in Tuban, Indonesia. 2022. Biodiversitas: 23 (6).
9. Fatimah, Millah, AI., Fadilah, RLA., Salsabila, S., Ramly, ZA., Sugiarti, T., Nurhariyati T., Ni'matuzahroh, Affandi , M. 2022. Isolation and Potency Test of Endophytic Bacteria as Nitrogen Fixer from Mangrove Plant in Lamongan. Jurnal Riset Biologi dan Aplikasinya, Volume 4, Issue 1, March 2022.
10. Salamun, Ni'matuzahroh, Fatimah, FindawatiV, Susetyo RD, Al-Batati N, 2020. Prospect of native entomopathogenic Bacilli from Baluran National Park as biological control of dengue fever vector. Ann Biol 2020;36 :232–7.

54. BACTERIOLOGY (PRACTICUM)

Course Code: BIM104

Credits: 1

Learning Goals imposed in this course:

Able to carry out isolation and identification of bacteria and be able to compile bacterial characteristics (A3 and P4) correctly

Course Description /Syllabus:

Morphology and gram staining, calculation of correlation between cell turbidity and cell concentration, characterization of Escherichia coli and coliform bacteria, characterization of Actinomycetes, isolation and characterization of anaerobic bacteria, characterization of gram-positive cocci bacteria, antiseptic effectiveness on bacterial growth, isolation and characterization of nitrogen-fixing bacteria, biomonitoring of water pollution, isolation and characterization of heavy metal and hydrocarbon degrading bacteria.

Lecturers: Prof. Dr. Ni'matuzahroh, Drs. Agus Supriyanto, M. Kes., Tri Nurhariyati, S.Si., M. Kes.

References:

1. Johnson, T., Case, C. 2018. *Laboratory Experiments in Microbiology (What's New in Microbiology*). Pearson; 12th edition

2. Delost, M.D. 2020. *Introduction to Diagnostic Microbiology for the Laboratory Science.* Jones & Bartlett Learning; 2nd edition

3. Holt, J.G. 1994. Bergeys Manual of Determinatif Bacteriology. William & Wilkins Baltimore.

55. BOTANICAL ECONOMICS

Course Code: BIB104

Credits: 2

Learning Goals imposed in this course:

Able to explain the scope of economic botany, botany of food crops, botany of horticultural crops, botany of wood-producing plants, botany of fiber plants, aspects of cultivation and technological developments, economic value and quality improvement efforts as agribusiness commodities.

Course Description /Syllabus:

The scope of economic botany, botany of food crops, botany of horticultural crops, botany of wood-producing plants, botany of fiber plants, aspects of cultivation and technological developments, economic value and quality improvement efforts as agribusiness commodities.

Lecturers: Dr. Junairiah, S.Si., M. Kes.

References:

1. Simpson, Berryl B., Corner O, and Molly. 2013. Plantin Our World: Economic Botany. McGraw-Hill Education; 4th edition
2. Kochhar, S.L. 2016. *Economic Botany: A Comprehensive Study*. Cambridge University Press; 5th edition.
3. Junairiah, Fatimah, nurhariyati T, Zuraidassanaaz. 2023. Antioxidant, Antimicrobial Activity and Phytochemical Screening of Syzygium cumini L Leaves in Tropical Region from Surabaya, East Java Indonesia. Asian Journal of Plant Sciences 22(1): 104-112.

56. ECOSYSTEM BIODIVERSITY

Course Code: BIE302

Credits: 2

Learning Goals imposed in this course:

Biology students of Universitas Airlangga can categorize ecosystems based on their biotic and abiotic components, and their interactions with human populations (C6).

Course Description /Syllabus:

Introduction to Biodiversity and Ecosystem Boundaries.Earth as an Ecosystem; abiotic components in ecosystems, Functions of organisms in the mechanism of energy flow balance in ecosystems. Ecosystem dynamics: temporal dynamics, heterogeneity in ecosystems, types of ecosystems.

Lecturers:

References:

1. Chaplin III, F, S., Matson, P. A., Vitousek, P.M. 2011. Principles of Terresttrial Ecosystem Ecology, 2nd ed. Springer, 527 hal.
2. Maslo, B., and Lockwood, J. (Ed) 2014. Coastal Conservation; Conservatiuon Biology 19. Cambridge, 382 hal.
3. Sucipto, H., Irawan, B., Mochammadi, N., and Soedarti Th. 2015. Lingkungan Abiotik, Jilid I: Atmosfer, Hidrosfer, Litosfer. Airlangga University Press, Surabaya.
4. Sucipto, H., Irawan, B., Mochammadi, N., and Soedarti Th. 2016. Lingkungan Abiotik, Jilid II: Mineral, Batuan, Gempa, Tanah and Iklim. Airlangga University Press, Surabaya.

57. PLANT BIODIVERSITY

Course Code: BIB305

Credits: 2

Learning Goals imposed in this course:

Able to determine the biodiversity of plants about:

1.Classification, economic, medicinal, and nutritional benefits of a taxon(C3).

2.Habitat and ecological distribution of plant taxon from a family (clade) (C3).

Course Description /Syllabus:

The classification of a taxon determines the habitat, ecological distribution, benefits (economic, medicinal, and nutritional) of the Bryophyta, Pterydophyta, Gymnospermae, Magnoliopsida, and Liliopsida families.

Lecturers: Dr. Hamidah, M. Kes.

References:

1. Simpson, Michael G. 2010. *Plant Systematics*. Academic Press. California.USA.
2. Judd, W.S., Campbell, C.S. 2015. Plant Systematics: A Phylogenetic Approach. Sinauer Associates is an imprint of Oxford University Press.

58. PLANT BIODIVERSITY (PRACTICUM)

Course Code: BIB306

Credits: 1

Learning Goals imposed in this course:

Able to apply biodiversity / plant diversity about

1. Classification, economic, medicinal, and nutritional benefits of a taxon (C3)
2. Habitat and ecological distribution of plant taxon from a family (tribe) (C3)

Course Description /Syllabus:

Classification diversity of a taxon and the habitat, ecological distribution, benefits (economic, medicinal and nutritional) of Bryophyta, Pterydophyta, Gymnospermae, Magnoliopsida, and Liliopsida families.

Lecturers: Dr. Hamidah, M. Kes., Dr. Junairiah S.Si., M. Kes.

References:

1. Keanekaragaman Tumbuhan Pulau Sempu dan Ekosistimnya, 2018. LIPI, Bogor.
2. Simpson, Michael G.2010. *Plant Systematics*. Academic Press. California.USA.
3. Judd, W.S., Campbell, C.S. 2015. Plant Systematics: A Phylogenetic Approach. Sinauer Associates is an imprint of Oxford UniversityPress
4. Heyne, K. 1987. Tanaman Berguna Indonesia jilit I, II, III, and IV. Baand Litbang Kehutanan. Jakarta.
5. Indonesia. Biodiversty Strategy and Action Plant 2015-2020., 2014, ITB, Bandung.

59. BIOINFORMATICS

Course Code: BIK308

Credits: 2

Learning Goals imposed in this course:

Understand the concepts and applications of bioinformatics and be able to perform analysis using bioinformatics

Course Description /Syllabus:

In this course students learn about the definition of bioinformatics, nucleotide database, genetic engineering, plasmid vectors, nucleotide alignment, RNA structure, protein database, protein structure, protein alignment, protein metabolic pathways, and protein interactions.

Lecturers: Dr. Listyani Suhargo, M.Si., Almando Geraldi, S.Si., Ph.D.

References:

1. Claverie, J. M., & Notredame, C. (2006). *Informatics for Dummies*. John Wiley & Sons.
2. Xiong, J. 2006. *Essential Bioinformatic*. Cambridge University Press. Cambridge.
3. Fatchiyah. 2015. *Prinsip Dasar Bioinformatika*. Penerbit UB Press.Malang.
4. Kharisma, V.D. 2019. Modul Workshop Bioinformatika. *Saintifikasi Tumbuhan Obat Malalui Kajian In Silico*. Yayasan Generasi Biology Indonesia

60. BIOINFORMATICS (PRACTICUM)

Course Code: BIK309

Credits: 1

Learning Goals imposed in this course:

Able to obtain related information and perform analysis and engineering of DNA, RNA, and proteins using bioinformatics programs.

Course Description /Syllabus:

Access and analyze information related to DNA, RNA, and proteins from databases available on the internet, design Polymerase Chain Reaction (PCR) primers and expression vectors with bioinformatics programs, introduce and model protein structures and non-protein compounds and predict interactions between compounds, Bioedit program.

Lecturers: Dr. Listyani Suhargo, M.Si., Almando Geraldi, S.Si., Ph.D.

References:

1. Claverie, J. M., & Notredame, C. (2006). Bioinformatics for dummies. John Wiley & Sons.
2. Fatchiyah. (2015). Prinsip dasar bioinformatika. Universitas Brawijaya Press.
3. Kharisma, V.D. 2019. Modul Workshop Bioinformatika. Saintifikasi Tumbuhan Obat Melalui Kajian in Silico. Yayasan Generasi BiologyIndonesia.

61. SPECIALIZED FIELD CAPITA SELECTA

Course Code: BIU300

Credits: 2

Learning Goals imposed in this course:

Students are able to analyze, reorganize and present scientific information on cutting-edge research articles systematically correctly.

Course Description /Syllabus:

Students are able to systematically analyze advanced scientific research articles in English, reorganize the results of the article review, present the results of the review and answer questions to explore the scientific concepts identified.

Lecturers: Intan Ayu Pratiwi, S.Si., M.Si., Prof. Dr. Y. Sri Wulan M., M.Si., Dr. Sugiharto, S.Si., M.Si.

References:

Scopus indexed English articles.

62. RESEARCH METHODOLOGY

Course Code: PNT497

Credits: 2

Learning Goals imposed in this course:

Statistical Methods

1. Able to apply basic concepts in research methodology correctly
2. Able to compile scientific research proposals and research reports correctly
3. Able to present and defend scientific research proposal assignments correctly
4. Able to conduct a review of scientific journals based on the concepts of basic concepts in research methodology.

Course Description /Syllabus:

This Research Methodology course is a compulsory course in the Biology Bachelor Degree Study Program. This course contains a study of the meaning, role, and benefits of research. Scientific mindset, research problems, literature study, and conceptual framework. Assumptions, hypotheses, variables, and operational definitions of variables. Types of research and research design (observational design and experimental design). Population, sample, and sampling techniques. Instruments and data collection techniques. Types of data and data analysis. Research proposal and scientific research report.

Lecturers: Dr. Salamun, M. Kes.

References:

1. Burkholder, G.J., Cox, K.A. 2019. *Research Design and Methods: An Applied Guide for the Scholar-Practitioner.* SAGE Publications, Inc
2. Muh. Zainuddin, 2000, Metotologi Penelitian, AUP, Surabaya.
3. Notoatmodjo, S., 2012, Metodologi Penelitian Kesehatan, Reneka Cipta, Jakarta.

63. ANIMAL BIODIVERSITY

Course Code: BIZ302

Credits: 2

Learning Goals imposed in this course:

Able to explain animal biodiversity in terms of the presence or absence of true tissue, body symmetry, body cavity, embryonic development and habitat and differentiate and exemplify animal species according to their classification (C4)

Course Description /Syllabus:

Introduction to animal biodiversity, habitat diversity, abundance, distribution and ecological functions of animals: Phylum Porifera, Phylum Cnidaria, Phylum Platyhelminthes, Aschelminthes, Phylum Annelida, Phylum Mollusca, Phylum Arthropoda, Phylum Echinodermata, Subphylum Vertebrata, Class Chondrichthyes, Class Osteichthyes, Class Amphibia, Class Reptilia, Class Aves, Class Mammalia.

Lecturers: Manikya Pramudya, S.Si., M.Si., Prof. Dr. Bambang Irawan, M.Sc.

References:

1. Bambang Irawan, 1987. *Taksonomi Hewan Tetrapoda*. Biology Lingkungan. Tidakdipublikasi
2. Ruppert, E.E., Fox, R.S., Barnes, R.D., 2011. *Invertebrate Zoology 7th ed*. Holt- Saunders International.
3. Suharsono. 2014. *Biodiversitas Biota Laut Indonesia.* LIPI.
4. Miller, S., Tupper, T.A. 2018. *Zoology.* McGraw-Hill Education; 11th edition
5. Fa, J.E., Funk, S.M. 2011. *Zoo Conservation Biology (Ecology, Biodiversity, and Conservation*). Cambridge University Press; 1stedition
6. Pechenik. 2014. *Biology of the Invertebrates 7thEd.* McGraw Hill India.
7 Irawan, B. 2013. *Karsinologi.* Airlangga University Press.
8. Peraturan perundang-undangan tentang Biodiversitas
9. Pramudya, M., Dewi, F.R.P., Pratiwi, I.A., Irawan, B. 2022. *Taksonomi Hewan*. ***Dalam proses.***
10. Ruppert, E.E., Fox, R.S., Barnes, R.D. 2004. *Invertebrate Zoology, a Functional Evolutionary Approach 7th ed*. Thomson Brooks/Cole. Australia

64. ANIMAL BIODIVERSITY (PRACTICUM)

Course Code: BIZ303

Credits: 1

Learning Goals imposed in this course:

Able to identify various types of animals based on morphological characters, classify various types of animals according to taxon and make a key to determining the taxon of animals practiced (C6)(P2)

Course Description /Syllabus:

Morphological characters and description of animals from: Phylum Platyhelminthes, Phylum Ashelminthes, Phylum Annelida, Phylum Mollusca, Phylum Arthropoda, Phylum Echinodermata, Subphylum Vertebrata, Class Chondrichthyes, Class Osteichthyes, Class Amphibia, Class Reptilia, Class

Aves, and Class Mammalia, identify and make determination keys of practiced animal taxa.

Lecturers: Manikya Pramudya, S.Si., M.Si.

References:

1. Bambang Irawan, 1987. *Taksonomi Hewan Tetrapoda*. Biology Lingkungan. Tidak dipublikasi
2. Ruppert, E.E., Fox, R.S., Barnes, R.D., 2011. *Invertebrate Zoology 7th ed*. Holt-Saunders International.
3. Suharsono. 2014. *Biodiversitas Biota Laut Indonesia.* LIPI.

65. VERTEBRATE EMBRYOLOGY

Course Code: BIR306

Credits: 2

Learning Goals imposed in this course:

Able to distinguish the structure and development of vertebrates from zygotes to perfect individuals

Course Description /Syllabus:

Discuss the embryology definition and development theories, gametes and fertilization, cleavage, gastrulation and organogenesis in vertebrates.

Lecturers: Prof. Win Darmanto, MS. Ph.D., Hari Soepriandono, S.Si., M.Si.

References:

1. Huettner, A.F. 1957. Comparative Embryology of The Vertebrate. The MacmillanCompany.New York.
2. Patten, B.M. 1957. Early Embryology of The Chick. McGraw-Hill Book Company Inc.
3. Hill, M. 2018. UNSW Embryology
4. Histology Guide © Faculty of Biological Sciences, University of Leeds.
5. Waddington, S.N. et al. 2005. In Utero Gene Therapy : Current Challenges and Perspectiv
6. Wang Z.G., Xu Z.R., Yu S.D.2007. Effects of oocyte collection techniques and maturation media on in vitro maturation and subsequent embryo development in Boer goat Czech J. Anim. Sci., 52, 2007 (1): 21–25

66. VERTEBRATE EMBRYOLOGY (PRACTICUM)

Course Code: BIR307

Credits: 1

Learning Goals imposed in this course:

Able to distinguish the structure and development of vertebrates from zygotes to perfect individuals and make animal embryo models and compile reports on animal organogenesis.

Course Description /Syllabus:

Gametogenesis, cleavage, blastultion, gastrulation, neurulation, organogenesis in vertebrates

Lecturers: Hari Soepriandono, S.Si. M.Si.

References:

1. Reese, A.M. 2015. *An Introduction to Vertebrate Embriology: Based on the study of the frog and the chick.* Sagwan Press

2. Marshall. A.M. 2015. *Vertebrate Embryology: a Text-Book for Student and Practitioners.* PalalaPress
3. De Beer, G. 2018. *Vertebrate Zoology*.Franklin Classics
4. Schoenwolf, G. C. 2008. *Laboratory Studies of Vertebrate and Invertebrate Embryos*. 8th. Prentice Hall Inc. USA.

67. AQUATIC ECOLOGY

Course Code: LKB301

Credits: 2

Learning Goals imposed in this course:

Can explain a number of distinguishing characteristics in the pattern of adaptation to environmental conditions among various taxon groups of organisms that exist in both freshwater and marine waters (C5).

Course Description /Syllabus:

Introduction to aquatic ecology, limiting factors, freshwater living environment, freshwater communities, habitat modification in freshwater ecosystems, estuarine communities, physical-chemical factors and limiting factors of marine waters, marine organism communities, planktonic communities, phytobenthic (seaweed and seagrass), zoobenthic communities, nekton communities, coral reefs.

Lecturers: Dra. Thin Soedarti, CESA.

References:

1. Soegianto, A. 2005. Diktat Ekologi Perairan Bagian I: Ekologi Tawar, Jurusan Biology FMIPAUnair.
2. Kaiser, M.J., Attrill, M.J. 2020. *Marine Ecology: Processes, Systems, and Impacts.* Oxford University Press; 3rdedition
3. Dodds, W and Whiles, M. 2019. *Freshwater Ecology: Concepts and Environmental Applications of Limnology (Aquatic Ecology).* Academic Press; 3rd edition.

68. AQUATIC ECOLOGY (PRACTICUM)

Course Code: LKB303

Credits: 1

Learning Goals imposed in this course:

Students can:

1) Measure physico-chemical and biological factors of water (p3)
2) Perform ecosystem analysis on freshwater and reservoirs, rivers/streams and sea/estuaries (p3)
3) Be able to express opinions on the results of the analysis of freshwater and marine / estuarine ecosystems (A3)

Course Description /Syllabus:

Measurement of water physico-chemical and biologys parameters; biotic components and ecosystem analysis of freshwater and reservoirs, rivers/streams and seas/estuaries.

Lecturers: Dra. Thin Soedarti, CESA., Dr. M. Affandi, M.Si.

References:

1. Hariyanto S., Irawan, B., and Soedarti, T., 2008, Teori and Praktik Ekologi, Airlangga University

Press, Surabaya.
2. Dodds, W and Whiles, M. 2019. *Freshwater Ecology: Concepts and Environmental Applications of Limnology (Aquatic Ecology).* Academic Press; 3rdedition
3. Kaill, W.M. & J.K. Frey., 1974. *Environments in Profile*. Canfield Press. San Franscisco.
4. Alaerts, G. & S.S. Santika., 1987. *Metoda Penelitian Air*. Usaha Nasional. Surabaya.

69. MYCOLOGY

Course Code: BIB202

Credits: 2

Learning Goals imposed in this course:

Able to compare the diversity of fungi based on morphology and cytology (C4)

Course Description /Syllabus:

History and benefits of mycology, overview of fungal ecology, taxonomy and classification of fungi, isolation and identification of fungi, cytology, reproduction, metabolism and application of yeast, mold, mushroom and mycorrhiza, mycotoxins, morphology and reproduction of Ascomycetes, Zygomycetes and Basidiomycetes.

Lecturers: Drs. Agus Supriyanto. M.Kes

References:

1. Kurtzman, C., Fell, J.W. 2011. *The Yeast: a Taxonomic Study.* Elsevier Science; 5thedition
2. Moore, D., Robson, G.D., Trinci, A.P.J. 2020. *21st Century Guidebook to Fungi. 2nd Ed.* Cambridge UniversityPress
3. Moore, E., and Landecker. 1996. *Fundamental of the Fungi*, 4th ed. Prentice Hall, Upper Saddle River, NewJersey.
4. Christa, J., Hodgkinson, K. 2018. *Break the Mold.* Cardinal Publisher's Group; Firstedition
5. Smith, S. E., and read, D. J. 2010. *Micorrhizal Symbiosid*, 3rd ed., Academic Press, Harcourt Brace & Co. Publisher.
6. Sastrahydayat I. R. 2011. *Mikologi Ilmu Jamur*, edisi pertama. Universitas Brawijaya Press (UB Press).

70. MYCOLOGY (PRACTICUM)

Course Code: BIB203

Credits: 1

Learning Goals imposed in this course:

Able to carry out independent research in the laboratory and in the field, as well as the ability to handle organisms (KK4)

Course Description /Syllabus:

Making slide culture of fungi. Macroscopic and microscopic characterization of Aspergillus, Penicillium, Rhizopus, Mucor, yeast. Isolation and identification of tape yeast and tempe yeast, molds from domestic waste, leaf litter and soil, fruits and cereals, mycorrhizal characterization and mycotoxin testing, fungal culture

Lecturers: Drs. Agus Supriyanto, M. Kes., Tri Nurhariyati, S.Si., M. Kes., Dr. Fatimah S.Si., M. Kes

References:

1. Moore, E., and Landecker. 1996. *Fundamental of the Fungi* 4thed. PrenticeHall, Upper Saddle River, New Jersey.
2. Moore, D., Robson, G.D., Trinci, A.P.J. 2020. *21st Century Guidebook to Fungi. 2nd Ed.* Cambridge University Press
3. Sastrahydayat I. R. 2011. *Mikologi Ilmu Jamur,* edisi pertama. Universitas Brawijaya Press (UB Press).
4. Tim Mikologi. 2018. *Petunjuk Practicum Mikologi.* FST Unair.

71. IMMUNOBIOLOGY

Course Code: BII201

Credits: 2

Learning Goals imposed in this course:

1. Capable of explaining life phenomena based on immunobiology principles.
2. Capable of applying immunobiology principles correctly.

Course Description /Syllabus:

Introduction to the immunobiology principles, immune system and non-specific immune system components, immune system and specific immune system components, antigens and antibodies, lymphoid tissue and immunocompetent cell maturation, immunoglobulin structure and function, immunoglobulin synthesis, major histocompatibility complex (MHC), cytokines and complement, immunodeficiency, hypersensitivity reactions, tumor immunology, and immunological techniques.

Lecturers: Prof. Dr. Sri Puji Astuti W., M.Si., Dr. Dwi Winarni, M.Si.

References:

1. Abul K. Abbas, Andrew H. Litchtman, and Jorand S. Pober. 2015. Cellular and molecular immunology, fourth edition. W.B. Saunders Company.
2. Murphy, K. and Weaver, C. 2016. Janeway's Immunobiology. W. W. Norton & Company; Ninthedition
3. Levinson, W. 2020. *Review of Medical Microbiology and Immunobiology. 16th Ed.* McGraw-Hill Education
4. Abul K. Abbas, Andrew H. Litchtman, 2019. Basic Immunology: Functions and Disorders of the Immune System. Elsevier; 6th edition.

72. ANIMAL TISSUE CULTURE

Course Code: BIT304

Credits: 2

Learning Goals imposed in this course:

Students are able to evaluate plant growth and development through plant tissue culture methods correctly.

Course Description /Syllabus:

History, basics, principles, and benefits of plant tissue culture (KJT); laboratory and its equipment; preparation and composition of KJT media including; macronutrients, micronutrients, carbon sources, growth regulators, vitamins: KJT methods; various KJT techniques.

Lecturers: Prof. Dr. Edy Setiti W.U., MS., Prof. Dr.Y. Sri Wulan Manuhara, M. Si

1. Smith, R.H. 2012. *Plant Tissue Culture: Technique and Experiments*. Academic Press; 3rd edition
2. Kyte, L., Kleyn, J. 2013. *Plant from Test Tubes: An Introduction to Micropropagation.* Timber Press; Fourth Edition
3. Koeling, C. 2015. *New Frontiers in Plant in Vitro Culture.* CallistoReference
4. Park, S. 2021. *Plant Tissue Culture: Techniques and Experiments.* Academic Press; 4th edition
5. Suryowinoto, M. 1996. *Pemuliaan Tanaman Secara In Vitro*, Penerbit Kanisius.

73. PLANT TISSUE CULTURE (PRACTICUM)

Course Code: BIT305

Credits: 1

Learning Goals imposed in this course:

Students can be skilled to sterilize tools, explant media, space; skilled to make media, skilled to inoculate and subculture explants appropriately.

Course Description /Syllabus:

Students can be skilled to sterilize tools, explant media, space; skilled to make media, skilled to inoculate and subculture explants appropriately.

Lecturers: Prof. Dr.Y. Sri Wulan M., M.Si., Dwi Kusuma Wahyuni, S.Si., M.Si., Ph.D.

References:

1. Smith, R.H. 2012. *Plant Tissue Culture: Technique and Experiments.* Academic Press; 3rdedition
2. Kyte, L., Kleyn, J. 2013. *Plant from Test Tubes: An Introduction to Micropropagation.* Timber Press; FourthEdition
3. Koeling, C. 2015. *New Frontiers in Plant in Vitro Culture.* Callisto Reference
4. Park, S. 2021. *Plant Tissue Culture: Techniques and Experiments.* Academic Press; 4th edition.

74. FIELD WORK PRACTICE (BMKM with non-Higher Education Institutions)

Course Code: KLT302

Credits: 4

Learning Goals imposed in this course:

1. Able to carry out field work practice activities in accorandce with the competence of the field of science in the world of work (P2)
2. Able to convey skills and knowledge in the workplace according to the tasks carried out (A3)
3. Able to outline task and work descriptions in accorandce with their scientific competence correctly (C2)

Course Description /Syllabus:

In this course students learn about: skills and knowledge in the workplace in accorandce with the tasks carried out during field work practice in the field of biology.

Lecturers: Intan Ayu Pratiwi, S.Si., M.Si.

References:

Buku Pedoman Practicum Kerja Lapangan, 2012, Departemen Biology, Fakultas Sains and Teknologi Universitas Airlangga, Surabaya.

75. MBKM with Partner Universities/Non-Higher Education Institutes

Course Code: BIU 311 (Industrial Knowledge, 4 credits) or BIU 312 (Information Technology Knowledge, 4 credits)

Credits: 4

Learning Goals imposed in this course:

Students gain experience in MBKM at Higher Education partners (2 credits) or non-Higher Education institutions (4 credits).

Course Description /Syllabus:

There are 3 activities to choose from, which include taking courses at partner universities and internship experiences in industry or information technology (IT).

Lecturers:

References:

Buku Pedoman MBKM Universitas Airlangga

76. EVOLUTION

Course Code: BIU309

Credits: 2

Learning Goals imposed in this course:

Able to show the relationship between the concepts of evolution, the development of evolution and the influence of science and technology on the evolution of living things.

Course Description /Syllabus:

History of the development of the theory of evolution of living things. Laws related to the evolutionary development of living things. Mono, inter, and multidisciplinary review and study of the evolutionary development of living things. Understanding evolution from the aspect of interaction between living things and their environment. Development towards modern humans. The development of science and technology and human evolution.

Lecturers: Prof. Dr. Sucipto Hariyanto, DEA.

References:

1. Reece, J. B., Taylor, M.R., et al. 2020. *Biology: Concepts and Connecions.* Pearson; 8th edition
2. Barraclough, T.G. 2019. *The Evolutionary Biology of Species.* Oxford University Press
3. Futuyma, D.J. and Kirpatrick, M.2017. *Evolution.* Oxford University Press
4. Bregstorm, C.T., Dugatkin, L.L. 2016. *Evolution.* W. W. Norton & Company; Second edition.

77. BIOSYSTEMATICS

Course Code: BIU101

Credits: 2

Learning Goals imposed in this course:

Learning Outcomes imposed in this course

1. Can construct a phylogeny tree to analyse the relationship between 10 taxa using phenetic and cladistic methods in 60 minutes each (C6).

2. Able to evaluate biodiversity in Indonesia according to the determination key correctly.
3. Be able to validate the cladogram as a phylogenetic tree with geological, paleontological, and literature evidence (C5).

Course Description /Syllabus:

Limitations of biosystematics, History of biosystematics, taxonomic activities, differences with biosystematics. Taxonomic characters. Manually construct phenograms in steps of 3, 5 and 10 taxa. Plesiomorphy and apomorphy characteristics. How to determine apomorphy characteristics. Construct cladogram using Henis method and Wagner method and one other method. Evaluate cladogram by calculating cladogram length, parsimony principle, calculating CI and RI values (statistical description). Calibrate cladograms (phylogenetic trees) based on geological, palaeontological, and literature parameters. Examples of software for constructing kinship diagrams (phenetic and cladistic methods).

Lecturers: Dr. Hamidah, M. Kes.

References:

1. Amin, M. H. F., dan Irawan, B. 2023. Filogeni dan Klasifikasi Osteichthyes. Airlangga Unuiversity Surabaya, inpress.
2. Irawan. B. 2022. Klasifikasi dan Deskripsi Kelas Chondrichthyes. Airlangga Unuversity Press, Surabaya; 103 hal.
3. Pramudya. M., Pratiwi, I, A., Amin, M. H. F., dan Irawan, B. 2023.
4. Filogeni dan Klasifikasi Filum Mollusca. Airlangga Unuiversity Surabaya, inpress.
5. Moore, D., Robson, G. D.m, Trinci, A. P. J. 2020. 21st Century Guide to Fungi, 2nd ed. Cambridge University Press, Cambridge, 600 hal.
6. Mount, D.W. 2004. Bioinformatics; sequence and genome analysis. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York; hal.:121-161.
7. Ruppert, E.E., Fox, R.S., dan Barnes, R.D. 2004. Invertebrate Zoology; a functional evolutionary approach, 7th ed. Thompson, Australia.
8. Sampel, J. C. 1996.An Introduction to Fungi, Algae and Plant, 2nd ed. Pearson Custom Publishing.
9. Skelton, P. 1993. Evolution; a biological and palaeontological apprioach. Prentice Hall, London.
10. Stuessy, T. F. 2009. Plant Taxonomy; The Systrematic Evaluation of Comarative Data, 2nd ed. Columbia University Press, New York, 539 hal.

78. BIOSYSTEMATICS (PRACTICUM)

Course Code: BIU102

Credits: 1

Learning Goals imposed in this course:

1. Be able to sketch a phylogeny tree for the analysis of kinship relationships between 10 taxa by phenetic and cladistic methods within 60 minutes each (P5). Be able to evaluate biodiversity in Indonesia according to the determination key correctly.
2. Be able to construct a phylogenetic tree that has been validated with geological, paleontological, and literature evidence (C6**).**

Course Description /Syllabus:

Study taxonomic characters to construct phylogenetic trees, determine the status of characteristics so that they can be used to construct phylogeny trees. Establish kinship relationships of 10 animal taxa, 10 plant taxa, 10 Fungi taxa phenetically and cladistically. Get to know the software to study the relationship between living things.

Lecturers: Practicum Biosystematics Team

References:

1. Baum, D.A., Smith, S.D. 2012. *Tree Thinking: An Introduction to Phylogenetic Biology*. W. H. Freeman; 1stedition
2. Balfour, A. 2016. *Principal of Plant and Animal Taxonomy.* Syrawood Publishing House
3. Simpson, M.G. 2019. *Plant Systematics 3rdEd.* Academic Press.

79. RELIGION II

Course Code:

Credits:

Learning Goals imposed in this course:

Course Description /Syllabus:

Lecturers:

References:

80. GENETIC ENGINEERING

Course Code: BIT307

Credits: 2

Learning Goals imposed in this course:

Students are able to explain various genetic engineering methods and analyze phenomena related to genetic engineering correctly.

Course Description /Syllabus:

Basic manipulation techniques, DNA isolation techniques, cutting and joining DNA molecules, plasmids as cloning vectors, gene cloning in E. coli host cells, gene transfer without host cells (PCR), gene transfer in eukaryotic cells (plants), gene transfer in eukaryotic cells (animals), protein isolation techniques, recombinant selection by Southern blotting, Northern blotting, and Western blotting methods.

Lecturers: Prof. Dr. Sri Puji Astuti W., M.Si., Prof. Dr.Y. Sri Wulan M., M.Si.

References:

1. Desmond S. T. Nicholl. 2008. An Introduction to Genetic Engineering, Third Edition. Cambridge University Press.
2. Hugo A. Barrera-Saldaña. 2011. Genetic Engineering – Basics, New Applications and Responsibilities. InTech Janeza, Rijeka, Croatia.
3. Gurbachan Miglani. 2016. Genetic Engineering Principles, Procedures and Consequences, First Edition. AlphaScience International (Oxford, UK) and Narosa Publishing House (New Delhi, India).

81. ENDOCRINOLOGY

Course Code: BIE301

Credits: 2

Learning Goals imposed in this course:

After taking this course, students will be able to analyze the changes caused by lack or excess of Vertebrate hormones based on the mechanism of controlling hormone secretion (C4)

Course Description /Syllabus:

Introduction to Endocrinology (Definition of hormones, endocrine glands, steroid hormones and peptides, Hypothalamus and Pituitary), ADH and oxytocin, Thyroid Gland, Adrenal Gland, Pancreatic Gland, Melanophore Stimulating Hormone, Endocrinology of Female Reproductive System, Endocrinology of Male Reproductive System

Lecturers: Dr. Dwi Winarni, M.Si., Dr. Listyani Suhargo, M.Si.

References:

1. Barret, KE., S.M. Barman, S. Boitano, H.L. Brooks. 2015. Ganong's Review of Medical Physiology. 25 th ed. Lange Mc. Graw Hill. Co.
2. Norris, David O. 2020. *Vertebrate Endocrinology*. 6th. Ed. London: Elsevier Academic Press.
3. Suharingsih, Dwi Winarni, Saikhu Akhmad Husen. Tri Anggono Priyo, 2018.Finding the Optimized Frequency of Electric Field on The Attempt of Reducing Blood Sugar Level in Type II Diabetes Patiens. Jurnal Vokasi Indonesia. 6(1): 598-608.

82. SPERMATOLOGY

Course Code: BIR303

Credits: 1

Learning Goals imposed in this course:

Able to review, convince, and demonstrate (C4, A3, P3) the principles of spermatology; structure and function, collection and analysis of spermatozoa in internal and external fertilization animals correctly.

Course Description /Syllabus:

In this course students learn about: Spermatology Research definition and insights ; Testicular structure in animals (internal and external fertilization); Comparison of spermatozoa structure in animals (internal and external fertilization); Regulation of spermatozoa maturation and capacitation; Molecular spermatozoa: Acrosome reaction and sperm-zona binding; Semen collection and analysis techniques; Ultrastructure of spermatozoa; Oxigen Species reaction (advantages and disadvantages); Testosterone synthesis and function; Testicular abnormalities, infertility and abnormal sex chromosomes; International journal

Lecturers: Prof. Dr. Alfiah Hayati, M.Kes., Hari Soepriandono, S.Si., M.Si.

References:

1. Hayati A., 2011, Spermatologi, Airlangga Press, Surabaya.
2. Nieschlag E, HM. Behre, and S. Nieschlag. 2010. Andrology, 3 rd Edition. Springer Heidelberg, New York.
3. Hafez ESE. And B. Hafez, 2013, *Reproduction in Farm Animals*, 7th Edition, John Wiley & Sons, Inc.
4. Cole KS., 2010, Reproduction and sexuality in marine fishes. First edition. University of California Press.

5. Carrell DT., CM. Peterson, 2010. *Reproductive Endocrinology and Infertility*, Springer, New York.

83. SPERMATOLOGY (PRACTICUM)

Course Code: BIR308

Credits: 1

Learning Goals imposed in this course:

Students are able to design, report, and plan (P4, A2, C5) research based learning (RBL) in the field of reproductive biology.

Course Description /Syllabus:

In this course, students learn to do practicum on: collection techniques and analysis of the quality and quantity of vertebrate spermatozoa; search for information and international journals related to the field of male reproduction through electronic media, textbooks, or surveys to community laboratories; preparation of research-based learning (RBL) plans, implementation of RBL, compiling reports, and presentation of RBL results.

Lecturers: Prof. Dr. Alfiah Hayati, M. Kes., Hari Soepriandono, S.Si., M.Si.

References:

1. Hayati A., 2011, Spermatologi, Airlangga Press, Surabaya.
2. Nieschlag E, HM. Behre, and S. Nieschlag. 2010. Andrology, 3 rd Edition. Springer Heidelberg, New York. Hoar, WS.,
3. Cole, K.S. 2010. *Reproduction and Sexuality in Marine Fishes: Pattern and Processes.* University of California Press.

84. APPLIED MICROBIOLOGY

Course Code: BIM301

Credits: 2

Learning Goals imposed in this course:

Able to conclude the benefits of microbes in the fields of food industry, mining, oil industry, biodegradation and biodeterioration, bioconversion, and biomonitoring and their processes (C6).

Course Description /Syllabus:

Introduction to applied microbiology, microbial storage and development techniques, biomass and probiotics, food fermentation, enzyme fermentation, organic solvent fermentation, amino acid fermentation, organic acid fermentation, antibiotic fermentation, vitamin fermentation, biopolymer fermentation.

Lecturers: Almando Geraldi, S.Si., Ph.D., Drs. Agus Supriyanto, M. Kes.

References:

1. Rittmann, B., McCarty P. 2020. *Environmental Biotechnology: Principles and Applications, 2nd Ed.* McGraw-Hill Education; 2ndeditio
2. Wilson, D.B., Sahm, H. 2020. *Industrial Microbiology*. Wiley-VCH; 1stedition.

85. APPLIED MICROBIOLOGY (PRACTICUM)

Course Code: BIM302

Credits: 1

Learning Goals imposed in this course:

Able to carry out and prove fermentation processes in the fields of food, industry and microBiologycal waste treatment (P5 and A6).

Course Description /Syllabus:

Fermentation of enzymes, organic acids, antibiotics, hormones, biopolymers, ethanol, amino acids, biosurfactants, biogas production, single cell proteins; microbiological waste treatment

Lecturers: Drs. Agus Supriyanto, M. Kes.

References:

1. Rittmann, B., McCarty P. 2020. *Environmental Biotechnology: Principles and Applications, 2nd ed.* McGraw-Hill Education; 2nd edition
2. Wilson, D.B., Sahm, H. 2020. *Industrial Microbiology*. Wiley-VCH; 1stedition
3. Luckner, Martin. 2013. *Secondary Metabolism in Microorganisms, Plants and Animal 3rd Ed.* Springer.

86. SEMINAR (PROPOSAL)

Course Code: PNT491

Credits: 2

Learning Goals imposed in this course:

1. Use Biologycal concepts and theories in his/her research topics.
2. Write a research plan

Course Description /Syllabus:

Develop a thesis research proposal based on the proposal writing guidelines that will be used as a thesis under guiandce of 2 supervising lecturers. Furthermore, the thesis proposal is seminars. The thesis proposal seminar is tested by 3 Lecture examiners including the supervisor.

Lecturers: Prof. Dr. Sri Puji Astuti W., M.Si.

References:

All scientific journals, textbooks according to the theme of the thesis research proposal.

87. COMMUNITY SERVICE PROGRAM (MBKM with non-Higher Education Institutes)

Course Code: KKN401

Credits: 3

Learning Goals imposed in this course:

Students are able to build togetherness as Unair students at the end of their studies before obtaining a bachelor's degree by implementing joint learning programs in the community and with the community and helping the government in community empowerment and solving various complex problems appropriately.

Course Description /Syllabus:

KKN pre-deployment briefing; Preparation of field activities carried out before students are deployed to the location; Departure of students to KKN locations; Preparation of activity plans based on agreed KKN themes and tailored to community needs; Realization of KKN programs; Assessment of student activity achievements.

Lecturers: KKN-BBM Universitas Airlangga Management Team

References:

KKN Guidebook, Universitas Airlangga, Surabaya.

88. MBKM with Partner Universities/Non-Higher Educatiotion Institutes

Course Code: BIU401 (Teaching Technology, 4 credits), BIU402 (Independent Study, 4 credits), BIU403 (Current Knowledge of Biology, 4

Credits: 7

Learning Goals imposed in this course:

Students gain experience in MBKM at partner universities (3 credits) or non-PT institutions (4 credits)

Course Description /Syllabus:

There are 4 activities to choose from, namely taking courses at partner HEIs and internship experiences in educational units, independent studies or current knowledge of Biology.

Lecturers: MBKM Team

References:

89. ANIMAL REPRODUCTION

Course Code: BIR302

Credits: 2

Learning Goals imposed in this course:

Able to analyze, convince, and show the structure (histology and anatomy) and physiology of the reproductive system of vertebrate animals correctly (C4, A3, P3).

Course Description /Syllabus:

In this course students learn about: Definition and Insights of Animal Reproduction Research; Reproductive Embryology & Sex Differentiation (Early Gonad Development, Factors Affecting It, Sex Chromosomes, Heterosex); Hormonal System Regulation (Gonadotropins) (HPG Axis, Gnrh, FSH, LH, Steroid Feedback, GnRH and GtH Signaling, Cell Signaling); Reproductive Organs (Female, Male) & Semen (Structure and Functionology, Semen); Gametogenesis (Spermatogenesis & Oogenesis) (Germinal Stem Cells (Spermatogonial & Oogonial), Differentiating Cells (Spermatogonia & Oogonia), Undifferentiated Spermatogonia, Progenitors, Regeneration); Physiology of Gonadal Hormones in Females (Functional Hypothalamic Amenorrhea, Hypogonadotropic Hypogonadism, Polycystic Ovary Syndrome (PCOS), Primary Ovarian Insufficiency (POI), Circadian, Estrogen, Progesterone, Signal Transduction, Steroid Hormones); Folliculogenesis, Ovulation, and Reproductive Cycle (Ovary, Estradiol, Progesterone, Sexual Maturation, Primate and Non Primate Puberty (Menstrual & Estrous Cycle), Menopause); Fertilization and Early Embryo Development (Fertility, Preimplantation, Implantation, Blastocyst, Decidualization); Hormonal Mechanisms in Pregnancy, Birth Process, Mamae Gland Development and Lactation; Artificial insemination techniques (Spermatozoa and Oocyte Collection, In Vitro Fertilization (IVF), In Vitro Maturation (IVM), Xenografting); Presentation Task →International Journal Review.

Lecturers: Prof. Dr. Alfiah Hayati, Dr. Listijani Suhargo, M.Si.

References:

1. Hayati A., 2011, *Spermatologi*, Airlangga Press, Surabaya.
2. Müller, Werner, Hassel, Monika, Grealy, and Maura, 2015, *Development and Reproduction in Humans and Animal Model Species*, Springer Verlag BerlinHeidelberg.
3. Molnar C. and J. Gair. 2013. *Concepts of Biology*, First Canadian edition, Pressbook, *open textbook*http://open.bccampus.ca.
4. Hafez ESE. and B. Hafez, 2013, *Reproduction in Farm Animals*, 7th Edition, John Wiley & Sons, Inc.
5. Cole KS., 2010, Reproduction and sexuality in marine fishes. First edition. University of CaliforniaPress.
6. Carrell DT., CM. Peterson, 2010. *Reproductive Endocrinology and Infertility*, Springer, New York.

90. ANIMAL CELL CULTURE

Course Code: BIZ401

Credits: 2

Learning Goals imposed in this course:

Students are able to compare, convince, and show the principles, work methods, maintenance of animal cell and tissue culture, application tests and research journals related to animal cell and tissue culture correctly. (C5 – A3 – P3)

Course Description /Syllabus:

In this course students learn about: The definition and types of animal cell and tissue culture, classification, sources and applications; equipment and laboratory management of animal cell and tissue culture; preparation of cell culture media, growth and maintenance of cell and tissue cultures, cell storage; various tests related to animal cell and tissue culture; discussion of relevant journals on animal cell and tissue culture.

Lecturers: Sugiharto, S.Si., M.Si. Members: Prof. Sri Puji Astuti W.,M.Si.

References:

1. ATCC (American Type Culture Collection*), Animal Cell Culture Basics: Tips and technique for continous cell lines*, USA
2. Gibco Invitrogen, *Handbook: Cell Culture Basics*, USA
3. Sugiharto, Ummi Zubaidah, Dwi Winarni and Y.S.W Manuhara, 2023. Gynura procumbens Methanolic Extracts Suppresses Proliferation of Hepatocellular Carcinoma: In Vitro Assay. AIP Conference Proceedings 2554, 090007 (2023); https://doi.org/10.1063/5.0104809
4. Sugiharto, Arbakariya Ariff, Syahida Ahmad, and Muhajir Hamid, 2015. Properties of Kojic Acid and Curcumin: Assay on Cell B16-F1, AIP (American Institute of Physics) Conference Proceedings 1718, 060006 (2016); https://doi.org/10.1063/1.4943328
5. Sugiharto, Arbakariya Ariff, Syahida Ahmad, and Muhajir Hamid, 2013. Properties of Curcumin: Assay of Tyrosinase Activities, Proceeding 4th International Conference and Workshop on Basic and Applied Sciences and 11th Regional Annual Fundamental Science Symposium (ICOWOBAS – RAFSS 2013), lbnu Sina Institute for Fundamental Science Studies, Universiti Teknologi Malaysia, Johor Bahru – Malaysia, p.80
6. Sugiharto, Arbakariya Ariff, Syahida Ahmad, dan Muhajir Hamid, 2012. Efektivitas Kurkumin Sebagai Antioksidan Dan Inhibitor Melanin Pada Kultur Sel B16-F1, Berkala Penelitian Hayati 17: 173–176

91. TERATOLOGY

Course Code: BIU302

Credits: 2

Learning Goals imposed in this course:

Students are able to conclude the occurrence of fetal defects caused by teratogens correctly.

Course Description /Syllabus:

Explain the definition of teratology, the incidence of fetal defects and how they are determined. Describe the timing of organogenesis, Demonstrate the administration of teratogen materials, demonstrate how to determine and explain the mechanism of fetal defects, abnormalities of the brain region, spinal cord and head, abnormalities of the body region and body members, abnormalities of the cardiovascular system, abnormalities of the urogenital system, and abnormalities of the digestive system. Create a schematic diagram of the working concept of teratogen testing. Demonstrate teratology experiments. At the end of the lecture, teratology research journals will be discussed.

Lecturers: Prof. Dr. Win Darmanto, M.Si.

References:

1. Kalter, H. 2012. *Issues and Reviews in Teratology*.Springer
2. Sadler, T.W. 2018. *Langman's Medical Embriology 14th Ed*.LWW
3. Marshall. A.M. 2015. *Vertebrate Embryology: a Text-Book for Student and Practitioners.* Palala Press
4. Schoenwolf, G. C. 2008. *Laboratory Studies of Vertebrate and Invertebrate Embryos*. 8th. Prentice Hall Inc.USA.

92. ANIMAL TISSUE ADAPTATIONS

Course Code: BIZ210

Credits: 2

Learning Goals imposed in this course:

Able to explain, analyze, convince, and demonstrate (C4, A3, P3) the principles of the mechanism of various types of animal tissue adaptation in response to changes in the internal and external environment correctly.

Course Description /Syllabus:

In this course students learn about: Homeostasis; cell, tissues and environmental adaptations; General structure of animal tissues, Cell reactions to stimuli, Various adaptations to environmental stress (hyperfunction, hypofunction, metaplasia); Inflammation and tissue repair; Neoplasias; International journal review assignments.

Lecturers: Dr. Dwi Winarni, M.Si.

References:

1. Kumar, V., R. Cotran, and T. Robbins 2013. *Robbins Basic Pathology*. 9th edition. Saunders Company.
2. Mescher, Anthony L. 2014. *Junqueira's Basic Histology*. 13th Edition. The McGraw-Hill Companies.
3. T. Scratcherd. 2010. Intisari FisiologiKedokteran. Editor Dr. Lyndon Saputra. Binarupa Aksara Publisher (bahasa Indonesia).

93. ENVIRONMENTAL MANAGEMENT

Course Code: LKB606

Credits: 2

Learning Goals imposed in this course:

After attending this course students will be able to:

1. Identify, examine and analyze key issues facing people involved in environmental management activities;
2. Identify and understand environmental ethics;
3. Understand environmental laws in Indonesia;
4. Explain and analyze the concept of sustainable development;
5. Know and understand the meaning, process and benefits of preparing AMDAL documents (KA-ANDAL, ANDAL, RKL and RPL) and Environmental Audits;
6. Understand environmental audits, clean production, ecolabels, ISO, in environmental pollution control;
7. Explain the impact of human activities in global climate change and how to manage the environment;
8. Use academic literature collected, in dealing with disasters;
9. Demonstrate knowledge advances and ability to analyze environmental management issues and communicate scientific information to target audiences.

Course Description /Syllabus:

Scope of study of environmental management and its role in human life. Theories and concepts of environmental management, theories of environmental ethics, concepts of sustainable development and resource use. Environmental Impact Assessment (AMDAL), RKL/RPL, Environmental Audit, Ecolabeling, ISO, Pollution Control, Impact of human activities on global climate change. Natural Disaster Management.

Lecturers: Prof. Dr. Sucipto Hariyanto, DEA

References:

1. Soemarwotto, Otto. 2003, Analisis Mengenai Dampak Lingkungan. UGM Press, Yogyakarta.
2. Raharjo, Mursid. Memahami AMDAL, 2014. Graha Ilmu, Yogyakarta.
3. Suratmo, Gunawan F. 2007. Analisis Mengenai Dampak Lingkungan. Gadjah Mada University Press, Yogyakarta.
4. Haryono, Waty S. 2011, Hukum Lingkungan. Universitas Islam Jakarta, Jakarta.
5. McKinney, M.L., Schoch, R.M. 2017. Environmental Science: System and Solutions. Jones & Bartlett Learning; 6th edition.

94. SPERMATOPHYTA REPRODUCTION

Course Code: BIE230

Credits: 2

Learning Goals imposed in this course:

Students are able to explain the mechanism of seed plants reproduction, explain the factors that affect seed plant reproduction, and correctly analyze problems related to seed plant reproduction.

Course Description /Syllabus:

Apex and lateral meristems. Flower formation (reproductive organs) of seed plants. Sexual reproduction (plant life cycle, alternation of offspring, macro/microsporogenesis and gametogenesis, pollination and fertilization, embryogenesis and germination). Vegetative regeneration and apomixis. Genetic factors, light, hormones, cell communication in reproduction.

Lecturers: Prof. H. Hery Purnobasuki, M.Si., Ph.D.

References:

1. Mauseth, J.D. 2019. *Botany: An Introduction to Plant Biology.* Jones & Bartlett Learning; 7thedition
2. Bewley, J.D. 2012. *Seeds: Physiology of Devalopment, Germination and Dormancy 3rd Ed.* Springer
3. Baskin, C.C., Baskin, J.M. *Seeds: Ecology, Biogeography, and Evolution of Dormancy and Germination*. Academic Press; 2nd edition.

95. SPERMATOPHYTA REPRODUCTION (PRACTICUM)

Course Code: BIE231

Credits: 1

Learning Goals imposed in this course:

Students are able to explain the mechanism of reproduction in seed plants, explain the factors that affect seed plant reproduction, and analyze problems related to seed plant reproduction correctly.

Course Description /Syllabus:

Sexual reproductive organs of Angiosperms. Angiospermae seed structure. Measurement of seed content. Asexual reproduction of Angisopermae by stem cuttings, leaf cuttings, grafting. Use of desiccant on seed storability. Use of different types of media in seed germination. Red brick test on some seeds. Breaking the dormancy period of Angiospermae seeds.

Lecturers: Prof. H. Hery Purnobasuki, M.Si., Ph.D., Prof. Dr. Edy Setiti W.U., MS.

References:

1. Mauseth, J.D. 2019. *Botany: An Introduction to Plant Biology.* Jones & Bartlett Learning; 7thedition
2. Bewley, J.D. 2012. *Seeds: Physiology of Devalopment, Germination and Dormancy 3rd Ed.* Springer
3. Baskin, C.C., Baskin, J.M. *Seeds: Ecology, Biogeography, and Evolution of Dormancy and Germination*. Academic Press; 2nd edition
4. Sutopo, L. 1985. *Teknologi Benih I*. Penerbit CV. Rajawali Jakarta.

96. ENVIRONMENTAL MICROBIOLOGY

Course Code: BIM303

Credits: 2

Learning Goals imposed in this course:

Able to describe the diversity and role of microbes in the environment (C6)

Course Description /Syllabus:

Diversity of microbial ecosystems, interactions of microorganisms and the environment, soil microbes, plant microbes, water and sediment microbes, air microbes, marine microbes, microbes in extreme environments, pathogenic microbes, pollutant microbes, disease vectors,

Lecturers: Prof. Dr. Ni'matuzahroh, Drs. Agus Supriyanto, M. Kes.

References:

1. Garrett, S.D. 2013. Soil Fungi and Soil Fertility. Pergamon; 2nd edition
2. Bertrand, J.C., Caumette, P. 2016. Environmental Microbiology, Fundamentals and Applications: Microbial Ecology. Springer
3. Kirchman, D.L. 2018. Processes in Microbial Ecology. Oxford University Press; 2nd edition
4. Pepper, I. L., Gerba, C.P. 2014. Environmental Microbiology. Academic Press; 3rd edition

97. ORCHIDOLOGY

Course Code: BIB103

Credits: 2

Learning Goals imposed in this course:

Able to explain the scope and development of orchids, morphology and classification, orchid utilization and ethnobotany, orchid phytochemistry, orchid physiology, mycorrhiza, orchid embryology, pollination, reproduction, ecology, in vivo cultivation, in vitro cultivation, orchid entrepreneurship correctly 80% based on the literature used, able to follow the development of orchid cultivation and related technologies in accorandce with current technological developments.

Course Description /Syllabus:

Introduction: (scope and development of orchids), morphology and classification, orchid utilization and ethnobotany, orchid phytochemistry, orchid physiology, mycorrhiza, orchid embryology, pollination, reproduction, ecology, in vivo cultivation, in vitro cultivation, orchid entrepreneurship.

Lecturers: Prof. Dr. Edy Setiti Wida Utami, MS.

References:

1. Arditti, J., 2007. Fundamental of Orchid Biology. John Willey and Son. Inc. New York.
2. Maarten, M.W.C., Christenhusz, J, M. 2017. *The Book of Orchids: A Life Size Guide to Six Hundred Species from Around the World.* University of ChicagoPress
3. Yam, T.W., Arditti, J. 2017. Micropropagation of Orchids, John Willey and Son. Inc., New York.

98. TROPICAL PLANT BIOTECHNOLOGY

Course Code: BIB401

Credits: 2

Learning Goals imposed in this course:

1. Students are able to understand and explain the physiological regulation and adaptation in tropical plant species
2. Students are able to understand and explain genetic and genomic regulation in tropical plant species
3. Students are able to understand and explain various biotechnological approach that can be applied to improve the quality and productivity of tropical plant species.
4. Student are able to design basic and applied research related to economically important tropical plant species,

Course Description /Syllabus:

Introduction to tropical plant biology and biodiversity; plant morpho-physiological adaptation to tropical ecosystem; response and adaptation to biotic stresses in tropical plant; response and adaptation to abiotic stresses in tropical plant; domestication, breeding and cultivation of tropical plant species; tissue culture and clonal propagation in tropical plant species, genetic engineering technology; genomic engineering technology, epigenetic regulation and engineering in plant, short-read and long read sequencing technology; genome engineering in of tropical crops; genome engineering in tropical tress; biosafety and regulation of GMOs, application of biotechnology for plant conservation.

Lecturers: Anjar Tri Wibowo, S.Si., M.Sc., Ph.D.

References:

1. N. Stewart Jr, Plant biotechnology and genetics: principles, techniques, and applications (2016).
2. A. Altman, P. M. Hasegawa, *Plant Biotechnology and Agriculture: Prospects for the 21st Century* (Academic Press, 2012).
3. P. de T. Alvim, T. T. Kozlowski, *Ecophysiology of Tropical Crops* (Elsevier, 2013).
4. S. C. Bhatla, M. A. Lal, *Plant Physiology, Development and Metabolism* (Springer, 2018).

99. UNDERGRADUATE THESIS

Course Code: PNT499

Credits: 6

Learning Goals imposed in this course:

1. Demonstrate discipline and confidence in work
2. Work independently as well as in a team

Course Description /Syllabus:

Undergraduate thesis writing guidelines, thesis writing techniques, formulating problems, reviewing literature, determining research design, objectives and benefits of research, determining the place and time of research, research materials and tools, collecting experimental or survey data, analyzing data, interpreting data and synthesizing it compared to previous research, making conclusions, making conclusions and suggestions. Communicate research results in written and oral form

Lecturers: All lecture

References:

All references used according to the thesis research theme.

METODE PENILAIAN DAN KRITERIA KELULUSAN

METODE PENILAIAN

Penilaian mata kuliah dilakukan berdasarkan Penilaian Acuan Patokan (PAP), sebagai berikut:

NILAI HURUF	NILAI MUTU	NILAI ANGKA
A	4	86 - 100
AB	3,5	78 - <86
B	3	70 - <78
BC	2,5	62 - <70
C	2	54 - <62
D	1	40 - <54
E	0	< 40

KRITERIA KELULUSAN

1. Telah menempuh ≥ 144 sks (sesuai bidang minat) dan sudah lulus seluruh mata kuliah yang diwajibkan.
2. IPK ≥ 2.00.
3. Tidak ada nilai E
4. Maksimal nilai D sebanyak 20%
5. Mempunyai nilai ELPT (English Language Proficiency Test) ≥ 450 yang dilaksanakan oleh Pusat Bahasa Universitas Airlangga (SK Rektor Unair No. 40 Tahun 2015).
6. Telah menyelesaikan tugas akhir/skripsi.

PREDIKAT KELULUSAN DENGAN PUJIAN (*CUMLAUDE*)

1. Masa studi maksimal 8 (delapan) semester
2. IPK antara 3,51 - 4,00
3. Nilai ujian skripsi A

CATATAN:

Hal-hal yang tidak tercantum dalam pedoman ini, mengacu pada Pedoman Pendidikan Fakultas Sains dan Teknologi dan Pedoman Pendidikan Universitas Airlangga.