UNS
UNIVERSITAS
SEBELAS MARET

MODULE HANDBOOK

BIOLOGY 2022

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MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043112010	Academic Session/Semester	1
Course name:	Indonesian Language	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course equips students with knowledge on applying the Indonesian language in proper and correct grammar. Students can demonstrate oral (formally and informally) and written communication skills (popular and scientific writings). Students demonstrate fluency in formal/standard words and use them on informal, formal, and scientific occasions.
References	1. Akhadiah, Sabarti, Maedar G. Arsjad, Sakura H. Ridwan. 1994. Pembinaan Kemampuan Menulis Bahasa Indonesia. Jakarta: Erlangga. 2. Arifin, E. Zaenal dan S. Amran Tasai.1989. Cermat Berbahasa Indonesia untuk Perguruan Tinggi. Jakarta: PT Mediatama Sarana Perkasa. 3. Darmadi, Kaswan. 1996. Meningkatkan Kemampuan Menulis: Panduan untuk Mahasiswa dan Calon Mahasiswa. Yogyakarta: Andi. 4. Depdikbud. 1991. Surat-menyurat dalam Bahasa Indonesia, seri penyuluhan 2. Jakarta: Pusat Pembinaan dan Pengembangan Bahasa. 5. Buku Pedoman Pembuatan Skripsi di masing-masing Fakultas 6. Hanafiah, A. Hadi. 1981. Anda Ingin Jadi Pengarang? Surabaya: Usaha Nasional. 7. Keraf, Gorys. 1980. Komposisi: Sebuah Pengantar Kemahiran Bahasa. Ende-Flores: Nusa Indah. 8. Moeliono, Anton M (penyunting penyelia). 1988. Tata Bahasa Baku Bahasa Indonesia. Jakarta: PT Balai Pustaka. 9. Tim Pengembang Pedoman Bahasa Indonesia. 2016. Pedoman Umum Ejaan Bahasa Indonesia yang Disempurnakan. JakartaL Badan Pengembangan dan Pembinaan Bahasa 10. Panitia Pengembang Bahasa Indonesia. 2008.Pedoman Umum Pembentukan Istilah. Jakarta: Pusat Bahasa 11. Razak, Abdul. 1990. Kalimat Efektif, Struktur, Gaya, dan Variasi. Jakarta: PT Gramedia. 12. Suryawinata, Zuchrudin dan Imam Suyitno. 1991. Bahasa Indonesia untuk Ilmu Pengetahuan & Teknologi. Malang: YA3. 13. Widyamartaya, A. 1990. Seni Menuangkan Gagasan. Yogyakarta: Kanisius. 14. Depdikbud. 1991. Surat-menyurat dalam Bahasa Indonesia, seri penyuluhan 2. Jakarta: Pusat Pembinaan dan Pengembangan Bahasa
Course Lecturer	Dr. Miftah Nugroho, M.Hum

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate effective communication in either Indonesian or English language	PLO 7	C2- Communicate	Study case/Cooperative learning	16	Discussion and Paper (60%)
2	Demonstrate fluency of information technology	PLO 9	C3- Apply	Study case/Cooperative learning	5.3	Discussion and Paper (20%)

3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO 9	C3-Apply	Study case/Copperative learning	5.3	Discussion and Paper (20%)

Prepared by:	Certified by head department:
Name: Dr. Miftah Nugroho, M.Hum. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142001	Academic Session/Semester	1
Course name:	English Language	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course equips students with basic English knowledge and skills on academic communication or courses in universities with a post-method approach (e.g., Audio-lingual, communicative language teaching, suggestopedia, task-based language instruction, natural approach, and other proper methods). After learning the underlying philosophy, students will learn English skills as developed from selected texts and genres, i.e., description, report, recount, procedure, explanation, exposition, and discussion. Students will mostly do exercises to show their understanding of studied language elements and concepts. The course will be executed in a workshop form – lecturer delivers brief key concepts and relevant examples, and students follow up with exercises
References	Journals downloaded from Science Direct
Course Lecturer	Lecturers from UNS Language Center

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate professional attitude	PLO5	C5-Demonstrate	Study case/Cooperative learning	16	Exam (60%)
2	Demonstrate effective communication in either Indonesian or English language	PLO7	C2-Communicate	Study case/Cooperative learning	5.3	Exam (20%)
3	Demonstrate fluency of information technology	PLO9	C3-Apply	Study case/Cooperative learning	5.3	Exam (20%)

Prepared by:	**Certified by head department:**
Name: Lecturers from UNS Language Center May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142009	Academic Session/Semester	1
Course name:	Biodiversity	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.66 ECTS)		

Course Synopsis	Biodiversity is a course focused on studying the definition and measurement techniques of biodiversity, different biodiversity levels (i.e., genetic, species, community, ecosystem), the relation between biotic and abiotic in the ecosystem, threats on biodiversity, biodiversity management, and conservation biology. Students obtain experiences in studying different levels of biodiversity, measuring biodiversity, and managing it. Students can demonstrate an understanding of the diversity of organisms and solve its problems. Students demonstrate the ability to disseminate and present scientific results.
References	1. Krishnamurthy KV. 2004. An Advanced Textbook on Biodiversity-Priciples and Practice.Oxford and IBH Publishing. 2. Groombridge B (eds). 1992. Global Biodiversity: Status of the Earth's Living Resources. Chapman and Hall Publisher. London.
Course Lecturer	Prof. Dr. Sugiyarto, M.Si. Ari Pitoyo, S.Si., M.Sc. Prof. Drs. Sutarno, M.Sc.Ph.D. Dr. Edwi Mahajoeno, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Study case/Cooperative learning	8	Writing Test (30%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Study case/Cooperative learning	5.3	Presentation (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Arrange	Study case/Cooperative learning	8	Writing Test (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO7	C2-Communicate	Study case/Cooperative learning	5.3	Paper (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Prof. Dr. Sugiyarto, M.Si Ari Pitoyo, S.Si., M.Sc. Prof. Drs. Sutarno, M.Sc., Ph.D. Dr. Edwi Mahajoeno, M.Si, May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142006	Academic Session/Semester	1
Course name:	General Biology	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	3/3.99		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	3	40h	40h	40h
	Total	3	120h (3.99 ECTS)		

Course Synopsis	General Biology studies the definition of biology and its relation with other sciences, scientific methods in biology, cell as building blocks of life, animal and plant cell structures, chemical substances of the cell, cell metabolism, diversity of organisms, basic classification of organisms, animal and plant systems, reproduction (i.e., mitosis, meiosis, amitosis), animal and plant reproduction, Mendel's genetics, ecosystem, inter and intra-species interactions, and evolution.
References	1. Biology of Microorganism (series). Madigan, M. T et al 2. Purwoko, T. 2007. Fisiologi Mikroba. Bumi Aksara. Jakarta. 3. Meunier-Goddik L., Hansen, A.S., Josephsen, J., Nip, W.K., Stanfield, P.S. & & Toldra, F.(eds), 2004, Handbook ofFood and Beverage Fermentaion Technology, Marcel Dekker Inc New York4 E-book mikrobiologi at http://www.bact.wisc.edu/microtextbook.themicrobialworld/
Course Lecturer	Prof. Drs. Suranto, M.Sc, Ph.D. Dr. Edwi Mahajoeno, M.Si. Dr. Tetri Widiyani, M.Si. Ari Pitoyo, S.Si., M.Sc. Hasbiyan Rosyadi S.Si. M.Si. Tanjung Ardo, S.Si. M.Sc.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehensive	Study case/Cooperative learning	14	Writing Test (35%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehensive	Study case/Cooperative learning	10	Writing Test (25%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C2-Comprehensive	Study case/Cooperative learning	16	Writing Test and Paper (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Prof. Drs. Suranto, M.Sc, Ph.D. Dr. Edwi Mahajoeno, M.Si. Dr. Tetri Widiyani, M.Si. Ari Pitoyo, S.Si., M.Sc. Hasbiyan Rosyadi S.Si. M.Si. Tanjung Ardo, S.Si. M.Sc. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043141007	Academic Session/Semester	1
Course name:	General Biology Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	The practicum focuses on studying basic biological principles. Laboratory instruments are introduced to be used in biological studies, e.g., cell structure, organism, organ system, diffusion, osmosis, plasmolysis, photosynthesis, respiration, transportation on animal and plant, growth, and development, hereditary in the organism, biodiversity, biotic and abiotic environment, and community.
References	1. Campbell N.A, et al.1999. Biology, concept & connections. Canada: Cummings Publishing Company, Inc. 2. Campbell, etal. 2003, Biologi, edisi kelima, Jakarta : Erlangga 3. Tim Biologi Umum Prodi Biologi. 2020. Petunjuk Praktikum Biologi Umum. Surakarta : Program Studi Biologi FMIPA UNS
Course Lecturer	Dr. Tetri Widiyani, M.Si. Tanjung Ardo, S,Si., M.Sc.
Topics	1. Introduction to Cell Structure and Organisms 2. Transport in Plants and animals 3. Growth and Development 4. Hereditary Traits in Organisms 5. Diversity of Living Things (Monera, Protista, Fungi, Plantae, Animalia) 6. Fundamentals of community studies 7. Introduction to laboratory equipment 8. Diffusion, Osmosis, Plasmolysis 9. Photosynthesis 10. Respiration 11. Introduction to the Abiotic Environment 12. Introduction to the Biotic Environment

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Experiment, Observation, and Report	4	Pretest (10%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C4-Analyze	Experiment, Observation, and Report	16	Report, Final Exam (40%)

3	Demonstrate a professional attitute	PLO5	C3-Demonstrate	Experiment, Observation, and Report	10	Assessing activity (25%)
4	Demonstrate teamwork skills	PLO8	C3-Demonstrate	Experiment, Observation, and Report	10	Assessing activity (25%)

Prepared by:	**Certified by head department:**
Name: Dr. Tetri Widiyani, M.Si. Tanjung Ardo, S.Si., M.Sc. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142003	Academic Session/Semester	1
Course name:	Basic Physics	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course is a part of basic course series to remind students, and synchronize theoretical understanding, of basic sciences, i.e., physics. Studied subjects cover physical quantities, dimension, unit conversion, vector analysis to solve a problem in physics, one-dimensional motion, two-dimensional motion, circular motion, bullet motion in mathematical equation and graphs, Newton's law of force and its application, working concepts, kinetic energy, potential energy, mechanical energy and power, fluids, principles of thermodynamics law, electrical field, electrical potential, electrical current and resistance, magnetic field, electromagnetic wave, optics.
References	1. Fisika Dasar 1, Mikrajuddin Abdullah, 2016, ITB, Bandung 2. Fisika, jilid 1 , Giancoli, D.C., 2001 Erlangga, Jakarta 3. Fisika Untuk Sains dan Teknik , Jilid 1 , Tipler, 1998, Erlangga Jakarta. 4. Fisika, jilid 2 , Giancoli, D.C., 2001 Erlangga, Jakarta 5. Fisika Untuk Sains dan Teknik , Jilid 2 , Tipler, 1998, Erlangga Jakarta
Course Lecturer	Lecturer Team of Physics Study Program FMIPA UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C3-Comprehend	Collaborative learning	8	Written exam (30%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Discussion and making paper	10.6	Paper (40%)
3	Demonstrate a logical and systematic problem-solving abiity	PLO6	C3-Apply	Collaborative learning	8	Written exam (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Lecturer Team of Physics Study Program FMIPA UNS May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142008	Academic Session/Semester	1
Course name:	Environmental Science	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course aims to help students in gaining a better understanding of environmental science (ES), ecology as the basis of environmental science, environment, status, and role of the human in the environment, identifying population strategy, environmental education, differentiate the characteristics of environmental education programs, defining the environmental development strategy, re-writing problems of ES.
References	1. Wiryono.2013.Pengantar Ilmu Lingkungan . Bengkulu : Pertelon Media, 2. Miller, Jr. G. T., 1982. Living in The Environment. Wadsworth Publishing Company. California. 3. Azrul Anwar, 1979, Pengantar Ilmu Lingkungan, Jakarta: Penerbit Mutiara. 4. Allaby, M. 1996. Basic of Enviromental Science, 1st Published by Routhledge London 5. Miller G.Yr. 2000,1998, Living in the Environment Principles, California: Wadsworth publishing Company. 6. Otto Soemarwoto,1991, Indonesia dalam Kancah Issue Lingkungan Global, Jakarta:Gramedia. 7. Soeriaatmadja,1991, Ilmu Lingkungan, Bandung: ITB 8. Jatna Supriatna, 2008, Melestarikan alam Indonesia, Jakarta : Yayasan Obor Indonesia
Course Lecturer	Prof. Dr. Okid Parama Astirin, M.Si. Prof. Dr. Sugiyarto, M.Si. Dr. Edwi Mahajoeno, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C3-Comprehend	Discussion and Lecture	8	Written test (30%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C3-Apply	Discussion, make a paper, and presentation	18.6	Written test (30%), Presentation (20%), Paper (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Prof. Dr. Okid Parama Astirin, M.Si. Prof. Dr. Sugiyarto, M.Si. Dr. Edwi Mahajoeno, M.Si. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142004	Academic Session/Semester	1
Course name:	Basic Chemistry	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	After learning Basic Chemistry, students demonstrate a comprehensive understanding of basic concepts on chemical events in nature, atomic theory, electron configuration, molecule structure/form, qualitative and quantitative relation in the chemical reaction, equilibrium concept, acid-base equilibrium in solution, solution chemistry, electrochemistry, pH concept, acid-base and redox reaction, organic chemistry, and simple chemical separation.
References	1. Brady JE dan JR Holum , Fundamental of Chemistry, Jhon Wiley and Sons, Inc 2. Petrucci RH, Harwood WS,1993, General Chemistry Principles and Modern Application, Sixth edition, Mac Millan Publishing Company, New York and Maxwell Macmillan Canada, Toronto 3. Brady JE dan JR Holum, 1993, Chemistry The Study of Matter and its Changes, Jhon Wiley and Sons, Inc.New York.
Course Lecturer	Lecturer Team of Chemistry Study Program FMIPA UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehensive	Collaborative learning	6.7	Exam (25%)
2	Produce scientific article or innovative products based on research	PLO3	C3-Apply	Discussion, making paper, and presentation	13.4	Paper (50%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Evaluate	Collaborative learning	6.7	Exam (25%)

Prepared by:	**Certified by head department:**
Name: Lecturer Team of Chemistry Study Program FMIPA UNS May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142005	Academic Session/Semester	1
Course name:	Basic Chemistry Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	This course contains basic application techniques in Basic Chemistry experiments, including separation techniques (filtration, decantation and recrystallization, simple distillation), acid-base reaction, isolation of Trimistrin from nutmeg, carbon compound, determination of Magnesium Hydroxide and Aluminium Hydroxide in ulcer medicine, chemical equilibrium, colloid system.
References	1. Buku Petunjuk Praktikum Kimia Dasar 2. Brady JE dan JR Holum , Fundamental of Chemistry, Jhon Wiley and Sons, Inc 3. Petrucci RH, Harwood WS,1993General Chemistry Principles and Modern Application, Sixth edition, Mac Millan Publishing Company, New York and Maxwell Macmillan Canada, Toronto 4. Brady JE dan JR Holum, 1993, Chemistry The Study of Matter and its Changes, Jhon Wiley and Sons, Inc.New York
Course Lecturer	Lecturer Team of Chemistry Study Program FMIPA UNS
Topics	1. Filtering, Decantation and Recrystallization 2. Simple Distillation 3. Extraction : Separation of Benzoic Acid and Naphthalene Compounds 4. Acid – Base Reaction 5. Isolation of Trimyristin from Nutmeg Seeds 6. Carbon Compounds 7. Determination of the Composition of Magnesium Hydroxide and Aluminum Hydroxide in Ulcer Medicine 8. Solubility product (Ksp) $Ca(OH)_2$

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	P3-Precise	Practical work/simulation	8	Activity (20%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	P3-Precise	Practical work/simulation	12	Exam (30%)
3	Demonstrate professional attitude	PLO5	C3-Apply	Practical work/simulation	8	Activity (20%)

4	Demonstrate teamwork skills	PLO8	C3-Apply	Practical work/simulation	8	Activity (20%)

Prepared by:	**Certified by head department:**
Name: Lecturer Team of Chemistry Study Program FMIPA UNS May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142002	Academic Session/Semester	1
Course name:	Basic Mathematics	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course is a part of essential course series in the Bachelor Program in Biology in the first semester with two credit points. This course comprises the concept of real numbers, inequality, absolute value, square and square-root, Cartesian coordinate, straight line, equation graphs, function and graphs, functional operation, function types, introduction and theorem of limit, continuity of a function, derivative rules, chain rules, high derivative, maximum and minimum, monotonicity and concavity, indefinite integral, definite integral, the introduction of linear equation, matrix, determinant, and inverse.
References	1. Stewart, J,Calculus : Concept and Context. Fourth Edition,Brooks/Cole Cengange Learning, USA,2010 2. Purcell, E.J, dkk,Kalkulus Edisi kedelapan Jilid 1,,2003 3. Purcell E.J Varberg,D,Kalkulus dan Geometri Analitis. Edisi kelima Jilid 1.,,1992 4. Anton H., Rorres C,Elementary Linear Algebra Applications Version, Seventh Edition,John Wiley and Sons,USA.,2005
Course Lecturer	Lecturer Team of Mathematic Study Program FMIPA UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehensive	Collaborative learning	6.7	Exam (25%)
2	Produce scientific article or innovative products based on research	PLO3	C3-Apply	Discussion, making paper, and presentation	13.4	Paper (50%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Evaluate	Collaborative learning	6.7	Exam (25%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Lecturer Team of Mathematic Study Program FMIPA UNS May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043112008	Academic Session/Semester	1
Course name:	Civics Education	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Civic Education is a course on character building. Students gain knowledge on ideology, humanity, law, and state administration through the course that can be applied in their social life. Students discuss current phenomena occurring in society.
References	1. Asir, A. Agama Dan Fungsinya Dalam Kehidupan Umat Manusia. Al-Ulum Jurnal Pemikiran Dan Penelitian Ke Islaman, 1(1), 50-58 2. Fauzi, I. & Srikantono. 2013. Pendidikan Kewarganegaraan (Civil Education). Penerbit Superior Jember 3. Gusmansyah, W. 2019. Bahan Ajar Matakuliah Pendidikan Kewarganegaraan. Penerbit IAIN Bengkulu 4. Ismail & S. Hartati. 2020. Pendidikan Kewarganegaraan Konsep Dasar Kehidupan Berbangsa dan Bernegara di Indonesia. Penerbit Qiara Media Pasuruan 5. Mahdayeni, M.R. Alhaddad & A.S. Saleh. 2019. Manusia Dan Kebudayaan (Manusia Dan Sejarah Kebudayaan, Manusia Dalam Keanekaragaman Budaya Dan Peradaban, Manusia Dan Sumber Penghidupan). Tadbir Jurnal Manajemen Pendidikan Islam 7(2): 154-165 6. Marzali, A. 2016. Agama dan Kebudayaan. Umbara Indonesian Journal of Anthropology. 1(1): 57-75 7. Ritaudin, M.S. 2015. Mengenal Filsafat dan Karakteristiknya. Kalam Jurnal Studi Agama dan Pemikiran Islam. 9(1): 127-144
Course Lecturer	Lecturer team of MKU UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate professional attitude	PLO5	C3-Application	Study case	13.4	Written test (50%)
2	Demonstrate well-mannered work ethics	PLO5	C3-Application	Study case	13.4	Review Assignment (50%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Lecturer team of MKU UNS May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242022	Academic Session/Semester	2
Course name:	Biochemistry	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biochemistry is a compulsory course in Bachelor Program in Biology. Students learn basic concepts on the structure and function of biomolecules, the relation between structure and function, and biomolecules metabolism (i.e., carbohydrates, proteins, and lipids). Students can demonstrate how living things function on the primary level. This course serves as the basis of several compulsory and elective courses, as well as final project research. This course comprises direct teaching and discussion. Independent tasks will be given to enhance understanding of how biochemistry concepts apply to daily problems.
References	1. Berg, J.M., Tymoczko, J.L., dan Stryer, L. , Biochemistry. 8th ed., W.H. Freeman and Company. 2015 2. David L Nelson & Michael M Cox. , Lehninger Principles of biochemistry 5th ed., W.H. Freeman and Company.,2017 3. Cuiping Pang, Xinxin Yin, Guoqiang Zhang, Song Liu, Jingwen Zhou, Jianghua Li, Guocheng Du, Current progress and prospects of enzyme technologies in future foods, Systems Microbiology and Biomanufacturing , 1:24–32, 1,2021, Springer 4. Tyler M.M.Stack, John A.Gerlt, Discovery of novel pathways for carbohydrate metabolism, Current Opinion in Chemical Biology Volume 61, April 2021, Pages 63-70, 61, 1, 2021, elsevier
Course Lecturer	Dr. Artini Pangastuti, S.Si., M.Si Siti Lusi Arum Sari, S.Si., M.Biotech

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C3-Apply	Case-based method	10.7	Written test (40%)
2	Mastering the knowledge and technology related to biology	PLO1	C3-Apply	Project-based method	10.7	Paper, presentation (40%)
3	Demonstrate a logical and systematic problem-solving ability	PLO9	C3-Apply	Case-based method	5.4	Participation, Peer assessment (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Artini Pangastuti, S.Si., M.Si Siti Lusi Arum Sari, S.Si., M.Biotech May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242023	Academic Session/Semester	2
Course name:	Biochemistry Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Biochemistry Practicum is a compulsory course in conjunction with Biochemistry course in the Bachelor Program in Biology. Students learn basic skills on identifying and quantifying biomolecules and demonstrate the capability to apply them in biology-related research and their final project. This course comprises practical classes with different sessions, i.e., basic theory, practical, report making, and evaluation.
References	1. Bintang M.,Biokimia: Teknik Penelitian,Erlangga,2010 2. Mahin Basha.,Analytical Techniques in Biochemistry. , Humana Press,2020
Course Lecturer	Dr. Artini Pangastuti, S.Si., M.Si Siti Lusi Arum Sari, S.Si., M.Biotech
Topics	1. SOP introduction of materials and tools 2. Intake of materials and preparation of solutions 3. Detection and identification of carbohydrate, protein, lipid compounds 4. Identification of biomolecules in materials 5. Titration and spectrophotometry: Protein, Vitamin C, enzyme activity 6. Separation of plant pigments by paper chromatography

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C3-Apply	Case-based method	20	Written test (50%)
2	Mastering the application of instruments in the field of bology	PLO2	P4-Articulate	Case-based method	20	Worksheet (50%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, S.Si., M.Si Siti Lusi Arum Sari, S.Si., M.Biotech May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	0904324024	Academic Session/Semester	2
Course name:	Cell Biology	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course emphasizes the structure and function of eukaryotic cells. It covers subjects, i.e., cell membrane structure and function, structure, and function of organelles inside the cells, protein synthesis inside the nucleus, cytoskeleton and cell movement, cell connections, and communication between cells.
References	1. Albert, B. , Molecular Biology of The Cell, Garland Science. New York, 2014 2. Albert, B. , Essential Cell Biology. , Garland Science. New York., 2013 3. Cooper, G. M., The Cell: A Molecular Approach. , Sinauer Asscociates. Oxford., 2015
Course Lecturer	Prof. Okid Parama Astirin, M.Si. Dr. Nita Etikawati, M.Si. Ari Pitoyo, M.Sc. Elisa Herawati, M.Eng., Ph.D

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Understand	Lecture and discussion collaborative learning	5.3	Quiz (20%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Lecture and discussion collaborative learning	10.7	Midterm and Final Exam (40%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Evaluate	Discussion and presentation	10.7	Presentation (40%)

Prepared by:	**Certified by head department:**
Name: Prof. Okid Parama Astirin, M.Si. Dr. Nita Etikawati, M.Si. Ari Pitoyo, M.Sc. Elisa Herawati, M.Eng., Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242025	Academic Session/Semester	2
Course name:	Biostatistic	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course emphasizes data analysis, i.e., numerical data (parametric) and rank data (non-parametric). Students demonstrate understanding on descriptive and inference data analysis. Students describe sampled data in mean, frequency, quartile, median, and modus. Students demonstrate analysis of sampled data in one-way ANOVA, two-way ANOVA, non-parametric analysis, regression, and correlation.
References	1. Rosmer, B. , Fundamentals of biostatistics. 8th ed. , Cengage Learning. Singapore., 2016 2. S okal, R.R. & F.J. Rohlf. , Introduction to biostatistics. 2nd ed. , Dover Publications Inc. New York, 1987 3. SPSS Inc, SPSS User's guide (minimum version 8.0), SPSS Inc, 1984 4. SPSS Inc, SPSS Application guide (minimum version 8.0), SPSS Inc, 1984
Course Lecturer	Tjahjadi Purwoko, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C2-Understand	Lecture and discussion	5.3	Written test (20%)
2	Mastering the application of instruments in the field of biology	PLO2	C2-Understand	Lecture and discussion	5.3	Written test (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Evaluate	Presentation and Discussion	8	Paper task (30%)
4	Demonstrate fluency of information technology	PLO9	P4-Articulate	Presentation and discussion	8	Paper task (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Tjahjadi Purwoko, M.Si. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242026	Academic Session/Semester	2
Course name:	Microbiology	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Microbiology is a course on the structure and physiology of single-cell organisms (i.e., bacteria) and simple multi-cell organisms (i.e., fungi). Students demonstrate an understanding of the basic concept of microbe's structure and function. Students exhibit fluency in disseminating written papers explaining microbe-related problems, alternative solutions, and the application of microbiology in daily life.
References	1. Purwoko, T. , Fisiologi Mikroba. , Bumi Aksara. Jakarta., 2007 2. Michael T. Madigan, John Martinko, Thomas Brock, Paul Dunlap, David P. Clark, Brock Biology of Microorganisms,Pearson/Benjamin Cummings, 2009 3. Kenneth Todar, Todar's Online Textbook of Bacteriology, University of Wisconsin Department of Bacteriology,2022, http://textbookofbacteriology.net/index.html
Course Lecturer	Dr. Ari Susilowati, M.Si Dr. Ratna Setyaningsih, M.Si Tjahjadi Purwoko, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Understand	Lecture and discussion	8	Written test 1 (30%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Evaluate	Lecture and discussion	5.3	Written test 2 (20%)
3	Demonstrate effective communication in either Indonesian or English language	PLO7	C2-Understand	Presentation and discussion	8	Paper task (30%)
4	Demonstrate fluency of information technology	PLO9	P4-Articulate	Presentation and paper	5.3	Paper task (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Ari Susilowati, M.Si Dr. Ratna Setyaningsih, M.Si Tjahjadi Purwoko, M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

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<tr><td>Course code:</td><td colspan="2">09043241027</td><td>Academic Session/Semester</td><td>2</td></tr>
<tr><td>Course name:</td><td colspan="2">Microbiology Practicum</td><td rowspan="2">Pre/co requisite Course name and code if applicable</td><td rowspan="2">-</td></tr>
<tr><td>Credit/ECTS:</td><td colspan="2">1/1.33</td></tr>
<tr><td>Language</td><td colspan="2">Indonesia</td><td>Relation to Curriculum</td><td>Compulsory</td></tr>
<tr><td>Workload</td><td colspan="3"><table><tr><td>Type</td><td>CSU</td><td>Face to Face</td></tr><tr><td>P</td><td>1</td><td>40 h</td></tr><tr><td>Total</td><td>1</td><td>40h (1.33 ECTS)</td></tr></table></td></tr>
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Course Synopsis	Microbiology Practicum is a course on learning instruments used in microbiology research, introduction to different microorganisms and how to observe them, microbial medium preparation, material and instrument sterilization, bacterial isolation, bacterial staining, microorganisms counting, the environmental influence on bacterial growth, air-borne and water-borne microorganisms, and fermentation.
References	1. Cappuccino, JG and Sherman N, Microbiology A Laboratory Manual, Praeson, 2014 2. Chavalit Vidthayanon, Henrik Larsen and Nguyen Van Duyen, Robyn Taylor and Robert Brown (Editors),Identification handbook of freshwater zooplankton of the Mekong River and its tributaries., MRC Technical Paper, -, 45, 2015, Mekong River Commision 3. Setyaningsih, R. , Petunjuk Praktikum Mikrobiologi., Program Studi S1 Biologi Fakultas Matematika dan IlmuPengetahuan Alam. Universitas Sebelas Maret, 2020 4. Watanabe, T. , Pictorial Atlas of Soil dan Seed Fungi, Morphologies of Cultured Fungi and Key to Species., CRCPress, 2002
Course Lecturer	Dr. Ari Susilowati, M.Si Dr. Ratna Setyaningsih, M.Si
Topics	1. Introduction to laboratory equipment 2. Microorganism introduction 3. Medium setup 4. Sterilization of materials and equipment 5. Staining Technique : gram staining 6. Practice using various equipment, make preparations, do gram staining, isolate bacteria and fungi, count the number of bacteria and fungi 7. Project: isolation and characterization of microorganisms 8. Preparation of reports and presentation of project results

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C3-Implement	Simulation	8	Written test (30%)
2	Mastering the knowledge and technology related to biology	PLO1	P3-Practice	Simulation	5.3	Practical exam (20%)

3	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	P5-Organize	Team based project	6.7	Work report (25%)
4	Demonstrate teamwork skills	PLO8	P5-Organize	Team based project	6.7	Peformance assessment (25%)

Prepared by:	**Certified by head department:**
Name: Dr. Ari Susilowati, M.Si Dr. Ratna Setyaningsih, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043212001	Academic Session/Semester	2
Course name:	Religion: Buddhism	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course comprises primary Buddhism teaching sourced from the Tripitaka. This course aims to encourage students to show noble personality according to dharma as the base of thinking, talking, and behaving, especially on developing their knowledge and profession
References	1. Jayasilo Lilik S. (2016). Membangun Pribadi yang Bersih. Surakarta: LPPMP UNS 2. Mettadewi W. (1987). Bhavana (Pengembangan Batin). Jakarta: Akademi Buddhis Nalanda. 3. Mulyadi Wahono. (2002). Pokok-pokok Dasar Agama Buddha. Jakarta: Dirjen Bimas Buddha 4. Nyanana Polika Thera. (2002). Petikan Angutara Nikaya. Klaten: Wisma Sambodhi 5. U Jotalankara. (2004). Ajaran-Ajaran Dasar Buddhisme. Nyanmar: PMTY Publishing
Course Lecturer	Lecturer Team of MKU UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Lecture and discussion	8	Written test/performance assessment (30%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Evaluate	Lecture and discussion	10.7	Written test/performance assessment (40%)
3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C3-Apply	Presentation and paper	8	Paper (30%)

Prepared by:	**Certified by head department:**
Name: Lecturer Team of MKU UNS May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043212002	Academic Session/Semester	2
Course name:	Religion: Hinduism	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course comprises basic Hinduism teachings sourced from the sacred texts of Vedas. This course aims to encourage students to show noble personality according to dharma as the base of thinking, talking, and behaving, especially on developing their knowledge and profession.
References	1. I Gusti Made Ngurah, Drs, dkk, 2012, Pendidikan Agama Hindu Untuk Perguruan Tinggi, Surabaya, Paramitha. 2. Gelgel Prof. DR. I Putu,, M.Hum, Suma I Made, SH, M.Pd, Surapati Nengah Drs, SH, MH, dkk, 2009, Hukum Hindu, Jakarta, Direktorat Jendral Bimbingan 3. Masyarakat Hindu Departemen Agama RI. 3. Pudja G, SH, MA, 2012, Bhagavad Gita, Surabaya, Pararnita. 4. Pudja G, MA, Sudharta Tjokorda Rai, MA, 2012, Manawa Dharma Sastra (Manu Dharmacastra) atau Manu Smrti Compedium Hukum Hindu, Surabaya, Paramita. 5. Titib, DR. I Made, 2010, Teologi dan Simbul-simbul Dalam Agama Hindu, Surabaya, Paramita. 6. Tititb I Made, DR, 2011, Weda Sabda Suci Pedoman Praktis Kehidupan, Paramita, Surabaya.
Course Lecturer	Lecturer Team of MKU UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Lecture and discussion	8	Written test/performance assessment (30%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Evaluate	Lecture and discussion	10.7	Written test/performance assessment (40%)
3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C3-Apply	Presentation and paper	8	Paper (30%)

Prepared by:	**Certified by head department:**
Name: Lecturer Team of MKU UNS May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043212003	Academic Session/Semester	2
Course name:	Religion: Islam	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Students show a balance of religious and social ethics. Students demonstrate a whole personality (kaffah) and use Islam as their base of thinking and behaving in their knowledge and professional development. A full personality can be realized by implementing faith and piety to Allah SWT. Building the conscience that faith and piety need to be supported by the development of its elements, i.e., Islamic knowledge, religious dispositions, Islamic skills, Islamic commitment, moslem confidence, and Islamic competence.
References	1. Syahidin, dkk. , Pendidikan Agama Islam Untuk Perguruan Tinggi, Direktorat Pembelajaran dan Kemahasiswaan. Dirjen Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, 2014 2. Adian Husaini, 10 Kuliah Agama Islam: Panduan menjadi Cendekiawan Mulia dan Bahagia, Pro-U Media.Yogyakarta, 2015 3. Ahmad Taufiq, dkk, Pendidikan Agama Islam: Pendidikan Karakter Berbasis Agama Islam, LPPMP UNS.Surakarta, 2016 4. Endang Saifuddin Anshari, Kuliah al-Islam, Rajawali. Jakarta., 1992 5. Jamal Syarif Iberani, Mengenal Islam, el-Kahfi. Jakarta, 2003 6. M. Quraish Shihab, Wawasan Al-Quran, Mizan. Bandung, 1996
Course Lecturer	Lecturer Team of MKU UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Lecture and discussion	8	Written test/performance assessment (30%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Evaluate	Lecture and discussion	10.7	Written test/performance assessment (40%)
3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C3-Apply	Presentation and paper	8	Paper (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Lecturer Team of MKU UNS May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043212004	Academic Session/Semester	2
Course name:	Religion: Catholicism	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course comprises basics on the Catholic faith and Catholic students' mission. Sources in this course include Holy Bible, Church teachings, and Catholic traditions. This course aims to shape Biology graduates with faith in Allah with Jesus Christ personality and responsible with their faith in society. In other words, 100% Catholic and 100% Indonesian.
References	1. Alkitab Dueterokanonika, LAI 1976, cetakan ke -5 thn 2002 2. Nurwardani, P., Saksama, H.Y., Habeahan, S., Kotan, D., Sinaga, A., Mulyono, E., Prawatyani, S.J., Anwar, A.A., Evawany.,Priyautama, F., Festanto, A. 2016. Pendidikan Agama Katolik untuk Perguruan Tinggi Cetakan I. Jakarta. Direktorat Jenderal Pembelajaran dan Kemahasiswaan.
Course Lecturer	Lecturer Team from MKU UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Lecture and discussion	8	Written test/performance assessment (30%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Evaluate	Lecture and discussion	10.7	Written test/performance assessment (40%)
3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C3-Apply	Presentation and paper	8	Paper (30%)

Prepared by:	**Certified by head department:**
Name: Lecturer Team of MKU UNS May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043212006	Academic Session/Semester	2
Course name:	Religion: Christianity	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Christian students nowadays are faced with positive and negative life values. Therefore, they need Christianity values as a basis for thinking, behaving, and acting. As a part of a big nation, Indonesians have faced a multidimensional crisis. This prolonged crisis can frustrate the people, causing further conflicts and violence throughout the country. Christian students are peace messengers wherever they live. This course equips Christian students in their self-finding and character building as Christian intellectuals that can actualize the Christianity values and faith in all aspects of life.
References	1. Alkitab 2. Haryono, T, dkk, Pendidikan Agama Kristen Pada Perguruan Tinggi Umum, Surakarta: UNSPress. 3. _____, Teguh Dalam Kristus (Seri KTBK), Surakarta: PMKS-STTG 4. _____, Bertumbuh Ke Arah Dalam Kristus (Seri KTBK), Surakarta: PMKS-STTG 5. _____, Saved By Faith. Surakarta: Yayasan Gamaliel 6. Anderson N T, Siapakah Anda Sesungguhnya. Bandung: LLB. 7. Boland BJ dan Niftrik, Dogmatika Masa Kini. Jakarta: BPK GM 8. Brownlee, M, Pengambilan Keputusan Etis. Jakarta: BPK Gunung Mulia 9. Heath WS, Sains, Iman dan Teknologi. Yogyakarta: PN Andi. 10. _____, Bertindak Tepat di Saat yang Tepat. Yogyakarta: PN Andi, 2004. 11. _____, Tak Mengambang Tak Meleset. Yogyakarta: Andi Ofset 12. Jongenel JAB, Hukum Kemerdekaan. Jakarta: BPK Gunung Mulia 13. Morris H, Biblical Basis for Modern Science. Michigan: BBH
Course Lecturer	Lecturer Team from MKU UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Lecture and discussion	8	Written test/performance assessment (30%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Evaluate	Lecture and discussion	10.7	Written test/performance assessment (40%)
3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C3-Apply	Presentation and paper	8	Paper (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Lecturer Team of MKU UNS May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043212009	Academic Session/Semester	2
Course name:	Pancasila	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Pancasila as the national principle, national ideology, philosophy, ethics, and basic development of knowledge. This course covers direct teaching, source study, discussion, presentation, and tasks.
References	1. Adian Huzaini, Pancasila bukan untuk Menindas Hak Konstitusional Umat Islam, Jakarta: Gema Insani Press,2009 2. Yudi Latif, Negara Paripurna: Historiositas, Rasionalitas, Aktualitas Pancasila, Jakarta : Gramedia Pustaka Utama.,2011 3. Hassan Suryono,, Pancasila berbasis Riset Tinjauan aspek historis, yuridis dan filosofis,, LPPMP UNS, 2016 4. Winarno, Paradigma Baru Pendidikan Pancasila, Jakarta : Bumi Aksara, 2017 5. Pemerintah RI, Desain Induk Pengembangan Karakter Bangsa 2010-2025., Jakarta : Pemerintah Republik Indonesia., 2010 6. LPPK, Pedoman Umum Implementasi Pancasila dalam kehidupan Bernegara, Jakarta: Cipta Prima Budaya, 2005
Course Lecturer	Dian Esti Pratiwi S.H.,M.H.,M.Kn

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate a professional attitude	PLO5	C3-Apply	Lecture and discussion	8	Written test/performance assessment (30%)
2	Demonstrate well-mannered work ethics	PLO5	C4-Evaluate	Lecture and discussion	10.7	Written test/performance assessment (40%)
3	Demonstrate a logical and systematic problem-solving ability	PLO9	C3-Apply	Presentation and paper	8	Written test/performance assessment (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dian Esti Pratiwi S.H.,M.H.,M.Kn May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243028	Academic Session/Semester	2
Course name:	Animal Structure and Development	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	3/3.99		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	3	40h	40h	40h
Total	3	120h (3.99 ECTS)		

Course Synopsis	Animal Structure and Development covers study on animal tissue, organ, and organ system. This course studies the histological structure of 4 primary tissues (i.e., epithelial, connective, muscle, and nerve), the anatomical structure of the muscle system, the anatomical structure of the skeletal system, the anatomical structure of the nervous system, anatomical and histological structure of the lymphatic system, anatomical and histological structure of the endocrine system, anatomical and histological structure of the digestive system, anatomical and histological structure of respiration system, anatomical and histological structure of the integumentary system, anatomical and histological structure of genitalia system, anatomical and histological structure of uropoetica system, gametogenesis, fertilization, embryogenesis (zygote division, differentiation of 3 main embryonic layers, and organogenesis).
References	1. Bevelander G and Ranalay J.A, Essentials of Histology, Mosby Co., England , 1979 2. Hammersen F & Sobotta M. , Histology Color Atlas of Microscopic Anatomy, Urban & Scharzenberg.In c.USA ,1985 3. Mescher, AL. , Histologi Dasar Juncquiera, Penerbit Buku Kedokteran EGC, 2016 4. Rohen JW. & E.L. Drecoll, Embriologi fungsional, Penerbit Buku Kedokteran EGC, 2008
Course Lecturer	Prof. Dr. Okid Parama Astirin, M.S. Dr. Tetri Widiyani, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture, question and answer, and discussion	16	Assesment, Quiz, Midterm and Final Exam (40%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Case-based method	24	Journal reviews and presentation (60%)

Prepared by:	**Certified by head department:**
Name: Prof. Dr. Okid Parama Astirin, M.S. Dr. Tetri Widiyani, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243029	Academic Session/Semester	2
Course name:	Animal Structure and Development Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face
	P	1	40 h
	Total	1	40h (1.33 ECTS)

Course Synopsis	This course is a practical class where students can learn about the anatomical and histological structure of vertebrates based on the living and preserved samples, macroscopically and microscopically. This course studies the histological structure of 4 main tissue (i.e., epithelial, connective, muscle, and nerve), anatomical structure of muscle system, the anatomical structure of skeletal system, anatomical structure of nervous system, anatomical and histological structure of lymphatic system, anatomical and histological structure of the endocrine system, anatomical and histological structure of digestive system, anatomical and histological structure of respiration system, anatomical and histological structure of integumentary system, anatomical and histological structure of genitalia system, anatomical and histological structure of uropoetica system, gametogenesis, fertilization, embryogenesis (zygote division, differentiation of 3 main embryonic layers, and organogenesis).
References	1. Widiyani T, Handajani NS, Harini M. , Petunjuk Praktikum Struktur dan Perkembangan Hewan, Surakarta : Program Studi Biologi FMIPA UNS, 2017 2. Burkitt HG, Young B, Heath JW. , Buku Ajar dan Atlas Wheater Histologi Fungsional. , Penerbit Buku Kedokteran EGC., 1995
Course Lecturer	Dr. Tetri Widiyani, M.Si. Elisa Herawati, M.Eng., Ph.D
Topics	1. Epithelial, connective, integumentary, muscle, bone and cartilage tissue, nerves, blood, cardiovascular, lymphatic, digestive, respiratory, endocrine, uropoetic, feminine/masculine genitalia. 2. Anatomy of *Rana sp* and *Cavia cobaya*, and the process of embryogenesis

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture, question and answer, and discussion	8	Mid-term exam (20%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C4-Analyze	Lecture, question and answer, and discussion	12	Final term exam (30%)
3	Demonstrate teamwork skills	PLO8	A4-Organize	Lecture, question and answer, and discussion	20	Participation, observation, work report (50%)

MODULE HANDBOOK

Prepared by:	**Certified by head department:**
Name: Dr. Tetri Widiyani, M.Si. Elisa Herawati, M.Eng., Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243029	Academic Session/Semester	2
Course name:	Plant Structure and Development	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	3/3.99		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	3	40h	40h	40h
Total	3	120h (3.99 ECTS)		

Course Synopsis	This course comprises an in-depth discussion on plants from their structure and development. The structure is defined as the plant's physical form and organizational hierarchy starting from the cell, tissue, organ, and individual (histology, anatomy, and morphology). Development is defined as the study of the structure form on each hierarchy successively. The learning method in this course covers classroom tutorials and online through interactive presentations, two-way discussions, and assignments.
References	1. Beck, C.B., , An Introduction of Plant Structure and Development, Cambridge Univ. Press, 2010, 2. Cuttler, D.F. T Botha, and D.W. Stevenson. , Plant Anatomy: An Applied Approach, Blackwell Pub. Ltd., 2007 3. Evert, R.F, Esau Plant Anatomy 3ed. , John Wiley and Son. New Jersey, 2006 4. Bell A.D.,, Plant form: An illustrated guide to flowering plant morphology. , Oxford University Press, 1991
Course Lecturer	Dr. Nita Etikawati Ari Pitoyo, M. Sc Tanjung Ardo, M. Sc

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C3-Comprehend	Lecture, Discussion, Question and Answer, and Quiz	12	Written exam (30%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Lecture, Discussion, Question and Answer, and Quiz	16	Written exam (40%)
3	Analyzing the potential for further utilization of biological resource	PLO4	C4-Analyze	Lecture, Discussion, Question and Answer, and Quiz	12	Written exam (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Nita Etikawati Ari Pitoyo, M. Sc Tanjung Ardo, M. Sc May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243031	Academic Session/Semester	2
Course name:	Plant Structure and Development Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	This course aims to equip students with skills, i.e., observation, identification, description, and comparison of plant objects. Students actively participate in preparing and observing plant objects, with or without optical instruments. The microscope is the main instrument used to observe the plant cell and tissue with micro-size. This course is a compulsory course alongside the Plant Structure and Development course.
References	1. Beck, C.B., An Introduction of Plant Structure and Development, Cambridge Univ. Press, 2010 2. Cuttler, D.F. T Botha, and D.W. Stevenson, Plant Anatomy: An Applied Approach, Blackwell Pub. Ltd., 2007 3. Evert, R.F, Esau Plant Anatomy 3ed, John Wiley and Son, 2006 4. Bell A.D., Plant form: An illustrated guide to flowering plant morphology, Oxford University Press. 1991.
Course Lecturer	Ari Pitoyo, S.Si., M.Sc. Dr. Nita Etikawati, S.Si., M.Si Tanjung Ardo, S.Si., M.Sc.
Topics	1. Cell wall, protoplasm, and ergastic bodies 2. Mersitem 3. Network system 4. Epidermal 5. Basic network system 6. Transport file system 7. Anatomy of stems, leaves and roots 8. Morphology of stems, roots and their modifications 9. Single leaf morphology 10. Compound leaf morphology 11. Single and compound flower morphology 12. Floral diagrams and floral formulas 13. Fruit and seed morphology

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analytical skills for instruments in the field of biology and its application	PLO2	C4-Analyze	Lecture, Discussion, Question and Answer	20	Mid-term exam (50%)
2	Demonstrate the application of instruments in the field of biology	PLO5	C3-Demonstrate	Lecture, Discussion, Question and Answer	20	Final exam (50%)

MODULE HANDBOOK

Prepared by:	**Certified by head department:**
Name: Ari Pitoyo, S.Si., M.Sc. Dr. Nita Etikawati, S.Si., M.Si Tanjung Ardo, S.Si., M.Sc. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142010	Academic Session/Semester	3
Course name:	Molecular Biology	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course studies the base of biological activity at the molecular level through the biomolecular study of DNA, RNA, and protein involved in storing the genetic information and cell functioning. This course covers a study on genetic engineering and molecular analysis techniques
References	1. Molecular biology of the cell / Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter ; with problems by John Wilson, Tim Hunt. -- Sixth edition. 2. Molecular genetics of bacteria 3rd edituon. 2007.Wendy Champness, Larry Snyder 3. David P. Clark, Nanette J. Pazdernik and Michelle R. McGehee. 2019. Molecular Biology, Third Edition. Academic Press.
Course Lecturer	Dr Artini Pangastuti Prof. Drs. Sutarno, M.Sc.Ph.D

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C4-Analyze	Lecture and Discussion	5.3	Written exam (20%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Study case and discussion	10.7	Paper (40%)
3	Demonstrate teamwork skills	PLO8	A4-Organize	Study case and discussion	10.7	Partecipation, observation, peer assessment (40%)

Prepared by:	**Certified by head department:**
Name: Dr Artini Pangastuti Prof. Drs. Sutarno, M.Sc.Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142011	Academic Session/Semester	3
Course name:	Molecular Biology Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	This course equips students with the skills to conduct molecular biology research. This course covers practical techniques, i.e., DNA extraction, PCR, electrophoresis, DNA cutting with the restriction enzyme, DNA purification from gel, and cloning.
References	1. E. F. Fritsch, Joseph Sambrook, and Tom Maniatis. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press
Course Lecturer	Dr. Artini Pangastuti, S.Si., M.Si Hasbiyan Rosyadi, S.Si., M.Si Tanjung Ardo, S.Si., M.Sc.
Topics	1. Introduction to basic and advanced equipment and its safety, DNA extraction 2. Measurement of the quality and quantity of DNA 3. Electrophoresis 4. PCR 5. Purification of DNA fragments from Gel electrophoresis 6. Cutting DNA with restriction enzymes 7. sequencing 8. Cloning

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C4-Analyze	Case-based method	20	Written test (50%)
2	Mastering the application of instruments in the field of biology	PLO2	P4-Mechanism	Case-based method	20	Worksheet (50%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, S.Si., M.Si Hasbiyan Rosyadi, S.Si., M.Si Tanjung Ardo, S.Si., M.Sc. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243012	Academic Session/Semester	3
Course name:	Animal Physiology	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	3/3.99		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	3	40h	40h	40h
Total	3	120h (3.99 ECTS)		

Course Synopsis	Animal Physiology covers the working mechanism of all animal systems, i.e., nervous, endocrine, muscle and movement, circulation, respiration, digestion, excretion, reproduction, thermoregulation, and osmoregulation, especially the body's homeostatic function in facing the changes of internal and external factors. Students demonstrate skills to apply animal and human physiology concepts to plan, analyze, and evaluate physiological phenomena to solve problems using science and technology. This course demands the active role of students, especially in observing physiological problems and using information technology to search data, process, analyze, and write the observation results. The results will be presented and discussed in the class.
References	1. Moyes, C. D. and P. M. 2015. Schulte. Principles of Animal Physiology. 3rd edition. Pearson. Boston.,Principles of Animal Physiology,Pearson. Boston.,2015 2. Reddy, P.B., 2015. Text Book of Animal Physiology. IMRF Publication. India.,Text Book of Animal Physiology,IMRF Publication. India.,2015 3. Kay, I. 1998. Introduction to Animal Physiology. Bios Scientific Publisher. Manchester, UK. Introduction to Animal Physiology,Bios Scientific Publisher. Manchester, UK.,1998
Course Lecturer	Dr. Shanti Listyawati, M.Si. Elisa Herawati, M.Eng., Ph.D

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Study case and discussion	4	Quiz (10%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Study case and discussion	16	Written test (40%)
3	Demonstrate teamwork skills	PLO8	C3-Apply	Presentation study case and discussion	10	Participation, observation (25%)
4	Demonstrate effective communication in either Indonesian or English language	PLO10	C3-Apply	Presentation study case and discussion	10	Participation, observation (25%)

MODULE HANDBOOK

Prepared by:	**Certified by head department:**
Name: Dr. Shanti Listyawati, M.Si. Elisa Herawati, M.Eng., Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243013	Academic Session/Semester	3
Course name:	Animal Physiology Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	This course equips students with basic methods and instruments used in animal physiology, covering the nervous system, endocrine, nutrition and digestion, respiration and circulation, and reproduction. This course is compulsory and needs to be taken alongside the Animal Physiology class to comprehend the basic concepts and their applications fully.
References	1. Hau J. and GJ Hoosier, 2003. Handbook of Laboratory Animal Science, Vol.1. 2nd edition. CRC Press. London 2. Lawson. R. Anatomy and Physiology Animal. https://craftx.org/sites/all/themes/craft_blue/pdf/Anatomy_and_Physiology_of_Animals.pdf (PDF generated using the open source mwlib toolkit. See http://code.pediapress.com/ for more information. PDF generated at: Thu, 16 May 2013 19:02:32 UTC 3. Gladwell, V., Reed, K., and Sandercock, G. Physiology Experiments. https://wellcometrust.files.wordpress.com/2010/09/current-physiology-experiments.pdf
Course Lecturer	Dr. Shanti Listyawati, M.Si. Elisa Herawati, M.Eng., Ph.D
Topics	1. Nervous system 2. Endocrine system 3. Reproduction system 4. Respiration system 5. Digestion and nutrition system 6. Circulation system 7. Thermoregulation 8. Excretion

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C4-Analyze	Study case (measure, analyze)	24	Assesment, quiz and midterm exam (60%)
2	Demonstrate teamwork skills	PLO8	C3-Apply	Discussion and reporting	8	Activity (20%)

3	Demonstrate fluency of information technology	PLO9	C3-Apply	Simulation (measure and analyze)	8	Report (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Shanti Listyawati, M.Si. Elisa Herawati, M.Eng., Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

<table>
<tr><td>Department:</td><td colspan="3">Biology</td><td rowspan="2">Page</td><td rowspan="2">1 of 1</td></tr>
<tr><td>Faculty:</td><td colspan="3">Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret</td></tr>
<tr><td>Course code:</td><td colspan="3">09043142014</td><td>Academic Session/Semester</td><td>3</td></tr>
<tr><td>Course name:</td><td colspan="3">Plant Physiology</td><td rowspan="2">Pre/co requisite Course name and code if applicable</td><td rowspan="2">-</td></tr>
<tr><td>Credit/ECTS:</td><td colspan="3">3/3.99</td></tr>
<tr><td>Language</td><td colspan="3">Indonesia</td><td>Relation to Curriculum</td><td>Compulsory</td></tr>
<tr><td>Workload</td><td colspan="5"><table>
<tr><td>Type</td><td>CSU</td><td>Face to Face</td><td>Structured Activities</td><td>Self-study</td></tr>
<tr><td>T</td><td>3</td><td>40h</td><td>40h</td><td>40h</td></tr>
<tr><td>Total</td><td>3</td><td colspan="3">120h (3.99 ECTS)</td></tr>
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Course Synopsis	Plant Physiology covers the physiological process in plants, i.e., plant cell structure, role and function of organic molecules in plants, plant relation to water, soil and nutrition, enzyme, respiration, photosynthesis, nitrogen and sulfur assimilation, growth and development, hormones, and growth-regulating substances, growth, and reproduction on high plants, plant movement, photoperiodism and vernalization, dormancy and aging. Students demonstrate an understanding of basic plant cell biochemistry and physiology. Students are also fluent in explaining plant growth and development, as well as capable of solving related problems. Students demonstrate experience in writing reports and presenting them.
References	Avramova V, AbdElgawad H, Zhang Z, Fotschki B, Casadevall R, Vergauwen L, Knapen D, Taleisnik E, Guisez Y, Asard H, and Beemster GTS. ,Drought Induces Distinct Growth Response, Protection, and Recovery Mechanisms in the Maize Leaf Growth Zone ,Avramova V, AbdElgawad H, Zhang Z, Fotschki B, Casadevall R, Vergauwen L, Knapen D, Taleisnik E, Guisez Y, Asard H, and Beemster GTS. 2015. Drought Induces Distinct Growth Response, Protection, and Recovery Mechanisms in the Maize Leaf Growth Zone Plant Physiology, October, Vol. 169, pp. 1382–1396, www.plantphysiol.org 2015 American Society of Plant Biologists. ,169,01,2015,American Society of Plant Biologists.
Course Lecturer	Dr. Solichatun, S.Si.M.Si Dr. Widya Mudyantini, S.Si.M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning	12	Written test 1 (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning	12	Written test 2 (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Group discussion	16	Paper and presentation (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Solichatun, S.Si.M.Si Dr. Widya Mudyantini, S.Si.M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043141015	Academic Session/Semester	3
Course name:	Plant Physiology Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Plant Physiology Practicum is a practical class in the laboratory to study the sigmoidal curve of leaf growth, water potential in plant tissue, effects of stomatal conductance, growth inhibition in lateral buds and apical dominance, transpiration measurement using a weighing scale, seed dormancy, germination in the presence/absence of light, and photosynthetic pigments.
References	1. Solichatun dan Mudyaningsih W. 2019. Petunjuk Praktikum Fisiologi Tumbuhan. Laboratorium Biologi, Program Studi Biologi, FMIPA, UNS 2. Salisbury, F.B. dan Ross, C.W. 1995. Fisiologi Tumbuhan. Diterjemahkan Diah R. Lukman dan Sumaryoto. Jilid 1 . Penerbit ITB, Bandung. 3. Sasmitahardja, D. dan Siregar, A. 1996. Fisiologi Tumbuhan. Dirjen Dikti Depdikbud, Bandung. 4. Fosket, D.E. 1984. Plant Growth and Development. Academic Press, San Diego.
Course Lecturer	Dr. Solichatun, S.Si.M.Si Dr. Widya Mudyantini, S.Si.M.Si
Topics	1. Plant growth sigmoid curve; calculating the water potential of plant tissue, transpiration and the factors that influence it, the behavior of stomata. 2. The role of hormones in apical dominance, the role of light in germination, types of seed dormancy and methods of breaking it down, and measurement of chlorophyll and carotenoid levels in various plant species.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analysis of instrument results in the field of biology	PLO2	C2-Comprehend	Study case/cooperative learning/team-based project	12	Exam (30%)
2	Mastering the application of instruments in the field of biology	PLO2	C2-Comprehend	Study case/cooperative learning/team-based project	12	Exam (30%)
3	Demonstrate teamwork skills	PLO8	C3-Apply	Cooperative teamwork project	16	Project based report and presentation (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Solichatun, S.Si.M.Si Dr. Widya Mudyantini, S.Si.M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142016	Academic Session/Semester	3
Course name:	Genetics	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	3/3.99		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	3	40h	40h	40h
Total	3	120h (3.99 ECTS)		

Course Synopsis	This course studies gene, gene expressions, gene variations and hereditary in living things. The scope of study in this course covers the contribution of genetics in human life, genetic material, Mendelian genetic material, deviation of Mendel's law, linkage and crossing-over, sex determination, chromosome number and structure alteration, chromosome mapping, genetic variation, non-Mendelian genetics, gene expression, population genetics, and cancer genetics
References	1. Ahluwalia, K.B. 2009, Genetics. Second edition, New Age International Ltd Publishers, New Delhi, India 2. Klug, W.S., Cummings, M.R., Spencer, C.A. and Palladino, M.A. 2013. Essentials of Genetics, Eight edition. Pearson, Boston.. 3. Krebs, JE., Goldsteins, E.S., & Kilpatrick, S.T., 2018, Lewins Genes XII, Jones & Bartlett Learning
Course Lecturer	Prof. Drs. Sutarno, M.Sc. Ph.D Dr. Nita Etikawati, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning	20	Written test (50%)
2	Produce writings or innovative products based on research	PLO3	C5-Synthesize	Case based method	20	Individual paper (30%); Group assignment paper (20%)

Prepared by:	**Certified by head department:**
Name: Prof. Drs. Sutarno, M.Sc. Ph.D Dr. Nita Etikawati, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043141017	Academic Session/Semester	3
Course name:	Genetics Practicum	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Genetics Practicum equips students with principal of genetics and skills on genetic experiments, i.e., identification of characteristic variations in plants, animal, and human, monohybrid and dihybrid cross, chromosome observation in mitosis and meiosis, karyotyping, chromosome mapping, Drosophila handling and cross-breeding, isolation and observation of giant chromosome and simple DNA isolation
References	1. Blair, C., 2018.,Genetics laboratory Manual, City University of New York (CUNY) 2. Koesmadji, W. Resna S., Fransiska S., Riandi., Sri A.,Sariwulan.2000. Pedoman Praktikum Genetika. Laboratorium Genetika. Jurusan Pendidikan Biologi. FPMIPA Universitas Pendidikan Indonesia 3. Mhiret, W.N.,2020. Laboratory manual for principle genetics.Lambert Academic Publishing 4. Stanfield, W.D.1969. Theory and Problems of Genetics. Schaum's Outline Series..Mc Graw Hill Book Co. New York. 5. https://learn.genetics.utah.edu/content/labs/
Course Lecturer	Dr. Nita Etikawati, M.Si Elisa Herawati, M.Eng., Ph.D
Topics	1. Variations in Plants, Animals and Humans 2. Mendelian genetics 3. The physical basis of inheritance 4. Model organisms 5. Multiple allele karyotypes 6. Polygene Genes that are influenced by sex 7. Sex-restricted genes 8. Giant chromosomes 9. DNA 10. Electrophoresis 11. Flowcytometry 12. Gene expression

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the application of instruments in the field of biology	PLO2	C5-Synthesize	Cooperative learning	16	Exam: quiz (40%)

2	Demonstrate a professional attitude	PLO5	C6-Evalute	Cooperative learning	16	Work attitude (20%), preparation of practical reports (20%)
3	Demonstrate teamwork skills	PLO8	P1	Team-based learning	8	Team project (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Nita Etikawati, M.Si Elisa Herawati, M.Eng., Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142018	Academic Session/Semester	3
Course name:	Reseacrh Methodology	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Research Methodology is a course focused on studying basic principles of research methods and the presentation of a research plan. Students show the capability to compose a research plan and present it in class.
References	1. Hanafiah, K.A. Rancangan Percobaan : Teori dan Aplikasi. Jakarta : PT Raja Grafindo Perkasa 2. Robert, G.D. Steel dan James H. Torrie. 1980. Prinsip dan Prosedur Statistik. (Diterjemahkan oleh Bambang Sumantri). Jakarta : Penerbit Gramedia. 3. Schefler, W.C. 1999. Statistika untuk Biologi, Farmasi, Kedokteran dan Ilmu yang Bertautan. (Diterjemahkan oleh Suroso). Bandung : Penerbit ITB 4. Somantri, A. dan Muhidin, S.A. 2006. Aplikasi Statistika dalam Penelitian. Bandung : CV Pustaka Setia. 5. Suryabrata, S.1997.Metodologi Penelitian. Jakarta: Raja Grafindo.
Course Lecturer	Suratman, S.Si., M.Si. Ari Pitoyo, S.Si., M.Sc. Tanjung Ardo, S.Si., M.Sc. Prof. Dr. Sugiyarto, M. Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning	2.7	Exam; quiz (10%)
2	Produce writtings or innovative products based on research	PLO3	C5-Synthesize	Study case/cooperative learning/team based project	10.7	Interpret research data (40%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Cooperative learning	8	Examine problem solving logically and systematically (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Discussion/presentation	5.3	Individual paper (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:		**Name:**
Suratman, S.Si., M.Si. Tanjung Ardo, S.Si., M.Sc.	Ari Pitoyo, S.Si., M.Sc. Prof. Dr. Sugiyarto, M. Si. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043142019	Academic Session/Semester	3
Course name:	Industrial Microbiology	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Industrial Microbiology focuses on the study of industrial microbiology, bioprocessing concept, raw material and microorganism used in bioprocessing, strain development, growth kinetics and product development, basics of a bioreactor, upscaling, process control, downstream process (product harvesting and purification), examples of the industrial process utilizing microorganisms, alcoholic fermentation industry, the enzyme in industry, organic acid and amino acid industry, antibiotic industry, and fermented food industry.
References	1. Aehle, W. (Ed). 2007. Enzyme in Industry. Wiley-VCH Verlag GmbH & Co. KgaA.Weinheim Balat, M. , Balat, H. Oz, C. Progress in Bioethanol processing. 2008. Progress in energy and combustion science 34:551-573 2. Cheryan, M. 2009. Acetic Acid Production. In Applied Microbiology: Industry. Elsivier 3. Kauffman, G.B. 2004. The Monosodium glutamate story: the commercial production of MSG and ther amino acid. Jourrnal of chemical education 8(31): 347-355 4. Okafor, N. 2007. Modern Industrial Microbiology and Biotechnology.2007. Science Publishers. New Hampshire 5. Venkatesh, M. Bairavi, V.G., Sasikumar, K.C. 2011. Generic antibiotic industries: Challenges and implied strategies with regulatory perspectives. J Pharm Bioallied Sci. 3(1): 101–108
Course Lecturer	Dr. Ari Susilowati, M.Si. Dr. Ratna Setyaningsih, M.Si. Tjahjadi Purwoko, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Discussion	2.7	Exam: quiz (10%)
2	Produce writings or innovative products based on research	PLO3	C5-Synthesize	Study case	10.7	Paper (40%)
3	Analyzing the potential for further utilization of biological resources	PLO4	P2-Take initiative in	Team based project	5.3	Designing paper (20%)

4	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Group presentation	5.3	Group presentation (20%)

5	Demonstrate teamwork skills	PLO8	P1-Demonstrate	Group presentation	2.7	Organize the division of labor (10%)

Prepared by:	**Certified by head department:**
Name: Dr. Ari Susilowati, M.Si. Dr. Ratna Setyaningsih, M.Si. Tjahjadi Purwoko, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043141020	Academic Session/Semester	3
Course name:	Laboratory Techniques	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	1	13.3h	13.3h	13.3h
Total	1	40h (1.33 ECTS)		

Course Synopsis	This course focuses on tools and instruments in biomolecular analysis, safety and security in the laboratory, liquid handling, sterilization, secondary metabolite extraction, chromatography, spectrophotometry, centrifugation, DNA extraction method, PCR, sequencing, DNA electrophoresis, protein electrophoresis (SDS PAGE), immunochemistry techniques, and DNA polymorphism analysis.
References	1. David J Holme, Hazel Peck. 2010. Analytical Biochemistry. Pearson Education. 2. Mahin Basha. 2020. Analytical Techniques in Biochemistry. Humana Press 3. David P. Clark, Nanette J. Pazdernik and Michelle R. McGehee. 2019. Molecular Biology, Third Edition. Academic Press. 4. CDC. 2009. Biosafety in Microbiological and Biomedical Laboratories 5th edition.
Course Lecturer	Dr. Artini Pangastuti, S.Si., M.Si. Elisa Herawati, S.Si., Meng. PhD

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Case-based method	5.3	Exam (40%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C3-Apply	Case-based method	8	Individual paper (60%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, S.Si., M.Si. Elisa Herawati, S.Si., Meng. PhD May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043141021	Academic Session/Semester	3
Course name:	Laboratory Techniques Practicum	Pre/co requisite Course name and code if applicable	Biochemistry
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face
	P	1	40 h
	Total	1	40h (1.33 ECTS)

Course Synopsis	Practical of Laboratory Techniques equips students with explanations of tools and instruments in the laboratory, laboratory visit, biosafety cabinet, secondary metabolite extraction, chromatography, spectrophotometry, ELISA, protein electrophoresis, DNA electrophoresis, and centrifuge.
References	1. David J Holme, Hazel Peck. 2010. Analytical Biochemistry. Pearson Education. 2. Mahin Basha. 2020. Analytical Techniques in Biochemistry. Humana Press 3. Bintang M. 2010. Biokimia: Teknik Penelitian. Erlangga 4. CDC. 2009. Biosafety in Microbiological and Biomedical Laboratories 5th edition.
Course Lecturer	Dr. Artini Pangastuti, S.Si., M.Si. Tanjung Ardo, M.Sc
Topics	1. Introduction to biology lab and SOP 2. centrifugation 3. Protein analysis by spectrophotometry 4. preparation and extraction of secondary metabolites 5. chromatography 6. electrophoretic technique 7. ELISA 8. molecular technique: PCR

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Case-based method	24	Exam: quiz (40%) Peer assessment (20%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C4-Analyze	Case-based method	16	Individual paper (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, S.Si., M.Si. Tanjung Ardo, M.Sc May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043241032	Academic Session/Semester	4
Course name:	Bioethics	Pre/co requisite Course name and code if applicable	General biology
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	1	13.3h	13.3h	13.3h
Total	1	40h (1.33 ECTS)		

Course Synopsis	This course equips students with ethics as a knowledge and norms underlying the attitude and character of a biologist. The study covers the basics and development of bioethics, bioethics in research, biotechnology, preclinical, epidemiology, natural resources utilization, biodiversity, and environment. Students demonstrate the ability to review, criticize, and set attitudes towards bioethical issues developed in society (e.g., GMO/GMF, Biobank, in-vitro fertilization, artificial insemination, euthanasia, abortion, etc.).
References	1. David J Holme, Hazel Peck. 2010. Analytical Biochemistry. Pearson Education. 2. Mahin Basha. 2020. Analytical Techniques in Biochemistry. Humana Press 3. Bintang M. 2010. Biokimia: Teknik Penelitian. Erlangga 4. CDC. 2009. Biosafety in Microbiological and Biomedical Laboratories 5th edition
Course Lecturer	Dr. Shanti Listyawati, S.Si., M.Si Dr. Nita Etikawati, S. Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate professional attitude	PLO5	C2-Comprehend	Cooperative learning	2.6	Exam: quiz (20%)
2	Demonstrate well-mannered work ethics	PLO5	C2-Comprehend	Study case/team based project	2.6	Exam: quiz (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C3-Apply	Cooperative learning	4	Group paper (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Discussion/Presentation	4	Group presentation (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Shanti Listyawati, S.Si., M.Si Dr. Nita Etikawati, S. Si., M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242033	Academic Session/Semester	4
Course name:	Bioinformatics	Pre/co requisite Course name and code if applicable	Biochemistry, Molecular biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course equips students to understand biological systems using information technology. Subjects cover how to work with molecular data (DNA, RNA, and protein) and related issues, such as storing, organizing, searching, analysis, interpretation, prediction, and molecular data visualization.
References	1. Hochreiter, S. ,Bioinformatics I Sequence Analysis and Phylogenetics,Institute of Bioinformatics. Johannes Kepler University Linz Austria,2013 2. Xiong, J. ,Essentials Bioinformatics,Cambridge University Press, New York ,2006 3. Kumar S, Stecher G, and Tamura K. ,MEGA7: Molecular Evolutionary Genetics Analysis version 7.0. ,Molecular Biology and Evolution.,2015
Course Lecturer	Dr. Ari Susilowati, M.Si Dr. Artini Pangastuti, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning	13.3	Exam: quiz (50%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Team-based project	8	Paper (30%)
3	Demonstrate fluency of information technology	PLO9	C5-Synthesize	Team-based project	5.3	Group presentation (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Ari Susilowati, M.Si Dr. Artini Pangastuti, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043241034	Academic Session/Semester	4
Course name:	Bioinformatics Practicum	Pre/co requisite Course name and code if applicable	Biochemistry, Molecular Biology
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	This practicum demonstrates how to work with software for molecular data analysis and interpretation, biological databases, and in-silico analysis to answer biology-related problems.
References	1. David J Holme, Hazel Peck. 2010. Analytical Biochemistry. Pearson Education. 2. Mahin Basha. 2020. Analytical Techniques in Biochemistry. Humana Press 3. Bintang M. 2010. Biokimia: Teknik Penelitian. Erlangga 4. CDC. 2009. Biosafety in Microbiological and Biomedical Laboratories 5th edition
Course Lecturer	Dr. Ari Susilowati, M.Si Dr. Artini Pangastuti, M.Si
Topics	1. Bioinformatics web 2. Biology Database 3. Prediction of gene sequences alignment with Clustal 4. Phylogenetic Analysis with MEGA 5. PCR primer design 6. Identification of organisms using marker gene sequences (database similarity searching, species concept) 7. Sequence analysis for various applications 8. Next Generation Sequencing data analysis 9. Gene Mining 10. Molecular docking

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the application of instruments in the field of biology	PLO2	C3-Comprehend	Discussion/Group project	5.3	Exam: quiz (40%)
2	Demonstrate fluency of information technology	PLO9	C6-Evaluate	Case analysis	8	Worksheet (60%)

Prepared by:	**Certified by head department:**
Name: Dr. Ari Susilowati, M.Si Dr. Artini Pangastuti, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243035	Academic Session/Semester	4
Course name:	Biosystematics	Pre/co requisite Course name and code if applicable	General Biology, Plant Structure and Development, Animal Structure and Development, Microbiology.
Credit/ECTS:	3/3.99		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	3	40h	40h	40h
Total	3	120h (3.99 ECTS)		

Course Synopsis	The Biosystematics course covers classification limit, biodiversity, taxonomic characteristics, collection techniques, preservation, identification, publication, theoretical classification, history of living things classification, taxonomical hierarchy, living things nomenclature, and speciation phylogeny, and evolution impact on biodiversity
References	1. Bhattacharyya, B. and B. M. Johri., Flowering Plants : Taxonomy and Phylogeny., Narosa Publising House, 1998 2. Budiharjo, A., Pengantar Taksonomi Hewan., Jurusan Biologi FMIPA UNS, 2006 3. Simpson, M.G., Plant Systematics., Elsevier Academic Press, 2008
Course Lecturer	Dr. Agung Budiharjo, M.Si Suratman, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning	12	Exam: quiz (30%)
2	Produce scientific paper or innovative products based on research	PLO3	C5-Synthesize	Project-based learning	8	Project based assignment (20%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C6-Evaluate	Project-based learning	12	Project based assignment (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO7	C4-Analyze	Listening to lectures, discussing, and compiling papers	8	Assignment (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Agung Budiharjo, M.Si Suratman, S.Si., M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243036	Academic Session/Semester	4
Course name:	Biosystematics Practicum	Pre/co requisite Course name and code if applicable	General Biology Pract., Plant Structure and Development Practicum., Animal Structure and Development Pract., Microbiology Pract.
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload	Type	CSU	Face to Face
	P	1	40 h
	Total	1	40h (1.33 ECTS)

Course Synopsis	Practical of Biosystematics course covers a study on character and characterization, description, classification, construction of determination key, kinship determination, animal collection and preservation techniques, plant collection and preservation techniques, and herbarium making
References	1. Budiharjo, A., Pengantar Taksonomi Hewan., Jurusan Biologi FMIPA UNS , 2006 2. Simpson, M.G. , Plant Systematics., Elsevier Academic Press, 2008 3. Suratman dan A. Budiharjo, Petunjuk Praktikum Biosistematika, Program Studi Biologi FMIPA UNS, 2020
Course Lecturer	Suratman, S.Si., M.Si
Topics	1. Learning and Introductory Contracts 2. Character and Characterization of Living Things 3. Creature Character Description 4. Classification 5. Plant Collection Techniques 6. Plant Preservation Techniques 7. Animal Collection Techniques 8. Animal Preservation Techniques 9. Generate Determination Key 10. Using the Determination Key 11. Plant Herbarium Manufacturing Techniques 12. Animal Herbarium Making Techniques 13. Analysis of Kinship Relationships of Living Things

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analysis of instrument results in the field of biology	PLO2	C2-Comprehend	Lecture/Discussion	12	Exam: quiz (30%)
2	Mastering the application of instruments in the field of biology	PLO2	C2-Comprehend	Lecture/Discussion	8	Exam: quiz (20%)

3	Demonstrate teamwork skills	PLO8	C2-Comprehend	Project based-learning	12	Project-based assignment (30%)
4	Demonstrate fluency of information technology	PLO9	C2-Comprehend	Project based-learning	8	Project-based assignment (20%)

Prepared by:	**Certified by head department:**
Name: Suratman, S.Si., M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243037	Academic Session/Semester	4
Course name:	Ecology	Pre/co requisite Course name and code if applicable	General Biology
Credit/ECTS:	3/3.99		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	3	40h	40h	40h
Total	3	120h (3.99 ECTS)		

Course Synopsis	Ecology course covers a study on reciprocal relationship and interaction between environmental components and living beings, the impact, and the interaction of inter- or intra- ecosystem components, productivity, biogeochemical cycle, habitat and niche, community, ecological adaptations, population ecology, and its characteristics.
References	1. Begon, M., J.I.Harper and C.R. Townsend. 1990. Ecology Individual. Population and Communities. Oxford. Blackwell Scientific PubI. 2. Eugene P.Odum. 1992. Dasar-Dasar Ekologi (Fundamental of Ecology). Edisi Ketiga. GadjahMada Univ. Pres Yogyakarta Indonesia. 3. Kormondy, E.J.1969.Concept Ecology. New Jersey. Prentice Hall. Inc. 4. Krebs, C.J.1972.Ecology: The Experimentaly Analysis of Distribution and Abundane. New York: Harper and Row. 5. Ridley, M. 1993. Evolution. Blackwell Scientific Publishing Inc. 6. Soetjipto, 1993. Dasar-Dasar Ekologi Hewan. Dikti. Depdikbud. Jakarta.
Course Lecturer	Prof. Dr. Sugiyarto, M.Si Dr. Edwi Mahajoeno, M.Si Hasbiyan Rosyadi, S.Si., M.Sc

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning	16	Exam (40%)
2	Demonstrate a well-mannered work attitude	PLO5	C2-Comprehend	Discussion	8	Group presentation (20%)
3	Demonstrate fluency of information technology	PLO9	C5-Synthesize	Team-based project	16	Project-based learning (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Prof. Dr. Sugiyarto, M.Si Dr. Edwi Mahajoeno, M.Si Hasbiyan Rosyadi, S.Si., M.Sc May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043243038	Academic Session/Semester	4
Course name:	Ecology Practicum	Pre/co requisite Course name and code if applicable	General biology practicum
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Ecology Practicum equips students with the knowledge on reciprocal relationship and interaction between environmental component and living beings, the impact, and the interaction of inter- or intra-ecosystem components, productivity, biogeochemical cycle, habitat and niche, community, ecological adaptations, population ecology and its characteristics.
References	1. Begon, M., J.I. Harper and C.R. Townsend, Ecology Individual, Population and Communities , Blackwell Scientific Publ., 1990 2. Campbell, F. , Biology, Benyamin Cummings Publ. Co, 1992 3. Hochachka. P.W and George N. Somero , Strategies of Biochemical Adaptation, W.B. Saunders Company.London., 1989 4. Kormondy, E.J. , Concept Ecology., Prentice Hall. Inc., 1969 5. Krebs, C.J. , The Experimentaly Analysis of Distribution and Abundance, Harper and Row., 1972 6. Ridley, M. , Evolution, Blackwell Scientific Publishing Inc., 1993 7. Soetjipto, , Dasar-Dasar Ekologi Hewan, Dikti. Depdikbud. Jakarta., 1993 8. Wilson, E.O. , The Diversity of Life, The Belknap Press, 1992 9. Sugiyarto, Petunjuk Praktikum Ekologi, Prodi S1 Biologi Uiversitas Sebelas Maret, 2020
Course Lecturer	Prof. Dr. Sugiyarto, M.Si Dr. Edwi Mahajoeno, M.Si Hasbiyan Rosyadi, S.Si., M.Sc
Topics	1. Practical briefing of all themes and division of project topics 2. Characterization of Organisms, Habitats, and Niche 3. Succession Studies 4. Population Estimation 5. Soil and Aerial Animal Community Studies 6. Plant Community Studies I 7. Plant Community Studies II 8. Lotic Waters Studies 9. Lentik Waters Study 10. Mapping I 11. Mapping II 12. Experimental Ecology 13. Project Reports and Presentations 14. Field Practice

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Field practicum/ cooperative learning	8	Exam (20%)

2	Mastering the application of instruments in the field of biology	PLO2	C2-Comprehend	Field practicum/ discussion	8	Exam (20%)
3	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Team based project	8	Project-based learning (20%)
4	Demonstrate professional attitude	PLO5	C2-Comprehend	Field practicum/ discussion	8	Group presentation (20%)
5	Demonstrate fluency of information technology	PLO9	C5-Synthesize	Cooperative/ team based project	8	Project-based learning (20%)

Prepared by:	Certified by head department:
Name: Prof. Dr. Sugiyarto, M.Si Dr. Edwi Mahajoeno, M.Si Hasbiyan Rosyadi, S.Si., M.Sc May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242039	Academic Session/Semester	4
Course name:	Evolution	Pre/co requisite Course name and code if applicable	Biosystematics, Ecology, Genetics
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	The course studies the basic theory of evolution, the linkage between reproduction isolation, natural selection, adaptation, evolution mechanism and its impact on biodiversity, evolution impact on phylogeny relationship, and behavioral changes in living things
References	1. Dawkins, R. 2009. The greatest show on earth. The Evidence for evolution. FP Press. New York. 2. Harms, WF. 2004. Information and Meaning in Evolutionary Process. Cambridge University Press. 3. Kemps, TS. 2005. The Origin and Evolution of Mammals. Oxford University Press. 4. Shamahan, T. 2007. The Evolution of Darwinism. Selection, Adaptation, and Process in Evolutionary Biology. Cambridge University Press. 5. Sober E. 2006. Conceptual issues in Evolutionary Biology. Massachussets Institute of Technology.
Course Lecturer	Dr. Agung Budiharjo, M.Si Hasbiyan Rosyadi, S.Si., M.Sc

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning	5.3	Exam: quiz (20%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Study case/cooperative learning/team based project	5.3	Exam: quiz (20%)
3	Produce scientific paper or innovative products based on research	PLO3	C5-Synthesize	Cooperative learning/team based project	8	Project based learning (30%)
4	Demonstrate teamwork skills	PLO8	C5-Synthesize	Cooperative learning/team based project	8	Project based learning (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Agung Budiharjo, M.Si Hasbiyan Rosyadi, S.Si., M.Sc May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242040	Academic Session/Semester	4
Course name:	Microbial Physiology	Pre/co requisite Course name and code if applicable	Microbiology, Biochemistry
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course studies the physiological process molecularly, although not from the molecular genetics point of view. Students demonstrate basic biochemistry and cell physiology concepts. Students show the capability to produce written scientific dissemination on explaining problems related to microbes and offer alternative solutions. Students are also capable of analyzing microbial physiology processes on the making of fermented foods
References	Purwoko, T., Fisiologi Mikroba. , Bumi Aksara Jakarta , 2007
Course Lecturer	Tjahjadi Purwoko, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning	5.3	Written test (20%)
2	Produce scientific paper or innovative products based on research	PLO3	C5-Synthesize	Team based project	10.7	Written test (40%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C6-Evaluate	Discussion/Presentation	5.3	Project task (20%)
4	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Team based project	5.3	Paper (20%)

Prepared by:	**Certified by head department:**
Name: Tjahjadi Purwoko, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043242041	Academic Session/Semester	4
Course name:	Cell and Tissue Culture	Pre/co requisite Course name and code if applicable	Cell Biology, Animal Physiology, Plant Physiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Cell and Tissue Culture is a compulsory course that studies the history and theories of animal cell culture, identification of steps in animal cell/tissue culture, application and benefit of animal cell/tissue, stem cell development, totipotency theory as a basis for plant tissue culture, aseptic techniques, sterilization concept, isolation and identification of explants, growth medium, application of hormone/growth regulator, callus culture, suspension culture, root and shoot culture, micropropagation, production of secondary metabolite through in-vitro plant culture.
References	1. Freshney I., Culture of Animal Cells: A Manual Basic Technique and Specialized Application. , John Willey & Sons,2011 2. Smith RH. , Pant Tissue Culture, Third Edition: Techniques and Experiments. , AP Press., 2012 3. Jensen Caleb and Teng Yong, Is It Time to Start Transitioning From 2D to 3D Cell Culture?, Frontiers in Molecular Biosciences, 7, 33, 2020, www.frontiersin.org 4. Gergana Krasteva, Vasil Georgiev, Atanas Pavlov, Recent applications of plant cell culture technology in cosmetics and foods, Engineering in Life Sciences , 21, 21, 2020, www.els-journal.com
Course Lecturer	Prof. Dr. Okid Parama Astirin, M.S Dr. Solichatun, S.Si. M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning/class discussion	8	Written test (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/class discussion	8	Written test (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C3-Apply	Discussion and presentation based on case study	10.7	Papr and presentation (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Prof. Dr. Okid Parama Astirin, M.S Dr. Solichatun, S.Si. M.Si. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043241042	Academic Session/Semester	4
Course name:	Animal Cell and Tissue Culture Practicum	Pre/co requisite Course name and code if applicable	Cell Biology, Animal Physiology
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Animal Cell and Tissue Culture Practicum equips students with skills on applying basic animal cell/tissue culture. Laboratory activities cover cell isolation, cell condition observation (morphology, viability, growth), and culture maintenance (how to change medium, sub-culture, cryopreservation). All activities are in aseptic condition, and students are aware of the standard operating procedure to work with animal cell culture in aseptic conditions.
References	1. Freshney I., Culture of Animal Cells: A Manual Basic Technique and Specialized Application., John Willey & Sons.,2011 2. Mohamed Al-Rubeai (eds.), Animal Cell Culture, https://www.pdfdrive.com/animal-cell-culture-books.html, 2015 3. Davis, J.M. , Animal Cell Culture: Essential Methods, John Willey & Sons., 2011
Course Lecturer	Elisa Herawati, M.Eng., Ph.D Dr. Nita Etikawati, M.Si.
Topics	1. Growth media and tools 2. Isolation and maintenance of primary cell cultures 3. Observation of cell morphology, checking whether there is contamination 4. Storing cells in a frozen state (cryopreservation) 5. Cell growth 6. Cell differentiation 7. Cell markers 8. Colorimetric based cytotoxicity method 9. Different types of cell lines and their uses 10. Characteristics and maintenance of tumor cells

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	P3-Precise	Simulation/Practical work	16	Practical exam (40%)
2	Mastering the application of instruments in the field of biology	PLO2	P3-Precise	Simulation/Practical work	16	Practical exam (40%)
3	Demonstrate teamwork skills	PLO8	C3-Apply	Simulation/Practical work	8	Practical exam (20%)

MODULE HANDBOOK

Prepared by:	**Certified by head department:**
Name: Elisa Herawati, M.Eng., Ph.D Dr. Nita Etikawati, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043241043	Academic Session/Semester	4
Course name:	Plant Cell and Tissue Culture Practicum	Pre/co requisite Course name and code if applicable	Cell biology, Plant physiology
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Plant Cell and Tissue Culture Practicum covers the study in laboratory design of plant in-vitro culture, medium and tool sterilization, explant sterilization, medium making, hormone preparation, explant planting, sub-culture, culture growth analysis, and the making of synthetic seeds.
References	1. Smith RH. , Pant Tissue Culture, Third Edition: Techniques and Experiments. , AP Press, 2012 2. Napier S and Bingham M. , Plant Cell and Tissue Cuture – A Tool in Biotechnology. , Springer., 2009 3. Solichatun dan Pitoyo A. , Buku Petunjuk Praktikum Kultur Sel dan Jaringan Tumbuhan, , Prodi Biologi, FMIPA,UNS, 2021
Course Lecturer	Dr. Solichatun, M.Si. Ari Pitoyo, M.Sc.
Topics	1. Aseptic techniques, culture media and culture hormones. 2. Understand the application of instruments in the field of biology, especially regarding tool sterilization, preparation of culture media, explant sterilization, explant planting, subculture 3. Analysis of the results of explant sterilization, media sterilization, explant planting, and culture results

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analysis of instrument results in the field of biology	PLO2	C2-Comprehend	Study case/ cooperative learning/ team based project	12	Exam/quiz (30%)
2	Mastering the application of instrument in the field of biology	PLO2	C2-Comprehend	Study case/ cooperative learning/ team based project	12	Exam/quiz (30%)
3	Demonstrate teamwork skills	PLO8	C3-Apply	Study case/ cooperative learning/ team based project	16	Paper and presentation (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Solichatun, M.Si. Ari Pitoyo, M.Sc. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	0904324044	Academic Session/Semester	4
Course name:	Bioproducts	Pre/co requisite Course name and code if applicable	General Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course studies bioproduct as bio-based materials that are technologically processed into new products with an economically and environmentally added value, e.g., biofood, biofeed, biopharmacy, bio supplement, biocosmetics, bioenergy(biofuel, bioethanol, biodiesel, biogas), biotextile, biofibre, biocomposite, biosurfactant, bioremediation, bioplastic, biopesticide, biofertilizer, microbial and fungal bioprospect, bioculture, bioart, bioceramic, natural dye, bioproduct technology, bioengineering, bioeconomic analysis, product standardization which applies sustainable methods and processes, while also environmentally friendly.
References	1. Anonim. , Buku Saku Bahan Pangan Potensial untuk Antivirus dan Imun Booster, Balai Besar Penelitian dan Pengembangan Pascapanen Pertanian, 2020 2. Deskmukh, A. M., R.M. Khobragade., and P.P. Dixit., Handbook of Biofertilizer of Biopesticide., Oxford Book Company. Jaipun, 2007 3. Hunger, K. , Industrial Dyes: Chemistry, Properties, Applications, Wiley –VCH. Frankfurt. German., 2003 4. Hefferon. K.L. , Biopharmaceuticals in Plant: Toward the Next Century of Medicine, CRC Press. New York., 2010 5. Kayser.O., and W. Quax. , Medicine Plant Biotechnology: From Basic Research to Industrial Applications, WileyVCH. Verlag GmbH & Co.Kga.A. Weinheim., 2007 6. Lang, A.R. , Dyes and Pigment New Reasearch, Nova Science Publishers. Inc. New York., 2009 7. Mackova, M., Dowling, D.N., and Macek, T. , Phytoremidiation and Rhizoremidiation. , Springer. Netherland., 2006 8. National Research Council of the National Academic. , Inspired by Biology from Molecules to Material to Machines., Th National Academic Press. Washington D.C., 2008 9. Park. J. B., and J. D. Bronzino., Biomaterials: Principles and Applications., CRC. Press. , 2002 10. Rai, V. R., Advances in Food Biotechnology., Wiley & Sons. Ltd. U.K, 2016 11. Renand, D.G.D., Vallea., and Y. Popineau. , Plant Biopolimer: Food and Non Food Application., The Royal Society of Chemistry. U.K, 2002 12. Wibisono, Y. , Biomaterial dan Bioproduk, UB Press. Malang, 2017
Course Lecturer	Dr. Widya Mudyantini, S.Si. M.Si. Dr. Agung Budiharjo, M.Si Tjahjadi Purwoko, M. Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture and discussion	5.3	Discussion, question and answer, summarize, material (20%)

2	Analyzing the potential for further utilization of biological resources	PLO4	P4-Articulate	Cooperative learning	10.7	Midterm exam (40%)

3	Demonstrate a logical and systematic problem-solving ability	PLO6	P4-Articulate	Cooperative learning	10.7	Final exam (40%)
4	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C3-Apply	Lecture and discussion	5.3	Paper assignment (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Widya Mudyantini, S.Si. M.Si. Dr. Agung Budiharjo, M.Si Tjahjadi Purwoko, M. Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043322002	Academic Session/Semester	5
Course name:	Student Internship	Pre/co requisite Course name and code if applicable	Accomplished all courses of semester 1-4
Credit/ECTS:	2/5.34		
Language	Indonesia	Relation to Curriculum	Compulsory
Workload	Student Internship 2 CSU 1 CSU consists of 2 hours/day 2 CSU Student Internship is conducted in 40 days = 40 days x 2 hours x 2 = 160 hours 2 CSU = total 160 hours in one semester 1 CSU = 80 hours/30 hours = 2.67 ECTS		

Course Synopsis	Student Internship course is a course that oversees students' practical work at private or government institutions within the field of biology or other related fields. Students demonstrate their knowledge as applied in the employment sector to gain work experience for approximately one month
References	Publication related with research subject
Course Lecturer	Internship supervisor

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate professional attitude	PLO5	C3-Apply	Project-based learning	64	Project-based assignment (40%)
2	Develop network and cooperation with various parties	PLO8	C3-Apply	Project-based learning	48	Project-based assignment (30%)
3	Demonstrate teamwork skills	PLO8	C3-Apply	Project-based learning	48	Project-based assignment (30%)

Prepared by:	**Certified by head department:**
Name: (Coordinator of Student Internship) Suratman, S.Si., M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043222003	Academic Session/Semester	6
Course name:	Entrepeneurship	Pre/co requisite Course name and code if applicable	-
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Compulsory

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course equips students with principles of entrepreneurial mentality, creative and innovative skills, business management, negotiation, and business ethics.
References	1. Hisrisck R.D., Refers M.P. , Entrepreneurship.International Edition. , McGraw Hill Higher Education. Singapore.,2002 2. Ika Sari Dewi, S.S., M.Si. dan I.K. Sihombing, M.Si., Buku Kewirausahaan dan Manajemen Strategis UKM Pedesaan, deepublish, 2019 3. Siti Kusumawati dan Agus, Buku Ajar Kewirausahaan, Kemenkes RI , 2017 4. Agustina, Tri Siwi. , Kewirausahaan di Era Revolusi Industri 4.0. , Jakarta: Mitra Wacana Media, 2019
Course Lecturer	Prof. Dr. Ir. Endang Yuniastuti, M. Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Lecture and group discussion	13.3	Discussion, assessment, mid exam (50%)
2	Demonstrate professional attitude	PLO5	C3-Apply	Lecture and group discussion	13.3	Discussion, assessment, final exam (50%)

Prepared by:	**Certified by head department:**
Name: Prof. Dr. Ir. Endang Yuniastuti, M. Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043322001	Academic Session/Semester	7
Course name:	Community Service Program	Pre/co requisite Course name and code if applicable	100 credits
Credit/ECTS:	2/5.34		
Language	Indonesia	Relation to Curriculum	Compulsory
Workload	Community Services 2 CSU 1 CSU consists of 2 hours/day 2 CSU Community Services is conducted in 40 days = 40 days x 2 hours x 2 = 160 hours 2 CSU = total 160 hours in one semester 1 CSU = 80 hours/30 hours = 2.67 ECTS		

Course Synopsis	This course involves activities that are conducted by students directly in local communities, which aims to contribute to the wellbeing of the communities. The duration of the activity is ± 1.5 months in the city of Solo or other regencies in the island of Java, and in some cases, outside of Java.
References	Publication related with research subject
Course Lecturer	KKN team LPPM UNS

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate professional attitude	PLO5	C3-Apply	Project-based learning	24	Quiz (15%)
2	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Project-based learning	16	Participation (10%)
3	Develop network and cooperation with various parties	PLO8	C5-Evaluate	Project-based learning	80	Project-based assignment (50%)
4	Demonstrate teamwork skills	PLO8	C3-Apply	Project-based learning	16	Report (10%)
5	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C4-Analyze	Project-based learning	24	Participation (15%)

Prepared by:	**Certified by head department:**
Name: KKN team LPPM UNS May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043322004	Academic Session/Semester	8
Course name:	Undergraduate Thesis	Pre/co requisite Course name and code if applicable	Compulsory and elective modules (total 120 credit)
Credit/ECTS:	6/16.02		
Language	Indonesia	Relation to Curriculum	Compulsory
Workload	Undergraduate Thesis 6 CSU 1 CSU consists of 4.8 hours/day 6 Undergraduate Thesis is conducted in 5 months = 20 days x 5 months x 4.8 = 480 hours 6 CSU = total 480 hours in one semester 1 CSU = 80 hours/30 hours = 2.67 ECTS		

Course Synopsis	This course covers research or system development activities within the field of Biology, as conducted independently by students. The Undergraduate Thesis starts with proposal submission, followed by research/development. The thesis review team then reviews the results of the research. Students consult with their supervisory team during the proposal development, research/development, and thesis writing.
References	Publication related with research subject
Course Lecturer	Thesis supervisor and reviewer

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C5-Synthesize	Project-based learning	48	Thesis exam and paper (10%)
2	Mastering the knowledge and technology related to biology	PLO1	C5-Synthesize	Project-based learning	48	Thesis exam and paper (10%)
3	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Project-based learning	72	Thesis exam and paper (15%)
4	Analyzing the potential for further utilization of biological resources	PLO4	C5-Synthesize	Project-based learning	72	Thesis exam and paper (15%)
5	Demonstrate professional attitude	PLO5	C3-Apply	Project-based learning	24	Thesis exam and paper (5%)
6	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Project-based learning	24	Thesis exam and paper (5%)
7	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Project-based learning	24	Thesis exam and paper (5%)

8	Demonstrate fluency of information technology	PLO9	C5-Synthesize	Project-based learning		Thesis exam and paper (20%)
9	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C5-Synthesize	Project-based learning		Thesis exam and paper (15%)

Prepared by:	**Certified by head department:**
Name: (Coordinator of Thesis) Elisa Herawati, M.Eng., Ph.D. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152001	Academic Session/Semester	5
Course name:	Biogeography	Pre/co requisite Course name and code if applicable	General biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biogeography course focuses on aspects that include the definition of biogeography, global distribution of fauna, phytogeography, significant meaning of phytogeography, factors limiting plant distribution, plant distribution (medium, dispersal tool), terrestrial plant distribution, identification and description of plant distribution factors, migration concept, distribution and dispersion, and aquatic plant distribution. Students demonstrate the capability to explain organism distribution aspects and solve related problems. Students are also capable of writing a scientific document and presenting it.
References	1. Cox CB, Moore PD, and Ladle RJ. , Biogeography: An Ecological and Evolutionary Approach, 9th Edition. , Publisher: Willey-Blackwell,2016 2. C. Hobohm. ,Endemism in Vascular Plants, Plant and Vegetation ,DOI 10.1007/978-94-007-6913-7 4, ,9,0,2014, Springer ScienceCBusiness Media Dordrecht
Course Lecturer	Prof. Dr. Drs. Sugiyarto,M.Si Dr. Solichatun, S.Si.M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 1: Midterm exam (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 2: Final Exam (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Study case method/ group or individual project	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**
Name: Prof. Dr. Drs. Sugiyarto,M.Si Dr. Solichatun, S.Si.M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152002	Academic Session/Semester	5
Course name:	Mutation Biology	Pre/co requisite Course name and code if applicable	General Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Mutation Biology course covers a study on action mechanisms and effects of physical (radiation, temperature), chemical, and biological mutagens on living things, as well as the use of mutagens on different aspects of life (medicine, industry, agriculture, farm, environment, etc.).
References	1. Chu, NHE. And Genoso,W, ,Mutation, cancer and malformation,Plenum Press, New York,1984 2. IAEA, ,Radiation Biologi: A Handbook for Teachers and Students, IAEA,. Vienna,2010 3. IAEA, ,Plant Mutation, Breeding and Biotechnology,IAEA,2012 4. Anonim ,Health Risks from Exposure to Low Levels of Ionizing Radiation:, BEIR VII Phase 2. ISBN -309-09156- X,2012.
Course Lecturer	Dr. Shanti Listyawati, M.Si. Dr. Nita Etikawati, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Case method	5.3	Exam, quiz, participation activities (20%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Case method	10.7	Presentation (40%)
3	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Project based method	10.7	Paper (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Shanti Listyawati, M.Si. Dr. Nita Etikawati, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152003	Academic Session/Semester	4
Course name:	Biotechnology	Pre/co requisite Course name and code if applicable	General biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biotechnology course studies the application of bioscience and technology in relation to the use of living organisms or their subcellular components in the service industry, manufacture, and environmental management. The scope of the course covers the contribution of biotechnology on all aspects of human life, applied genetics in biotechnology, underlying biotechnological techniques, MAS, DNA recombinant technology, application of biotechnology in agriculture, animal feed nutrition, and medicine
References	1. Anonim ,Health Risks from Exposure to Low Levels of Ionizing Radiation:, BEIR VII Phase 2. ISBN -309-09156- X,2012. 2. Vallero, D.A. 2010. Environmental Biotechnology, a biosystem approach. Academic Press-Elsevier, London. 3. Bernard R. Glick, Cheryl L. Patten. 2017. Molecular Biotechnology: Principles and Applications of Recombinant DNA, Fifth Edition. ASM Press Washington DC.
Course Lecturer	Prof. Drs. Sutarno, M.Sc., Ph.D. Prof. Drs. Suranto, M.Sc., Ph.D.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture and discussion	8	Written exam and assessment (30%)
2	Produce scientific article or innovatibe product based on research	PLO3	C2-Comprehend	Case-based methods	8	Paper (30%)
3	Demonstrate professional attitude	PLO5	C3-Apply	Case-based methods	10.7	Presentation (40%)

Prepared by:	**Certified by head department:**
Name: Prof. Drs. Sutarno, M.Sc., Ph.D. Prof. Drs. Suranto, M.Sc., Ph.D. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043151004	Academic Session/Semester	5
Course name:	Enzyme Biotechnology	Pre/co requisite Course name and code if applicable	Biochemistry, Biochemistry Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course focuses on the study of enzyme as biocatalyzators, enzyme activity and factors affecting it, enzyme kinetics, enzyme sources and production, activity screening, enzyme extraction and purification, enzyme characterization, protein engineering, as well as enzyme applications in various fields
References	1. Bernard R. Glick, Cheryl L. Patten. 2017. Molecular Biotechnology: Principles and Applications of Recombinant DNA, Fifth Edition. ASM Press Washington DC. 2. Berg, J.M., Tymoczko, J.L., dan Stryer, L.. 2002. Biochemistry. 5th ed. W.H. Freeman and Company. 3. Wolfgang Aehle. 2007. Enzymes in Industry: Production and Applications. Wiley-VCH, Inc. 4. Berbagai artikel jurnal terkini.
Course Lecturer	Dr. Artini Pangastuti, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Demonstrate a logical and systematic problem-solving ability	PLO6	C3-Apply	Case-based method	13.3	Written test and solving case (50%)
2	Demonstrate teamwork skills	PLO8	A4-Organize	Project-based method	13.3	Paper assignment (30%) Presentation (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043151005	Academic Session/Semester	5
Course name:	Enzyme Biotechnology Practicum	Pre/co requisite Course name and code if applicable	Biochemistry, Biochemistry Practicum
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	This course studies techniques used in enzyme research, covering aspects from isolation and screening of enzyme-producing microorganisms, medium preparation, inoculation and observation, production, extraction and productivity measurement, enzyme activities and factors affecting them, measurement of Km and Vmax, to enzyme inhibitors.
References	1. Chand, P., Aruna, A., Maqsood, A.M., dan Rao, L.V.. 2005. Novel Mutation Method for Increased Cellulase Production . J. of Appl. Microbiol. 98: 318–323 2. Copeland, R.A.. 2000. Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis. 2nd ed. Wiley-VCH, Inc. 3. Ghose, T.K.. 1987. Measurement of Cellulase Activityes. Pure & Appl Chem. 59: 257-268 4. Holme DJ and Peck H. 1998. Analytical Biochemistry 3rd Ed. Prentice Hall. 5. Berbagai artikel jurnal terkini.
Course Lecturer	Dr. Artini Pangastuti, M.Si
Topics	1. Isolation and screening of enzyme-producing microorganisms 2. Enzyme production 3. Purification of enzymes Enzyme activity and factors that influence it 4. Enzyme kinetics

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the application of instruments in the field of biology	PLO2	P3-Precise	Case-based method	20	Written test (50%)
2	Demonstrate teamwork skills	PLO8	A4-Organize	Project-based method	20	Research project (50%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043151006	Academic Session/Semester	5
Course name:	Forensic Botany	Pre/co requisite Course name and code if applicable	General Biology, Plant Structure and Development, Biosystematics
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Forensic Botany is a course that focuses on using plant evidence to solve forensic problems. This course educates students on the limitation and scope of forensic botany, the role of forensic botany, the relation of forensic botany with other branches of knowledge, the impact of recent knowledge advances in forensic botany, the use of plant evidence on forensic, types of plant sources in forensic, the introduction of plant evidence in the crime scene, documentation of plant evidence at the crime scene, the role of plant morphological evidence, plant anatomical structure, plant molecular, plant systematics, plant ecology and limnology in forensic, collection and preservation of plant morphology evidence, palynology, and forensic case study based on plant morphological evidence.
References	1. Chandra, R. and V. Sharma.,Forensic Botany: An Emerging Discipline of Plant Sciences.,Indian Botanists,2014. 2. Coyle, H.M.,Forensic botany : principles and applications to criminal casework.,CRC Press,2005. 3. Hall, D.W. & J. H. Byrd,Forensic Botany: A Practical Guide,John Wiley-Blackwell,2012
Course Lecturer	Suratman, S.Si., M.Si. Ari Pitoyo, S.Si., M.Sc. Tanjung Ardo, S.Si., M.Sc.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology as well as knowledge and technology related to biology	PLO1	C2-Comprehend	Lecture/ cooperative learning	8	Exam: quiz (30%)
2	Analyzing the potential of biological resources	PLO4	C2-Comprehend	Project-based learning	5.3	Project based assignment (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C2-Comprehend	Project-based learning	8	Project based assignment (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO7	C4-Analyze	Listening to lecture, discussing, and compiling papers	5.3	Assignment (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Suratman, S.Si., M.Si. Ari Pitoyo, S.Si., M.Sc. Tanjung Ardo, S.Si., M.Sc. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043151007	Academic Session/Semester	5
Course name:	Terrestrial Ecology	Pre/co requisite Course name and code if applicable	Ecology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Terrestrial Ecology course focuses on selected concepts related to terrestrial environmental management at different levels (local, regional, and global). Selected topics cover earth environmental condition (climate, geology, and soil), water and energy balance, carbon input and production, decomposition, nutrient cycling, trophic dynamics, community effects on ecosystem processes, temporal dynamics, heterogeneity and landscape dynamics, application of ecological concepts on the most recent environmental problems: deforestation, watershed degradation, and soil degradation. The selected main topic of terrestrial ecology application is farm ecology, forestry, and marginal environment.
References	1. Hall, D.W. & J. H. Byrd,Forensic Botany: A Practical Guide,John Wiley-Blackwell,2012. 2. Canadell JJ, Pataki DE, and Pitelka LF (eds.). 2010. Terrestrial Ecosystems in a Changing World. Publisher: London: Springer Nature.
Course Lecturer	Prof. Dr. Drs. Sugiyarto, M.Si. Hasbiyan Rosyadi, S.Si., M.Sc.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture/ cooperative learning	8	Exam (30%)
2	Mastering knowledge and technology related to biology	PLO1	C2-Comprehend	Study case/ cooperative learning/ team based project	8	Exam (30%)
3	Demonstrate fluency of information technology	PLO9	C5-Synthesize	Cooperative/ team/ based project	10.7	Project-based assignment (40%)

Prepared by:	**Certified by head department:**
Name: Prof. Dr. Drs. Sugiyarto, M.Si. Hasbiyan Rosyadi, S.Si., M.Sc May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152008	Academic Session/Semester	6
Course name:	Animal Embryology	Pre/co requisite Course name and code if applicable	Animal Structure and Development
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	1	13.3h	13.3h	13.3h
Total	1	40h (1.33 ECTS)		

Course Synopsis	Animal Embryology is a course on vertebrate structure and development, i.e., gametogenesis, fertilization, embryogenesis (cleavages, gastrulation, differentiation, and organogenesis), and the introduction of possible developmental abnormalities. This course also discusses embryology applications, e.g., artificial insemination, in-vitro fertilization, and stem cells.
References	1. Canadell JJ, Pataki DE, and Pitelka LF (eds.). 2010. Terrestrial Ecosystems in a Changing World. Publisher: London: Springer Nature. 2. Carlson, B.M. 1981. Foundations of Embryology. Tata Mc. Graw-Hill. 3. Kalthoff, K. 1996. Analysis of Biological Development. Mc. Graw Hill, New York. 4. Muller, W.A. 1997. Development Biology Springer, New York. 5. Yatim, W. 1990. Reproduksi dan Embriologi. Tarsito, Bandung. 6. Thomas Sadler. 2003. Langman's Medical Embryology. Lippincot Williams & Wilkins.
Course Lecturer	Prof. Dr. Okid Parama Astirin, M.S. Dr. Tetri Widiyani, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture, question and answer, and discussion	8	Assesment, quiz, midterm, and final exam (60%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C2-Comprehend	Case-based method	5.3	Journal reviews and presentation (40%)

Prepared by:	**Certified by head department:**
Name: Prof. Dr. Okid Parama Astirin, M.S. Dr. Tetri Widiyani, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043151009	Academic Session/Semester	6
Course name:	Animal Embryology Practicum	Pre/co requisite Course name and code if applicable	Animal Structure and Development
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Animal Embryology Practicum covers vertebrate structure and development from gametogenesis and embryogenesis (cleavages, gastrulation, differentiation, and organogenesis) using preserved microscopical specimens (mammalian testicle and ovary), frog eggs before fertilization up to hatching, chicken embryo incubated at 18-96 hours (microscopic slide and wholemount).
References	1. Mathews, W.W. 1976. Atlas of Descriptive Embryology. 2nd Edition. Macmillan Publishing Co. Inc., New York. 2. Rugh, R. 1969. Laboratory Manual of Vertebrate Embryology. Burgess Publishing, Minneapolis. 3. Sagi, M. 1978. Embriologi Katak. Fakultas Biologi UGM, Yogyakarta. 4. Tim Pengampu Matakuliah SPH. 2006. Petunjuk Praktikum Struktur dan Perkembangan Hewan III. Jurusan Biologi FMIPA UNS, Surakarta.
Course Lecturer	Dr. Tetri Widiyani, M.Si.
Topics	1. Oogenesis and Spermatogenesis 2. Zygote cleavage 3. Blastulation 4. Gastrulation 5. Neurulation 6. Organogenesis 7. Frog embryogenesis 8. Chicken embryogenesis 9. Mammal embryogenesis

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture, question and answer, and discussion	14	Mid-term exam (35%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C4-Analyze	Lecture, question and answer, and discussion	14	Final term exam (35%)
3	Demonstrate teamwork skills	PLO8	A4-Organize	Lecture, question and answer, and discussion	12	Participation observation, work report (30%)

MODULE HANDBOOK

Prepared by:	**Certified by head department:**
Name: Dr. Tetri Widiyani, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152010	Academic Session/Semester	5
Course name:	Seed Physiology and Technology	Pre/co requisite Course name and code if applicable	Plant physiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Seed Physiology and Technology is a course that focuses on seed formation and development, seed structure and classifications, orthodox seeds, recalcitrant seeds, DNA intermediate, seed chemical composition, seed dormancy, seed germination, seed storage and maturation, collection technique, seed priming technique, coating technique, pelleting technique and artificial/synthetic seeds. Students gain an understanding of the basic concept of seed physiology and the application of seed technology. Students prepare a short resume and present it in class.
References	1. Black MJ, Bradford KJ, and Ramos JV. , Seed Biology: Advances and Applications. , CABI Publishing,2000. 2. Bennet GM and Lloyd J. 2015. ,Seed Inoculation, Coating and Precision Pelleting:Science, Technology and Practical Applications.,CRC Press.,2015.
Course Lecturer	Dr. Solichatun, S.Si.M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 1 (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 2 (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Cooperative learning/ class discussion	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Solichatun, S.Si.M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152011	Academic Session/Semester	5
Course name:	Phytohormone	Pre/co requisite Course name and code if applicable	Plant Physiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Phytohormones is a course that focuses on basic concepts of plant hormones and their impact on plant growth and development. This course also covers signal receptor and response mechanism, classical and modern hormone classification, history of hormone invention (auxins, gibberellins, abscisic acid, ethylene, brassinosteroids, jasmonates, salicylic acid, and polyamines), biosynthesis, work mechanism, transportation, application on plant cultivation and in-vitro culture. Students show understanding of the basic concept of hormones as signal, biosynthesis and impact on plant growth and development. Students demonstrate fluency in explaining plant growth and development aspects and problem-solving through their short resumes.
References	1. Taiz L and Zeiger E. 2002. Plant Physiology, 3rd ed. Hardcover: 690 pages Publisher: Sinauer Associates; 3 edition (Aug 30 2002) Language: English ISBN: 087893823. 2. Hopkins, William G. 2008. Introduction to plant physiology / William G. Hopkins and Norman P. A. Huner. –4th ed. ISBN 978-0-470-24766-2 (cloth). John Wiley & Sons, Inc. 523 p. 3. Satish C Bhatla and Manju A. Lal. 2018. Plant Physiology, Development and Metabolism. Springer. ISBN 978-981-13-2022-4 ISBN 978-981- 13-2023-1 (eBook) https://doi.org/10.1007/978-981-13-2023-1. 1251 p. 4. Han, X.; Zeng, H.; Bartocci, P.; Fantozzi, F.; Yan, Y. Phytohormones and Effects on Growth and Metabolites of Microalgae: A Review. Fermentation 2018, 4, 25. https://doi.org/10.3390/fermentation4020025. 5. Egamberdieva D, Wirth SJ, Alqaeawi AA, Abd Allah EF, and Hashem A. 2017. Phytohormones and Beneficial Microbes: Essential Components for Plants to Balance Stress and Fitness. Front. Microbiol., 31 October 2017 | https://doi.org/10.3389/fmicb.2017.02104. 6. Wound-Induced Endogenous Jasmonates Stunt Plant Growth by Inhibiting Mitosis Zhang Y, Turner JG (2008) Wound-Induced Endogenous Jasmonates Stunt Plant Growth by Inhibiting Mitosis. PLOS ONE 3(11): e3699. https://doi.org/10.1371/journal.pone.0003699.
Course Lecturer	Dr. Solichatun, S.Si.M.Si. Dr. Widya Mudyantini, S.Si.M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 1 (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 2 (30%)

3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesis	Case study/ group discussion	10.7	Paper and presentation (40%)

Prepared by:	Certified by head department:
Name: Dr. Solichatun, S.Si.M.Si. Dr. Widya Mudyantini, S.Si.M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152012	Academic Session/Semester	5
Course name:	Plant Genetics	Pre/co requisite Course name and code if applicable	Genetics
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Plant Genetics is a course that focuses on hereditary plant characteristics, including quantitative and qualitative characters, plant chromosomes, cytoplasmic hereditary, developmental genetics, and the basics of plant breeding. This course supports biology students in mastering the basic biological concepts and applications, enabling them to participate in biodiversity preservation and plant breeding to support sustainable resource utilization. This course helps students to later perform as a researcher on basic or applied botany such as plant breeder
References	1. Acquaah, G., 2012, Principles Plant Genetics and Breeding, 2nd edition, Wiley Blackwell,785 p. 2. Singh, R.J., 2003, Plant Cytogenetics,2nd editon, CRC Press Nygaard OF, WK. Sinclair, and JT.Leit, 1992. Advances in Radiation Biology. Academic Press. Inc. San Diego.
Course Lecturer	Dr. Nita Etikawati, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology as well as knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ discussion	13.3	Written test (50%)
2	Produce scientific article or innovative products based on research	PLO3	C2-Comprehend	Project-based methods	3.3	Paper (25%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C2-Comprehend	Case-based methods	3.3	Presentation (25%)

Prepared by:	**Certified by head department:**
Name: Dr. Nita Etikawati, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152013	Academic Session/Semester	4
Course name:	Immunology	Pre/co requisite Course name and code if applicable	Biochemistry
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Immunology studies the human immune system. Selected topics cover innate and adaptive immunity, immunological methods (e.g., vaccine), autoimmunity, and immune deficiency
References	1. Kenneth P. Murphy, Kenneth M. Murphy, Paul Travers, Mark Walport, Charles Janeway, Claudia Mauri, Michael Ehrenstein. 2008. Janeway's Immunobiology. Garland Science. 2. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt . 2017. Roitt's Immunology. Wiley. 3. Berbagai artikel jurnal terkini.
Course Lecturer	Dr. Artini Pangastuti, S.Si.M.Si. Dr. Ari Susilowati, S.Si.M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C3-Applying	Case-based method	13.3	Written test and quiz (50%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C3-Applying	Project-based method	13.3	Paper and presentation (50%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, S.Si.M.Si. Dr. Ari Susilowati, S.Si.M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152014	Academic Session/Semester	7
Course name:	Carcinology	Pre/co requisite Course name and code if applicable	Biosystematic
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Carcinology course covers carcinology studies, introduction to family crustacea with their essential features, life cycle, morphology, diversity, habitat, ecology, feeding pattern, artificial feed, shrimp diseases, and artemia cultivation
References	1. Barbier EB and Sathirathai S. 2004. Shrimp farming ang mangrove loss in gthailand. Edward Edgar Publishing Limited. UK. 2. Davie PJ. 2021. Crabs. A global natural museoum. Princetown University press. England. 3. Holthuis LB. 1991. FAO species catalogue: marine lobster of the worlds. FAO fiheries synopsis 125 Volume 13. Roma. 4. Legaki MT. 2006. Issues of decapod crustacean biology. Qoloquiom crustacea decapoda mediterania. Springer. Netherlands. 5. Sanz VA. 2010. The shrimp book. Nottingham University press. UK. 6. Saxena, A. 2005. Text Book of Crustacea. Discovery Publishing House. New Delhi. 7. Wickins JF and Lee DO. 2010. Crustacean Farming Ranching ang Culture.. Blackwell Science. Paris.
Course Lecturer	Dr. Agung Budiharjo, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Lecture and discussion	6.7	Written test and quiz (25%)
2	Produce scientific article or innovative products based on research	PLO3	C3-Apply	Lecture and discussion	13.3	Paper and presentation (50%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Lecture and discussion	6.7	Written test and quiz (25%)

Prepared by:	**Certified by head department:**
Name: Dr. Agung Budiharjo, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152015	Academic Session/Semester	7
Course name:	Prokaryotes Molecular Diversity	Pre/co requisite Course name and code if applicable	Microbiology, Molecular Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Procaryotic Molecular Diversity course covers topics that include operon, signal transduction, constitutive and inducible expression, control of gene on nitrogen fixation, ice nucleation, and control of gene influenced by environmental factors
References	1. Vilar, J.M.G., Guet, C.C and Leibler, S. 2003. Modeling network dynamics: lac operon, a case study. The Journal of Cell Biology 161(3): 471-476. 2. Bijlsma, J.J.E. and Groisman E.A. 2003. Making informed decisions: regulatory system between two-component systems. TRENDS in Microbiology 11(8): 359-366. 3. Weake, V.M. and Workman, J.L. 2010. Inducible gene expression: diverse regulatory mechanisms. Nature Reviews Genetic 11: 426-437. 4. Martinez-Argudo, I. Little, R., Shearer, N., Johnson, P. and Dixon, R. 2005. Nitrogen fixation: key genetic regulatory mechanisms. Biochemical Society Transaction 33(1): 152-156. 5. Lorv, J.S.H., Rose, D.R. and Glick, B.R. 2014. Bacterial ice crystal controlling proteins. Scientifica 2014: 1-20. 6. Bergrren, M., lapierre, J. and Giorgio, P.A. 2011. Magnitude and regulation of bacterioplankton respiratory quotient across freshwater environmental gradients. The Isme Journal: 1-10. 7. Han, H. et al. 2011. Adaptation of aerobic respiration to low O2 environments. PNAS 108 (34): 14109-14114. 8. Lamy, D. Et al. 2011. Ecology of aerobic anoxygenic phototrophic bacteria along an oligotrophic gradient in the Mediterranean Sea. Biogeosciences 8: 937-985. 9. Li, Y. and Tian, X. 2012. Quorum sensing and bacterial social interactions in biofilms. Sensors 12: 2519-2538. 10. Nakamoto, H. et al. 2014. Physical interaction between bacterial heat shock protein 90 (Hsp90) and Hsp70 chaperones mediates their cooperative action to refold denaturated proteins. The Journal of Biochemical Chemistry. Published online January 12. 1-3. 11. Tang, K.H. , Yue, H. and Blankenship, R.E. 2010. Energy metabolism of Heliobacterium modesticaldum during phototrophic and chemotrophic growth. BMC Microbiology 10: 150. 12. Bai, A.J and Rai, V. R. 2011. Bacterial quorum sensing and food industry. Comprehensive reviews in food science and food safety 10: 184-194. 13. Deep, A., Chaudary, U. and Gupta, V.2011. Quorum sensing and bacterial pathogenecity: from molecules to deseases.Journal of Laboratory Physicians 3(1): 4-11.
Course Lecturer	Dr. Ari Susilowati, S.Si., M.Si. Dr. Ratna Setyaningsih, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Discussion	8	Written test (30%)

2	Analyzing the potential for further utilization of biological resources	PLO4	P3-Indicate	Case study	5.3	Paper (20%)

3	Demonstrate effective communication in either Indonesian or English language	PLO7	C1-Knowledge	Team-based project	8	Written test (30%)
4	Demonstrate fluency of information technology	PLO9	P3-Demonstrate	Team-based project	5.3	Presentation (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Ari Susilowati, S.Si., M.Si. Dr. Ratna Setyaningsih, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152016	Academic Session/Semester	7
Course name:	Chemotaxonomy	Pre/co requisite Course name and code if applicable	Biosystematics, Biosystematics Practical
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Chemotaxonomy course studies the use of chemical compounds as evidence for the classification of organisms. This course covers the background of emergence, basic principles, development, prospect, the contribution of chemotaxonomy and its relation with other knowledge, chemical substances in living things used in chemotaxonomy, collection of chemical compounds from organismsfor chemotaxonomic study, chemical compound identification in organisms, analysis of chemotaxonomic data, chemotaxonomy in various organisms (algae, lichens, Bryophyta, Pteridophyta, Spermatophyta, microorganisms, and animals).
References	1. Cannell, R.J.P.,Natural Products Isolation,Natural Products Isolation,1998. 2. Croteau, R., T.M. Kutchan, and N.G. Lewis.,Natural Products (Secondary Metabolites). In Buchanan, B., W. Gruissem, R. Jones (Eds.). Biochemistry & Molecular Biology of Plants,American Society of Plant Physiologists ,2000. 3. de Winter, W.P. and Amoroso, V.B.,Plant Resources of South East Asia No. 15 (2). Cryptogams : Fern and fern allies,Prosea Foundation.,2003. 4. Departemen Kesehatan Republik Indonesia,Parameter Standar Umum Ekstrak Tumbuhan Obat,Departemen Kesehatan Republik Indonesia,2000. 5. Gerhart, D.J.,The chemical systematics of colonial marine animals : an estimated phylogeny of the order Gorgonacea based on terpenoid characters,Biol. Bull.,164,,1983. 6. Harborne, J.B.,Metode Fitokimia : Penuntun Cara Modern Menganalisis Tumbuhan. (Diterjemahkan oleh Kokasih Padmawinata dan Iwang Soediro).,Penerbit ITB,1987. 7. Manitto, P.,Biosintesis Produk Alami (diterjemahkan oleh Koesomardiyah dan Bambang Sudarto).,IKIP Semarang Press,1981. 8. Moat, A.G. & J.W. Foster.,Microbial Physiology,Wiley-Liss.,1995.
Course Lecturer	Suratman, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture/ cooperative learning	8	Exam: quiz (30%)
2	Produce scientific paper or innovative products based on research	PLO2	C5-Synthesize	Project based learning	5.3	Project based assignment (20%)
3	Analyzing the potential for further utilization of biological resources	PLO6	C6-Evaluate	Project based learning	5.3	Project based assignment (20%)

4	Demonstrate effective communication in either Indonesian or English language	PLO7	C4-Analyze	Listening to lecture, discussing and compiling papers	5.3	Assignment (20%)

Prepared by:	Certified by head department:
Name: Suratman, S.Si., M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152016	Academic Session/Semester	5
Course name:	Environmental Microbiology	Pre/co requisite Course name and code if applicable	Microbiology, Microbiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Environmental Microbiology studies microorganisms in their natural habitat, microbial adaptation in extreme environments, the role of microorganisms in the biogeochemical cycle, environmental issues, and solving environment-related problems using microbiological approaches.
References	1. Kolwzan, B., Adamiak, W., Grabas, K., Pawelczyk. 2006. Introduction to Environmental Microbiology. OficynaWydawnicza Politechniki Wroclawskiej, Wrowklaw. 2. Polymenakou, P.N. 2012. Atmosphere: a source of pathogenic or beneficial microbes ?. Atmosphere 3: 87-102Sigee, D.C. 2005. Freshwater Microbiology, Biodiversity and Dinamyc Interactions of Microorganisms in TheAquatic Enironment. John Wiley & Sons, Chichester. 3. Rampeloto, P.H. 2010. Resistance of microorganisms to extreme environmental conditions and its contributionto astrobiology, Sustainibility 2: 1602-1623. 4. Madsen, E.L. 2011. Microorganisms and their role in fundamental biogeochemical cycle. Current OpinioninBiotechnology 22:456-464. 5. Bernhard, A. 2010. The Nitrogen cycle: processes, players, and human impact. Nature Education KnowledgeProject 2(2): 12.
Course Lecturer	Dr. Ratna Setyaningsih, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of environmental microbiology	PLO1	C3-Apply	Collaborative learning	10.7	Written exam (40%)
2	Mastering knowledge and technology related to biology	PLO1	C2-Comprehend	Discussion	8	Activity and report of discussion (30%)
3	Produce writings or innovative products based on research	PLO3	C5-Synthesize	Case-based learning	5.3	Paper (20%)
4	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Case-based learning	3	Presentation (10%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Ratna Setyaningsih, M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043151018	Academic Session/Semester	7
Course name:	Microtechnique	Pre/co requisite Course name and code if applicable	Animal Structure and Development, Animal Structure and Development Practicum, Plant Structure and Development Practicum, Plant Structure and Development
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	The Microtechnique course equips students with techniques to prepare plant and animal microscope slides for detection and micro-object characterization purposes. Prepared objects include molecules, cells, tissue, organ, and the whole body. Techniques on microscopic slide-making have increasingly developed along with the advances in microscope technology as well as in the fields of biochemistry and molecular biology.
References	1. Edward Chee Tak Yeung, Claudio Stasolla, Michael John Sumner, Bing Quan Huang, 2015. Plant microoecnhnique and Protocols. Springer. 2. S. Dutta Gupta and Yasuomi Ibaraki, 2015. Plant Image Analysis: Fundamentals and Applications. CRC Press. 3. Ruzin SE. 1999. Plant microtechnique and microscopy . Oxford, New York: Oxford University Press. 4. Kiernan, J.A., 1990. Histological & Histchemical Methods : Theory & Practice. Pergamon Press, Oxford, New York, Beijing, Frankfurt, Sao Paulo, Sydney, Tokyo,Toronto. 5. Suntoro, S.H.,1983. Metode Pewarnaan (Histologi dan Histokimia). Bhatara Karya Aksara. Jakarta. 6. Erick Khristian, Dewi Inderiati. 2017. Sitohistoteknologi. Kementerian Kesehatan RI.
Course Lecturer	Ari Pitoyo, S.Si., M.Sc. Dr. Tetri Widiyani, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Collaborative learning	10.7	Written test (40%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C2-Comprehend	Collaborative learning	10.7	Written test (40%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Collaborative learning	5.3	Presentation (20%)

Prepared by:	Certified by head department:
Name: Ari Pitoyo, S.Si., M.Sc. Dr. Tetri Widiyani, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

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<tr><td>Department:</td><td colspan="2">Biology</td><td rowspan="2">Page</td><td rowspan="2">1 of 1</td></tr>
<tr><td>Faculty:</td><td colspan="2">Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret</td></tr>
<tr><td>Course code:</td><td colspan="2">09043151019</td><td>Academic Session/Semester</td><td>7</td></tr>
<tr><td>Course name:</td><td colspan="2">Microtechnique Practicum</td><td rowspan="2">Pre/co requisite Course name and code if applicable</td><td rowspan="2">Animal Structure and Development, Animal Structure and Development Practicum, Plant Structure and Development Practicum, Plant Structure and Development</td></tr>
<tr><td>Credit/ECTS:</td><td colspan="2">1/1.33</td></tr>
<tr><td>Language</td><td colspan="2">Indonesia</td><td>Relation to Curriculum</td><td>Elective</td></tr>
<tr><td>Workload</td><td colspan="3"><table><tr><td>Type</td><td>CSU</td><td>Face to Face</td></tr><tr><td>P</td><td>1</td><td>40 h</td></tr><tr><td>Total</td><td>1</td><td>40h (1.33 ECTS)</td></tr></table></td></tr>
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Course Synopsis	Practicum of Microtechnique studies techniques on preparing plant and animal microscopic slides for detection and characterization of micro- molecule, cell, tissue, organ, and the whole body.
References	1. Edward Chee Tak Yeung, Claudio Stasolla, Michael John Sumner, Bing Quan Huang, 2015. Plant microecnhnique and Protocols. Springer. 2. S. DuGa Gupta and Yasuomi Ibaraki, 2015. Plant Image Analysis: Fundamentals and ApplicaOons. CRC Press. 3. Kiernan, J.A., 1990. Histological & Histchemical Methods : Theory & PracOce. Pergamon Press, Oxford, New York, Beijing, Frankfurt, Sao Paulo, Sydney, Tokyo,Toronto. 4. Suntoro, S.H.,1983. Metode Pewarnaan (Histologi dan Histokimia). Bhatara Karya Aksara. Jakarta. 5. Erick KhrisOan, Dewi InderiaO. 2017. Sitohistoteknologi. Kementerian Kesehatan RI.
Course Lecturer	Ari Pitoyo, S.Si., M.Sc. Dr. Tetri Widiyani, M.Si
Topics	1. Preparation of animal and plant paraffin microscopic slide 2. Chromosome preparation 3. Pollen preparation 4. Epidermal preparations 5. Wholemount preparation 6. Supravital preparations 7. Smear preparations 8. Manufacture of rubbing preparations 9. Manufacture of range preparations 10. Documentation of plant and animal objects with a microscope 11. Using imageJ software for image analysis of plants and animals

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture, question and answer, and discussion	14	Midterm exam (35%)

2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C4-Analyze	Lecture, question and answer, and discussion	14	Final term exam (35%)
3	Demonstrate teamwork skills	PLO8	A4-Organize	Lecture, question and answer, and discussion	12	Participation observation, work report (30%)

Prepared by:	**Certified by head department:**
Name: Ari Pitoyo, S.Si., M.Sc. Dr. Tetri Widiyani, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152020	Academic Session/Semester	5
Course name:	Morphometrics	Pre/co requisite Course name and code if applicable	Biosystematics, Biosystematics Practical
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	The Morphometrics course concerns the quantification and analysis of organism forms that become variation sources of their biological traits. The course also includes an introduction to morphometrics softwares and programs, along with their application.
References	1. Henderson, A.2006. Traditional morphometrics in plant systematics and its role in palm systematic. Botanical Journal of the Linnean Society. 151: 103-111. 2. Lestrel, P.E. 2000. Morphometrics for the Life Sciences. World Scientific. Singapore. 3. Singh, G. 2003. Plant Systematics an Integrated Approach. Science Publishers. Inc. Enfield. NH.USA. India
Course Lecturer	Dr. Tetri Widiyani, M.Si. Suratman, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Collaborative learning	8	Midterm exam (30%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Project-based learning	8	Journal review and presentation (30%)
3	Demonstrate fluency of information technology	PLO9	C5-Synthesize	Project-based learning	10.7	Final exam (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Tetri Widiyani, M.Si. Suratman, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152021	Academic Session/Semester	7
Course name:	Ornithology	Pre/co requisite Course name and code if applicable	Biosystematics, Biosystematics Practical
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Ornithology course explains generic bird morphology and essential identification features, bird diversity and their interaction with their environment, birdlife history and behavior, conservation concepts, and birdwatching practices in nature.
References	1. Elphic J. 2016. Birds: a complete guide to their biology and behavior. Firefly Book. Illustrated edition. 2. Gill FB. 2021. Ornithology. WH Freeman and Company. New York. 3. Gill FB and Prum RO. 2019. Ornithology. WH Freeman. 4. Kaplan G and Rogers LJ. 2001. Birds: their habits and skills. Allen and Unwin. New south wales. 5. Lovette IJ and Fitzpatrick JW. 2016. Handbook of bird biology. Cornell University. 6. Morrison ML, Rodewald AD, Voelker G, Colon MR, and Prather JF. 2018. Ornithology. John Hopkins University press. 7. Newton I. 2008. The migration ecology of birds. Academic press. Elsevier Ltd. 8. Taylor M. 2020. How birds work. The experiments. Illustration edition.
Course Lecturer	Dr. Agung Budiharjo, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Understand the concept of biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	8	Writing test (30%)
2	Produce writings or innovative products based on research	PLO3	C5-Synthesize	Lecturing/ collaborative learning	8	Paper (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO3	C1-Knowledge	Lecturing/ collaborative learning	10.7	Writing test (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Agung Budiharjo, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152022	Academic Session/Semester	5
Course name:	Bacterial Pathogenesis	Pre/co requisite Course name and code if applicable	Microbiology, Microbiology Practical
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Bacterial Pathogenesis course covers a study on bacteria-human interaction, pathogenic and normal microflora, bacterial pathogenic mechanisms, host defense mechanism on pathogens, bacterial defense system towards host immune system, prevention, and inhibition of pathogenesis, as well as pathogenic bacteria in Indonesia and their handling.
References	1. Brenda A. Wilson et al. 2011. Bacterial pathogenesis : a molecular approach 3rd ed. ASM press. 2. Todar's Online Textbook on Bacteriology. 3. Berbagai jurnal terbaru.
Course Lecturer	Dr. Ratna Setyaningsih, M.Si. Dr. Artini Pangastuti, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Collaborative learning	6.7	Exam (25%)
2	Produce writings or innovative products based on research	PLO3	C5-Synthesize	Project-based method	8	Paper (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO3	C2-Comprehend	Case-based method	6.7	Exam (25%)
4	Demonstrate effective communication in either Indonesian or English language	PLO7	C2-Comprehend	Project-based method	5.3	Presentation (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Ratna Setyaningsih, M.Si. Dr. Artini Pangastuti, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152023	Academic Session/Semester	5
Course name:	Introduction to Cancer Biology	Pre/co requisite Course name and code if applicable	Cell Biology, Animal Physiology, Animal Physiology practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Introduction to Cancer Biology course is an elective course that focuses on biological hallmarks of cancerous cells, dysregulation mechanism on cell cycle, cell division and differentiation, and biomolecular aspects that are responsible in changing normal tissue to become cancerous. Such mechanisms involve signaling/ communicating between cells and the organ system. This course also covers the most recent and advanced research on curing cancer.
References	1. Hesketh, R. 2013. Introduction to Cancer Biology. Cambridge University Press. Cambridge, UK. 2. Advanced in Cancer Research: Book Series. Academic Press. 3. Referensi jurnal: Nature Reviews Cancer, Cancer Cell, Journal of Clinical Oncology, dsb.
Course Lecturer	Elisa Herawati, M.Eng., Ph.D

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C3-Comprehend	Lecturing/ collaborative learning	8	Written test (30%)
2	Demonstrate a logical and systematic problem solving ability	PLO3	C4-Analyze	Case-based study	8	Written test (30%)
3	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Group discussion	5.3	Group presentation (20%)
4	Demonstrate fluency of information technology	PLO9	C3-Apply	Lecturing/ collaborative learning	8	Paper assignment (30%)

Prepared by:	**Certified by head department:**
Name: Elisa Herawati, M.Eng., Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152024	Academic Session/Semester	5
Course name:	Management of Natural Resources and Environment	Pre/co requisite Course name and code if applicable	Ecology, Ecology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course covers the definition of natural resources and environment (NRE), as well as the principles of NRE management that are based on ecological concepts, ranging from ecosystem structure-function, biogeochemistry, bioenergetics, community, population, and individual diversity (community dynamics, competition, predator and prey, biodiversity, primary and secondary productivity), aquatic and terrestrial biomes, human ecology (urban green areas, agroforestry, ecotourism, etc.).
References	1. Barbour, M.G., J.H. Burk, and W.D. Pitts, 1980. Terrestrial Plant Ecology. The Benyamin/Cummings Publishing Company, Inc. London. 2. Barbour, M.G., J.H. Burk, and W.D. Pitts, 1980. Terrestrial Plant Ecology. The Benyamin/Cummings Publishing Company, Inc. London. 3. Brower, J.E., and J.H. Zar, 1977. Field and Laboratory methods for General Ecology. WM.C. Brown Company Publishers, Iowa. 4. Chapman, J.L, M.J., Reis, 1995, Ecology, Principles and Applications, Cambridge: Cambridge University Press. 5. Cox, G.W., 1972. Laboratory Manual of General Ecology. WM.C Brown Company Publisher, Iowa.
Course Lecturer	Dr. Edwi Mahadjoeno, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecturing/ cooperative learning	10.7	Exam (40%)
2	Demonstrate well-mannered work ethics	PLO5	C2-Comprehend	Lecturing/ discussion	5.3	Group presentation (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Lecturing/ discussion	5.3	Discussion (20%)
4	Demonstrate teamwork skills	PLO8	C2-Comprehend	Lecturing/ discussion	5.3	Discussion (20%)

Prepared by:	Certified by head department:
Name: Dr. Edwi Mahadjoeno, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152025	Academic Session/Semester	7
Course name:	Primatology	Pre/co requisite Course name and code if applicable	Biosystematic, Biosystematic Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Primatology course focuses on the biology of primates. Selected topics cover taxonomy, morphology, physiology, behavior, ecology and conservation of primates and their use as a biomedical research model and field observation techniques on primates' behavior.
References	1. Fleagle JG. 2013. Primate Adaptation and Evolution. Academic Press. 2. Lee PC. (ed). 2004. Comparative Primate Socioecology. Cambridge University Press. 3. Platt ML, Ghazanfar AA. (eds). 2010. Primate Neuroethology. Oxford University Press. 4. Ravosa MJ. and Dagosto M. (eds). 2007. Primate Origins: Adaptations And Evolution. Springer Science.
Course Lecturer	Dr. Tetri Widiyani, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	8	Midterm exam (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	8	Final exam (30%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Project-based learning	10.7	Journal review and presentation (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Tetri Widiyani, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152026	Academic Session/Semester	7
Course name:	Plant Reproduction	Pre/co requisite Course name and code if applicable	Plant Structure and Development, Practicum on Plant Structure and Development
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Plant Reproduction is a course on the sexual plant reproduction system. Plants are multicellular organisms characterized by a generational phasing from haploid (gametophyte) into diploid multicellular (sporophyte). Although in principle, this life cycle is similar in all plant groups, several variations occurring the development of reproductive structure. This indicates an evolutionary life cycle as a means to adapt to changes in the environment. Students demonstrate how plants reproduce and apply it in plant research development.
References	1. Lersten, N.L., 2004. Flowering Plant Embriology: with Emphasis on Economic Species. Blackwell Publishing. USA. 2. Rimawat K.G., Merillon J.M., Shivanna K.R. Reproductive Biology of Plants. 2014. CRC Press. 3. Russel S.D., Dumas C. 1992. Sexual Reproduction in Flowering Plants. Academic Press. Inc.
Course Lecturer	Ari Pitoyo, S.Si., M.Sc. Dr. Nita Etikawati, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	16	Writing test (60%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Lecturing/ collaborative learning	5.3	Presentation (20%)
3	Analyzing the potential for additional utilization of biological resources	PLO4	C5-Analyze	Lecturing/ collaborative learning	5.3	Paper (20%)

Prepared by:	**Certified by head department:**
Name: Ari Pitoyo, S.Si., M.Sc. Dr. Nita Etikawati, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152027	Academic Session/Semester	5
Course name:	Systematics of Phanerogamae	Pre/co requisite Course name and code if applicable	Biosystematics, Biosystematics Practicum, Plant Structure and Development, Plant Structure and Development Practicum.
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Systematics of Phanerogamae studies the life of seed-bearing plants, covering their characterization, phylogenetic relation, nomenclature, diversity, and economic value. This course also covers the characteristics of phanerogamae, its taxonomy among other organisms, basics of phanerogamae classifications, phylogenetic relation, and evolution of phanerogamae compared to other plants, characteristics, and classification of Pinophyta (Gymnospermae) and Magnoliophyta (Angiospermae).
References	1. Backer, C.A. and R.C. Bakhuizen van den Brink, Jr. 1963-1968. Flora of Java Vol. I-III. Groningen: P. Noordhoff. 2. Bhattacharyya, B. and B.M.Johri. 1998. Flowering Plants: Taxonomy and Phylogeny. New Delhi: Narosa Publising House. 3. Hutchinson, J.1959. The Families of Flowering Plants (Dicotyledoneae and Monocotyledoneae). Vol. I-II. Oxford: The Clarendon Press. 4. Lawrence, G.H.M. 1964. Taxonomy of Vascular Plants. New York: Macmillan Company. 5. Simpson, M.G. 2008. Plant Systematics. Elsevier Academic Press. California.
Course Lecturer	Suratman, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Lecture/ cooperative learning	8	Exam: quiz (30%)
2	Produce scientific paper or innovative products based on research	PLO3	C5-Synthesize	Project-based learning	5.3	Project based assignment (20%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C6-Evaluate	Project-based learning	8	Project based assignment (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO7	C4-Analyze	Lectures, discussion, and compiling paper	5.3	Assignment (20%)

Prepared by:	Certified by head department:
Name: Suratman, S.Si., M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

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<tr><td>Department:</td><td>Biology</td><td rowspan="2">Page</td><td rowspan="2">1 of 2</td></tr>
<tr><td>Faculty:</td><td>Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret</td></tr>
<tr><td>Course code:</td><td>09043152028</td><td>Academic Session/Semester</td><td>7</td></tr>
<tr><td>Course name:</td><td>Systematics of Phanerogamae Practicum</td><td rowspan="2">Pre/co requisite Course name and code if applicable</td><td rowspan="2">Biosystematics, Biosystematics Practicum, Plant Structure and Development, Plant Structure and Development Practicum.</td></tr>
<tr><td>Credit/ECTS:</td><td>1/1.33</td></tr>
<tr><td>Language</td><td>Indonesia</td><td>Relation to Curriculum</td><td>Elective</td></tr>
<tr><td>Workload</td><td colspan="3"><table><tr><td>Type</td><td>CSU</td><td>Face to Face</td></tr><tr><td>P</td><td>1</td><td>40 h</td></tr><tr><td>Total</td><td>1</td><td>40h (1.33 ECTS)</td></tr></table></td></tr>
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Course Synopsis	Systematics of Phanerogamae Practicum supports the Systematics of Phanerogamae course. Both are elective courses for the Bachelor Program in Biology. This course equips students with skills to recognize Spermatophyte, such as characteristics, classifications, taxonomic position, diversity, phylogenetic relation and economic value of Phanerogamae. Students can apply those skills to their research or final project. The practicum comprises sessions of practical classes with explanations on fundamental theories, practical activity, report making, and evaluation.
References	1. Backer, C.A. and R.C. Bakhuizen van den Brink, Jr. 1963-1968. Flora of Java Vol. I-III. Groningen: P. Noordhoff. 2. Bhattacharyya, B. and B.M.Johri. 1998. Flowering Plants: Taxonomy and Phylogeny. New Delhi: Narosa Publising House. 3. Hutchinson, J.1959. The Families of Flowering Plants (Dicotyledoneae and Monocotyledoneae). Vol. I-II. Oxford: The Clarendon Press. 4. Lawrence, G.H.M. 1964. Taxonomy of Vascular Plants. New York: Macmillan Company. 5. Simpson, M.G. 2008. Plant Systematics. Elsevier Academic Press. California. 6. Suratman. 2018. Petunjuk Praktikum Sistematika Tumbuhan Tinggi. Surakarta: Program Studi Biologi FMIPA UNS.
Course Lecturer	Suratman, S.Si., M.Si
Topics	1. Learning Contracts, Introduction and General Assistance 2. Systematics of the Division of Pinophyta/Gymnopsermae 3. Systematics of Basal Angiosperms and Magnoliid Complex 4. Basal Monocots Systematics 5. Systematics of the subclass Commelinidae 6. Systematics of the subclass Caryophyllidae 7. Systematics of the subclass Systematics 8. Systematics of the subclass Asteridae 9. Techniques for collection and preservation of Phanerogamae 10. Phanerogamae herbarium technique 11. Determination of Phanerogamae 12. Analysis of phylogenetic relation of Phanerogamae

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO2	C2-Comprehend	Lecture/ discussion	12	Exam: quiz (30%)

2	Mastering the application of instruments in the field of biology	PLO2	C2-Comprehend	Lecture/ discussion	8	Exam: quiz (20%)
3	Demonstrate teamwork skills	PLO8	C2-Comprehend	Project-based learning	12	Project-based learning assignment (30%)
4	Demonstrate fluency of information technology	PLO9	C2-Comprehend	Project-based learning	12	Project-based learning assignment (30%)

Prepared by:	Certified by head department:
Name: Suratman, S.Si., M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152029	Academic Session/Semester	5
Course name:	Numerical Taxonomy	Pre/co requisite Course name and code if applicable	Biosystematics, Biodiversity, and Evolutionary Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Numerical Taxonomy covers the grouping of living beings using the numerical method of taxonomic units into taxa based on their characteristics. This course studies the definition and scope of numerical taxonomy, basic principles of numerical taxonomy, the contribution of numerical taxonomy on science and knowledge, the relation of numerical taxonomy with other branches of knowledge, the relation of numerical taxonomy to phylogenetics and cladistic, benefits of studying numerical taxonomy, steps on working with numerical taxonomy, determination of Operational Taxonomic Units (OTU's), characteristics determination, scale and character code, cluster analysis, developing a dendrogram, data interpretation, and how to draw a conclusion based on the data analysis.
References	1. Rohlf, F.J.,NTSyst. Numerical Taxonomi and Multivariate Analysis System. Version 2.1.,Department of Ecology and Evolution State University of New York,2001. 2. Sneath, P.H.A and R.R. Sokal.,Numerical Taxonomy,W.H. Freeman and Co ,1973.
Course Lecturer	Suratman, S.Si. M.Si. Dr. Agung Budiharjo, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology as well as knowledge and technology related to biology	PLO1	C2-Comprehend	Lecture/ cooperative learning	8	Exam: quiz (30%)
2	Demonstrate a logical and systematic problem solving ability	PLO3	C5-Synthesize	Project-based learning	5.3	Project based assignment (20%)
3	Communicate effectively in Indonesian and English	PLO7	C4-Analyze	Lecture/ discussing and compiling papers	5.3	Assignment (20%)
4	Utilizing information technology in the workplace and following the development of science and technology	PLO9	C2-Comprehend	Project-based learning	8	Project-based learning (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Suratman, S.Si. M.Si. Dr. Agung Budiharjo, M.Si. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152030	Academic Session/Semester	7
Course name:	Food Fermentation Technology	Pre/co requisite Course name and code if applicable	Microbiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Fermented Food Technology is a course that focuses on techniques of making fermentation products, especially fermented foods. Students learn various techniques on making fermented food and beverages using bacteria (i.e., cheese, yogurt, kimchi) and fungi (bread, wine, beer, tempeh, soy sauce). Students explore modern fermentation techniques for fermented food production.
References	1. Stanbury PF, Whitaker A & Hall SJ. 1995. 2nd ed. Principles of Fermentation Technology. ButterworthHeinemann Oxford. 2. Hui YH, Meunier-Goddik L, Hansen AS, Josephsen J, Nip WK, Stanfield PS & Toldra F (eds). 2004. Handbook of Food and Beverages Fermentation. Marcel Dekker New York. 3. Bamfort, C.W. 2005. Food Fermentation and Microorganism. Blackwell science Oxford. 4. Adams MR & Nout MJR (eds). 2001. Fermentation and Food Safety. Aspen Publisher Maryland.
Course Lecturer	Tjahjadi Purwoko, M. Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Discussion	5.3	Written test (20%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Case study	10.7	Written test (20%) Paper task (20%)
3	Demonstrate a logical and systematic problem solving ability	PLO6	P3-Apply	Case study	10.7	Fermentation project (40%)

Prepared by:	**Certified by head department:**
Name: Tjahjadi Purwoko, M. Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152031	Academic Session/Semester	5
Course name:	Teratology	Pre/co requisite Course name and code if applicable	General biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Teratology course covers the definition, history, and theory on teratology, principles of teratology, causes of congenital malformation, teratogenesis mechanism, abnormal growth and development, mechanism of external factors entering the body, teratogenicity tests, and teratology behavior.
References	1. Hans Hedrich, J., 2012, The Laboratory Mouse, Second Edition (HANDBOOK OF EXPERIMENTAL ANIMALS) 2nd Edition, Elsevier Ltd, Amsterdam, London, Sandiego. 2. Smith J.B., 1986, Pemeliharaan, pembiakan dan penggunaan hewan percobaan di daerah tropis, Penerbit UI Press, Jakarta. 3. Yatim, W. 1994. Reproduksi dan Embryologi. Edisi Ketiga. Bandung.Penerbit Tarsito. 4. Sagi, M. 1999, Teratologi, Laboratorium Histologi, Fakultas Biologi UGM, Yogyakarta. 5. Swindle M. M, and A.C. Smith, Animal , 1994, Models in Biomedical Research, United States Department of Agriculture Agricultural Research Service National Agricultural Library Animal Welfare Information Center. 6. Tjay, T.H., dan Rahardja, K. 2002. Obat-obatan Penting Khasiat, Penggunaan dan Efek-efek Sampingnya. Edisi ke 5. Jakarta: PT Elex Media Komputindo. 7. Tumbleson, ME, 1986, Swine in Biomedical Research, Vol. 1-3, New York, NY, Plenum Press. 8. Von Recum, AF (ed.), 1986, Handbook of Biomaterials Evaluation. NY: Macmillan Publishing.
Course Lecturer	Prof. Dr. Okid Parama Astirin, M. Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture	16	Exam: quiz (30%) Exam: quiz (30%)
2	Demonstrate a logical and systematic problem solving ability	PLO6	C4-Analyze	Discussion	10.7	Individual assignment (20%); Presentation (20%)

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MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043152032	Academic Session/Semester	5
Course name:	Environmental Toxicology	Pre/co requisite Course name and code if applicable	Ecology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Environmental Toxicology course comprises in-class theoretical teaching and outclass teaching on environmental toxicology (definition, concepts, scope, the fate of chemical substances in the biogeochemical cycle, the fate of chemical substances in organism system, quantitative environmental toxicology, LC-50 and LD-50, experimental toxicology, TCLP (Toxicity Characteristic Leachate Procedure) for dangerous toxic substances (bahan berbahaya beracun-B3), valuation of the toxicity level in environmental conditions, the standard operating procedure of environmental toxicology laboratory.
References	1. Casarett & Doul. Casarett & Doul. Toxicology. Toxicology. The Basic Science of Poisons. The Basic Science of Poisons. 6 ed. Mac Graw Hill. 6 ed. Mac Graw Hill. 2001. 2. Morrow PE. Morrow PE. Dust Overloading of the Lungs. Dust Overloading of the Lungs. Update & Apraisal. Toxicol Appl Pharmacol 113:1-12, 1992. 3. Wyatt RJ, Shore D. Wyatt RJ, D. Shore Alumunium & Alzheimer's Disease. Aluminum's Disease & Alzheimer's Disease. J. J. Nerve Ment. Nerve Ment. Dis. 171:553-558, 1983. PUPPY. 171:553-558, 1983. 4. WHO. Technical Report Series. WHO. Technical Report Series. 513. 513. Safe Use of Pesticides. WHO. Safe Use of Pesticides. WHO. 1973. 1973. 5. WHO. Guidelines of Drinking water Quality. WHO. Guidelines of Drinking Water Quality. 2 nd. Ed. 2 nd. Ed. Vol I recommendations. Vol I recommendations. Geneva. Geneva. WHO. WHO. 1993. 1993. 6. WHO: IARC Monographs on the Evaluation of carcinogenic Risks to humans. Lyons, France WHO 1993. WHO: IARC Monographs on the Evaluation of Risks to Humans carcinogenic. Lyons, France WHO, 1993. 7. WHO: IPCS Environmental Health Criteria: Vol 134, Cadmium. WHO: IPCS Environmental Health Criteria: Vol 134, Cadmium. Geneva: WHO 1992 Geneva: WHO, 1992. 8. WHO: IPCS Environmental Health Criteria: Vol 61, Chromium. WHO: IPCS Environmental Health Criteria: Vol 61, chromium. Geneva: WHO 1988 Geneva: WHO, 1988. 9. WHO: IPCS Environmental Health Criteria for inorganic Lead: Vol 165, Cadmium. WHO: IPCS Environmental Health Criteria for inorganic Lead: Vol 165, Cadmium. Geneva: WHO 1995. Geneva: WHO, 1995.
Course Lecturer	Dr. Edwi Mahajoeno, M. Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Matering the concept of biology	PLO1	C2-Comprehend	Lecture/ cooperative learning	16	Exam (60%)

2	Demonstrate a logical and systematic problem solving ability	PLO6	C4-Analyze	Lecture and discussion	10.7	Discussion (40%)

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MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043251033	Academic Session/Semester	6
Course name:	Experimental Anatomy	Pre/co requisite Course name and code if applicable	Animal Structure and Development
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Elective

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	1	13.3h	13.3h	13.3h
	Total	1	40h (1.33 ECTS)		

Course Synopsis	Experimental Anatomy course studies the basics of biomedical experiments and tests. Students equip with types of test animals in biomedical research, maintenance and the use of experimental animals, animal welfare concepts, treatments and experiments on test animals, introduction to toxicology, types of xenobiotics and their toxicity, xenobiotic distribution, xenobiotic disposition, xenobiotic metabolism and excretion in the body, the target organ of xenobiotic, basic of anatomical pathology to evaluate treatments/experiments on the anatomical structure of the test animal.
References	1. Smith J.B., Pemeliharaan, pembiakan dan penggunaan hewan percobaan di daerah tropis, Penerbit UI Press, Jakarta, 1986. 2. Hans Hedrich, The Laboratory Mouse, Second Edition (Handbook of Experimental Animals) , 2nd Edition, Elsevier Ltd, Amsterdam, London, Sandiego, 2012. 3. Swindle M. M, and A.C. Smith, Animal , Models in Biomedical Research, United States Department of Agriculture Agricultural Research Service National Agricultural Library Animal Welfare Information Center , 1994. 4. Tumbleson, ME, Swine in Biomedical Research, Vol. 1-3, New York, NY, Plenum Press, 1986. 5. Von Recum, AF (ed.), Handbook of Biomaterials Evaluation, NY: Macmillan Publishing., 1986.
Course Lecturer	Prof. Dr. Okid Parama Astirin, M.S. Dr. Tetri Widiyani, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture, discussion and video review	3.3	Midterm, exam (25%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO4	C4-Analyze	Project-based learning	6.7	Journal review and presentation (50%)
3	Demonstrate well-mannered work ethics	PLO6	C3-Apply	Lecture, discussion, and video review	3.3	Final exam (25%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

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MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043251034	Academic Session/Semester	6
Course name:	Experimental Anatomy Practicum	Pre/co requisite Course name and code if applicable	Animal Structure and Development
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	Experimental Anatomy Practicum course is a practical class at the laboratory to study the maintenance and use of test animals, treatments on the test animal, how to administer solution on test animals, blood drawing from test animals, treatments effect on target organ/tissue/cell macroscopically and microscopically, and ways to evaluate treatments given on biomedical research.
References	1. Swindle M.M and A. C.Smith. , Animal Models in Biomedical Research, United States Department of Agriculture. Agricultural Research Service National Agricultural Library Animal Welfare Information Center., 1994. 2. Swindle M.M, Surgery, Anesthesia and Experimental Techniques in Swine, Ames, IA: Iowa State University Press. 3. Tumbleson, ME., Swine in Biomedical Research, Vol1-3, New York, NY, Plenum Press, 1986. 4. Von Recum, AF, Handbook of Biomaterials Evaluation. , Macmillan Publishing., 1986. 5. Smith, John B., Mangkoewidjojo, Soesanto. , Pemeliharaan, pembiakan dan penggunaan hewan percobaan di daerah tropis., Universitas Indonesia,, 1988.
Course Lecturer	Dr. Tetri Widiyani, M.Si
Topics	1. Laboratory Animals 2. Animal Welfare 3. Animal Handling 4. Xenobiotic treatment 5. Determination of treatment dose 6. Reproduction 7. Tissue/organ sampling and euthanasia

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Lecture, discussion and video review	20	Midterm and final exam (50%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO4	C3-Apply	Project-based learning	8	Work report (20%)
3	Demonstrate well-mannered work ethics	PLO6	C3-Apply	Project-based learning	8	Work report (20%)

4	Demonstrate teamwork skills	PLO8	C3-Apply	Project-based learning	4	Work report (10%)

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MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252035	Academic Session/Semester	6
Course name:	Bacteriology	Pre/co requisite Course name and code if applicable	Microbiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Bacteriology course focuses on studying bacteria cell and other procaryotic organisms (morphology, physiology, ecology, diversity, association with other organisms) and their benefits to humankind. Students demonstrate knowledge on solving problems caused by bacteria and use it as a part of available solutions.
References	1. Groisman, E.A. (ed). , Principles of Bacterial Pathogenesis. , Academic Press. California, 2011. 2. Rosenberg, E, E.F. Delong, S. Lory, E. Stackebrandt & F. Thompson (eds). , The Prokaryotes other major lineage of bacteria and archaea. (4th ed.), Springer New York, 2014.
Course Lecturer	Tjahjadi Purwoko, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C3-Apply	Lecture	13.3	Paper test 1 (20%) Paper test 2 (30%)
2	Produce scientific article or innovative products based on research	PLO3	C4-Analyze	Discussion	6.7	Paper test (25%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C6-Evaluate	Study case	6.7	Paper task (25%)

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MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252036	Academic Session/Semester	6
Course name:	Bioanthropology	Pre/co requisite Course name and code if applicable	Biological evolution
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Bioanthropology focuses on human life and their biological variations in the evolutionary frame. This course explains how human lives in the biological system and process resources to realize their aspirations. Supporting subjects selected are primate biological characteristics, human life cycle, learning ability, human adaptation and ecology, as well as migration and microevolution of humans.
References	1. John H. Relethford., The Human Species, An Introduction to Biological Anthropology. , McGraw-Hill. , 2010. 2. Roger Lewin., Human Evolution: An Illustrated Introduction., Blackwell Publishing Ltd., 2005. 3. Robert Jurmain, Lynn Kilgore, Wenda Trevathan., Essentials of Physical Anthropology. , Wadsworth, Cengage Learning., 2009. 4. Philip L. Stein, Bruce M. Rowe, Physical Anthropology., The McGraw-Hill Companies, Inc., 2006. 5. Barry Bogin, Holly Smith, Evolution of the Human Life Cycle. , American Journal of Human Biology, 8, , 1996. 6. Barry Bogin., Evolutionary Perspective on Human Growth. , Annual Reviews of Anthropology , 28, , 1999. 7. Katerina Semendeferi, Nicole Barger And Natalie Schenker, The Human Brain Evolving. , Stone Age Institute Press., 2010. 8. Katerina Semendeferi, Nicole Barger And Natalie Schenker, The Human Brain Evolving. , Stone Age Institute Press., 2010. 9. Norgan NG, Laboratory and field measurements of body composition., Public Health and Nutrition, 8, 7A, 2005. 10. Norton K, Olds T (Eds). , Anthropometrica., University of New South Wales Press, Sydney, 1996.
Course Lecturer	Dr. Tetri Widiyani, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture and discussion	13.3	Mid term (25%); final exam (25%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Study case and presentation	13.3	Journal review and presentation (50%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name: Dr. Tetri Widiyani, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252037	Academic Session/Semester	6
Course name:	Bioenergy	Pre/co requisite Course name and code if applicable	Physics, Chemistry, Mathematics, and General Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Bioenergy course equips students with a comprehensive understanding of new sustainable fuel based on biomass, details and availability of biomass, biomass characteristics concerning bio-based fuel production, concepts of first to third-generation bio-based fuel (taken from agricultural and biomass waste), operationalization of bioenergy generator, as well as analysis and design of the biobased fuel production process.
References	1. Robert C. Brown. , Biorenewable Resources: Engineering New Products from Agriculture. , Wiley-Blackwell Publishing, 2003. 2. American Society for Microbiology , Bioenergy. , ASM Press Washington, 2008.
Course Lecturer	Dr. Edwi Mahajoeno, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology as well as knowledge and technology related to biology	PLO1	C2-Comprehend	Lecture and discussion	8	Exam (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Study case/ cooperative learning/ team based project	8	Exam (30%)
3	Demonstrate a logical and systematic problem solving ability	PLO6	C4-Analyze	Lecture and discussion	5.3	Discussion (20%)
4	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C5-Synthesize	Lecture and discussion	5.3	Quiz (10%) and individual assignment (10%)

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MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252038	Academic Session/Semester	6
Course name:	Biocontrol	Pre/co requisite Course name and code if applicable	Physics, Chemistry, Mathematics, and General Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biocontrol course studies the definition of biocontrol, the current development of biocontrol, biological control of pests using natural enemies (predators, parasites, entomopathogens), classical biocontrol compared to inundative release (release of natural enemy bred in the laboratory), sterile male technique, biocontrol of disease vector (mosquito), biocontrol of plant diseases, types of antagonistic agents for plant diseases, the use of antagonistic agents with habitat management, the development of biocontrol technology, technical abilities on the use of soil bacteria as biocontrol agents.
References	1. Bellows, T.S., Fisher, T.W. Eds. 1999. Handbook of Biological Control Principles and Applications of Biological Control. 2. Mahr, S.E.R., Cloyd R.A., Mahr, D.L & Sadof, C.S. 2001. Biological Control of insects and othter pests of Greenhouse crops.
Course Lecturer	Prof. Dr. Sugiyarto, M.Si. Tjahjadi Purwoko, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Lecture and discussion	5.3	Written test (20%)
2	Mastering the knowledge and technology related to biology	PLO1	C3-Apply	Lecture and discussion	5.3	Written test (20%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Lecture and discussion	10.7	Written test (20%) Paper task (20%)
4	Demonstrate well-mannered work ethics	PLO5	C3-Apply	Lecture and discussion	2.7	Written test (10%)
5	Demonstrate a logical and systematic problem solving ability	PLO6	C3-Apply	Lecture and discussion	2.7	Written test (10%)

Prepared by:	Certified by head department:
Name: Prof. Dr. Sugiyarto, M.Si. Tjahjadi Purwoko, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252039	Academic Session/Semester	6
Course name:	Fungal Biology and Application	Pre/co requisite Course name and code if applicable	Microbiology, Microbiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This is a course on fungal biology and its application in human lives. Selected topics cover the classifications of fungi, yeast and morphology of fungi, nutrition and metabolism, life cycle and reproduction, pathogenic fungi, edible mushroom, fungi for food and feed industry, pharmaceutical commodity derived from fungi, biotechnology of enzyme and other protein from fungi, also the role of fungi in agriculture and environment.
References	1. Kavanagh K. , Fungi Biology and Application. 2nd Ed, Chichester: Wiley-Blackwell, 2011. 2. Miguel A Naranjo-Ortiz, Toni Gabaldon, Fungal Evolution: diversity, taxonomy and phylogeny of the fungi, Biological Reviews, -, 94, 2019, Cambridge Philosophycal Society. 3. Gupta S, Gupta M, Summuna B, Annepu SK. , Edible Mushrooms: Cultivation, Bioactive Molecules, and HealthBenefifits, Springer International Publishing AG, 2018.
Course Lecturer	Dr. Ratna Setyaningsih, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecture and collaborative learning	13.3	Written exam (50%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Project-based learning	8	Paper (30%)
3	Demonstrate effective communication in either Indonesian or English language	PLO7	P4-Demonstrate	Project-based learning	2.7	Presentation (10%)
4	Demonstrate fluency of information technology	PLO9	P4-Demonstrate	Project-based learning	2.7	Presentation (10%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name: Dr. Ratna Setyaningsih, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252040	Academic Session/Semester	6
Course name:	Regenerative Biology	Pre/co requisite Course name and code if applicable	Animal Physiology, Animal Physiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Regenerative Biology course studies regeneration in living beings, cellular turnover of stem cells and other parts of organ/tissue to maintain homeostatic condition. This course also covers subjects, inter alia senescence/aging, degeneration, and regeneration. For example, hematopoiesis of blood cell formation after bleeding and extreme regeneration of frog and mouse by forming replica of their feet after cut. This course also discusses the method and applications of tissue engineering. Through this course, students demonstrate fluency in observing regeneration biology problems, information technology to collect data, processing, analyzing, and compile observational results in the form of a written resume presented in the classroom.
References	1. Carlson, B.M, Principles of Regenerative Biology, Academic Press, 2007. 2. Scotum, D, Foundation of Regenerative Biology and Medicine, IOP Publishing, IOP, 2018. 3. Scotum, D, Regenerative Biology and Medicine. 2nd Edition, Academic Press., 2012. 4. Atala, A., et al, Principles of Regenerative Medicine. 3rd Edition, Academic Press., 2019.
Course Lecturer	Elisa Herawati, M.Eng., Ph.D

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecturing and collaborative learning	5.3	Written exam (20%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Case-based study	6.7	Presentation (25%)
3	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Case-based study	6.7	Presentation (25%)
4	Demonstrate teamwork skills	PLO8	C3-Apply	Lecturing and collaborative learning	2.7	Participation (10%)
5	Demonstrate fluency of information technology	PLO9	C3-Apply	Lecturing and collaborative learning	5.3	Report (20%)

Prepared by:	Certified by head department:
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MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252041	Academic Session/Semester	6
Course name:	Soil biology	Pre/co requisite Course name and code if applicable	General biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Soil Biology focuses on the definition of soil, physical and chemical characteristics of soil, soil fertility, soil health, organic farming, soil diversity and food web, soil microorganisms, organic substance decomposition, contagious plant diseases spread through the soil, soil microorganisms that enhance plant growth, soil bioremediation, and paddy soil characteristics.
References	1. Alberto Orgiazzi1, Richard D. Bardgett2, Edmundo Barrios 3, Valerie Behan-Pelletier4, María J. I. Briones5, Jean- Luc Chotte6, Gerlinde B. De Deyn7,8, Paul Eggleton9, Noah Fierer10, Tandra Fraser11, Katarina Hedlund12, Simon Jeffery13, Nancy C. Johnson14, Arwyn Jones1, Ellen Kandeler15, Nobuhiro Kaneko16, Patrick Lavelle17, Philippe Lemanceau18, Ladislav Miko19, Luca Montanarella1, Fatima M. S. Moreira20, Kelly S. Ramirez8, StefanScheu21, Brajesh K. Singh22, Johan Six23, Wim H. van der Putten8,7, Diana H. Wall24., Global Soil BiodiversityAtlas, Europian Union, 2015. 2. Awale, R., Ghimiri, R,. Machado, S., Bista, P, Soil Health, ResearchGate, 2017, https://www.researchgate.net/publication/317648217. 3. Barbieri, E., Agostini, D., Ceccaroli, P., Stocchi, V, Soil Biology, , 2013, https://www.researchgate.net/publication/278658027.
Course Lecturer	Prof. Dr. Sugiyarto, M.Si Dr. Ratna Setyaningsih, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Lecturing and discussion	8	Exam (30%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Lecturing and discussion	5.3	Presentation (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Lecturing and discussion	13.3	Exam, demonstration, practice, paper (50%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Prof. Dr. Sugiyarto, M.Si Dr. Ratna Setyaningsih, M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252042	Academic Session/Semester	6
Course name:	Biology of Aquatic Plant	Pre/co requisite Course name and code if applicable	Plant Physiology, Plant Physiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Undergraduate students that focus on forms of water bodies, plant zonation (freshwater, transitional zone, and saltwater), the morphological adaptation of aquatic plants, physiological adaptations of aquatic plants, heterophile and affecting factors, aquatic plant reproduction, dynamics of aquatic plants and their specific interactions, aquatic plant nutrition, aquatic plant as a weed, and phytoremediation.
References	1. Cook C. D. K. , Aquatic Plant Book. , SPB Academic Publishing, The Hague., 1990. 2. Kirk JTO. , . Light and Photosynthesis in Aquatic Ecosystems. , Cambridge University Press. , 2010. 3. Viana DS., Can Aquatic Plants Keep Pace with Climate Change? , Front. Plant Sci. , 8, 1906, 2017, www.frontiersin.org. 4. Zhang P, Grutters BMC, van Leeuwen CHA, Xu J, Petruzzella A, van den Berg RF and Bakker ES , Effects of Rising Temperature on the Growth, Stoichiometry, and Palatability of Aquatic Plants. , Front. Plant Sci. , 9, 1947, 2019, www.frontiersin.org.
Course Lecturer	Dr. Widya Mudyantini, S.Si.M.Si Dr. Solichatun, S.Si. M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 1 (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 2 (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Cooperative learning/ class discussion	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Widya Mudyantini, S.Si.M.Si Dr. Solichatun, S.Si. M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252043	Academic Session/Semester	5
Course name:	Biology of Plant Virus	Pre/co requisite Course name and code if applicable	Microbiology, Microbiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biology of Plant Virus is an interactive course where students and lecturers discuss problems related to cases of plant viral diseases. Subjects in this course cover plant virus nomenclature, virus structure, virus grouping based on its virulence, genome viral structure, gene function, the viral gene for transgenic plants.
References	1. Suranto, Virologi Tumbuhan, Graha Ilmu , 2014.
Course Lecturer	Prof. Drs. Suranto, M.Sc, Ph.D

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology as well as knowledge and technology related to biology	PLO1	C2-Comprehend	Lecturer and discussion	13.3	Exam (50%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C6-Arrange	Lecturer and discussion	13.3	Exam (50%)

Prepared by:	**Certified by head department:**
Name: Prof. Drs. Suranto, M.Sc, Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252044	Academic Session/Semester	6
Course name:	Biotechnology of Secondary Metabolite	Pre/co requisite Course name and code if applicable	Biochemistry, Biochemistry Practicum, Cell Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biotechnology of Secondary Metabolites is a course on basic concepts of secondary metabolites compound, biosynthesis, the bioactivity of secondary metabolites, in-vitro production of secondary metabolites, elicitation techniques, biotic and abiotic elicitors, engineering production through bioreactor and its application. Through this course, students are equipped with basic knowledge on exploring natural compounds that can also help their final projects. This course comprises direct teaching and discussion and independent tasks related to applying natural compounds in human life.
References	1. Smith RH. , Plant Tissue Culture, Third Edition: Techniques and Experiments, AP Press, 2012. 2. Napier S and Bingham M. , Plant Cell and Tissue Culture – A Tool in Biotechnology, Springer, 2009. 3. Crozier A, Clifford MN, and Ashihara H. , Plant Secondary Metabolites: Occurence, Structure and Role in the Human Diet, Blackwell Publishing, 2006. 4. Lewis, WH, Medical Botany, John Wiley & Sons, 2003.
Course Lecturer	Dr. Artini Pangastuti, S.Si. M.Si Dr. Solichatun, S.Si. M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	6.7	Written test exam 1 (25%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	6.7	Written test exam 2 (25%)
3	Analying the potential for further utilization of biological resources	PLO4	C4-Analyze	Project-based method/ group discussion	13.3	Paper and presentation 1 (25%) Paper and presentation 2 (25%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Artini Pangastuti, S.Si. M.Si Dr. Solichatun, S.Si. M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252045	Academic Session/Semester	6
Course name:	Biotechnology of Waste Treatment	Pre/co requisite Course name and code if applicable	General Biology, General Biology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biotechnology of Waste Management course equips students with an introduction to biologically processed waste management (general review, purposes, the role of microorganisms, types biological process for processing wastewater);, organic pollutant measurement (physical, chemical, biological), assessment of organic content in waste, basic of microbial growth kinetics (dissolved substrate utilization rate, oxygen absorption rate, biological processing system, anaerobic suspension treatment), modification of ASP (complete mixture of active mud, oxygenated active mud, oxidation pool, stabilization pool), aerobic attached-growth processes biological treatment (filter trickling, oxygen transfer and use, application of rotating biological contactor, bio-towers), anaerobic decomposition (anaerobic fermentation mechanism, multistep processes, microbiology and biochemistry of anaerobic processes, substrate inhibition, optimal anoxic environment).
References	1. Awuchi, C.G., Awuchi, C.G., Twinomuhwezi, H., Victory, I.S, Industrial Waste Management, Treatment, andHealthIssues: Wastewater, Solid, and Electronic Wastes, European Academic Research, VIII, 2, 2020. 2. Nduka Okafur , Modern Industrial Microbiology and Biotechnology, Science Publishers Enfield NHUSA, 2007. 3. Buyukgungor, H., Gurel, L, The role of biotechnology on the treatment of wastes, African Journal of Biotechnology, 8, 25, 2009. 4. Fahad, A., Al-Sahari, M., Mohammed, RMSR, Wastewater and its Treatment Techniques: An Ample Review, Indian Journal of Science and Technology, -, -, 2019, ResearchGate.
Course Lecturer	Dr. Edwi Mahajoeno Dr. Ratna Setyaningsih, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Collaborative learning	13.3	Written exam (50%)
2	Produce scientifix article or innovative products based on research	PLO3	P4-Produce	Project-based learning	5.3	Paper (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO7	C5-Synthesize	Project-based learning	5.3	Paper (20%)

4	Utilizing information technology to keep abreast the latest development in science and technology	PLO9	C4-Analyze	Project-based learning	2.3	Presentation (10%)

Prepared by:	Certified by head department:
Name: Dr. Edwi Mahajoeno Dr. Ratna Setyaningsih, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252046	Academic Session/Semester	4
Course name:	Biotechnology of Antimicrobial Compound	Pre/co requisite Course name and code if applicable	Microbiology Cell and Molecular Biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Biotechnology of Antimicrobial Compounds course studies definition of antimicrobials and antibiotics, antibiotic-producing organism, antibiotic classification, mode of action, resistance, biosynthesis, genetic engineering, screening of antibiotic-producing microorganism, in-vitro microbial activity test, types of antimicrobial compounds from plants and animals, science and technology development on the antimicrobial compound, analysis potential of bioresources as antimicrobial compounds.
References	1. Attimarad, S.L., Ediga, G.N., Karigar, A.A., Karadi, R., Chandrashekhar, N. dan Shivanna, C., Screening, isolationand purification of antibacterial agents from marine actinomyces., International Current Pharmaceutical Journal, 1, 12, 2012. 2. Etebu, E., Arikekpar, I., Antibiotics: Classification and mechanisms of action with emphasis on molecular perspectives, IJAMBR, 4, -, 2016. 3. Gyawali, R., Ibrahim, S, Natural products as antimicrobial agents, Food Control, 46, -, 2014, Elsevier. 4. Kapoor, G., Saigal,S. Elongavan,A, Action and resistance mechanisms of antibiotics: A guide for clinicians, Journal of Anaesthesiology Clinical Pharmacology |, 33, -, 2017, Wolters Kluwer – Medknow. 5. Katiyar, C., Gupta, A., Kanjilal, S. dan Katiyar,S., Drugs discovery from plant sources: an integrated aprroach., AnInternational quarterly Joyrnal of Research in Ayurveda, 33, 1, 2012. 6. Kumar, S. dan Varela, M.F. 2013. Di dalam Mendéz-Vilas, A. Microbial Pathogens and strategies for combatingthem: science, technology and education., Molecular mechanisms of bacterial resistance to antimicrobial agents., Formatex , -, -, 2013. 7. Procopio, R.E.L., da Silva, I. R., Martins, M.K., Azevedo, J.L. dan Araujo, J.M. . 466-471, Antibiotics producedbyStreptomyces, The Brazilian Journal of Infectious Diseases., 16, 5, 2012. 8. Radulovi?, N.S., Blagojevi?, P.D., Stanojovi?-Radi?, Z.Z. dan Stojanovi?, N.M.. , Antimicrobial plant metabolites: structural diversity and mechanism of action, Current Medicinal Chemistry, 20, -, 2013.
Course Lecturer	Dr. Ratna Setyaningsih, M.Si Dr. Ari Susilowati, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology molecular and cellular level in terms of compounds antimicrobial	PLO1	C2-Comprehend	Lecturer, discussion, make a paper	8	Exam: quiz (30%)

2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Making paper	5.3	Paper (20%)
3	Analyzing the potential of biological resources to improve the benefits	PLO4	C4-Analyze	Lecturer and discussion	10.7	Exam: quiz (40%)

4	Demonstrate effective communication in either Indonesian or English language	PLO7	C2-Comprehend	Presentation	2.3	Presentation (10%)

Prepared by:	**Certified by head department:**
Name: Dr. Ratna Setyaningsih, M.Si Dr. Ari Susilowati, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252047	Academic Session/Semester	6
Course name:	Economic Botany	Pre/co requisite Course name and code if applicable	General biology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Economic Botany course focuses on the economic aspects of plants in human lives. This course covers the limitation and scope of economic botany, its role in human lives, the economic aspect of plants as sources of commodities (fibers, gum and resin, rubber and latex, tannin and dye, non-wood forest products, medicine, food, decorative, bamboo, rattan, algae, lichens, bryophytes and pteridophyte). This study also discusses the prospect of developing economic plants for human lives in the future.
References	1. Hill, A.F. , Economic Botany: A Textbook of Useful Plants and Plant Products, McGraw Hill Book. Co., New York, 1952. 2. Robert, V. , Economic Botany, print version, -, Journal no. 12231, 2017, ISSN: 0013-0001. 3. Robinson, R., Plant Sciences, Macmillan References USA., 2001. 4. Smith, G. M, A Textbook of General Botany, Urheberrechtlich Geschutzles Material., 1993. 5. Winter, W.P., de. And V.B Amoroso , Plant Resources of South-East Asia (PROSEA), PROSEA Foundation, 2003.
Course Lecturer	Dr. Widya Mudyantini, M.Si Tanjung Ardo, S.Si, M.Sc.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Learning and discussion	10.7	Exam (40%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Presentation	5.3	Paper (20%)
3	Utilizing information technology in the workplace and following the development of science and technology	PLO9	C3-Apply	Lecturing and discussion	10.7	Exam (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Widya Mudyantini, M.Si Tanjung Ardo, S.Si, M.Sc. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252048	Academic Session/Semester	6
Course name:	Animal Ecophysiology	Pre/co requisite Course name and code if applicable	Animal physiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Animal Ecophysiology course combines physiological topics: comparative ecology, environment, evolution, and organism. Students exhibit an understanding of animal strategic adaptation in the face of physiological challenges in their habitat. This course also covers animal adaptation in extreme environments (desert, pole, highland, deep sea), where environmental conditions hinder their survival. After following this course, students master the concept of environmental changes in animal life. Students need to work on independent and group resumes that will be presented and discussed in the classroom.
References	1. Randal, D., W. Burggren, and K. French. 1997. Eckert Animal Physiology: Mechanism and Adaptations. New York: W. H Freeman and Company. 2. Reddy, P.B. 2015. Textbook of Animal Physiology. IMRF Publication. India. 3. Willmer P, G.Stone, I. Johnston. 2005. Environmental Physiology of Animals 2nd edition. Blackwell Pub. Ltd 4. Jurnal bereputasi terkait ekofisiologi hewan
Course Lecturer	Dr. Shanti Listyawati, M.Si. Elisa Herawati, M.Eng., Ph.D

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Lecturing, discussion and evaluation	5.3	Exam (20%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Lecturing, discussion and evaluation	5.3	Exam (20%)
3	Demonstrate professional attitude	PLO5	C1-Knowledge	Lecturing, discussion and evaluation	5.3	Exam (20%)
4	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Lecturing, discussion and evaluation	8	Paper (30%)

5	Demonstrate effective communication in either Indonesian or English language	PLO7	C3-Apply	Lecturing, discussion and evaluation	2.7	Presentation (10%)

Prepared by:	Certified by head department:
Name: Dr. Shanti Listyawati, M.Si. Elisa Herawati, M.Eng., Ph.D May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252049	Academic Session/Semester	6
Course name:	Plant Ecophysiology	Pre/co requisite Course name and code if applicable	Plant physiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Plant Ecophysiology is an elective course on the study of the biosphere as a place to grow, basics of response and adaptive mechanisms, morphological adaptations, anatomy and physiology, plant responses to light, plant responses to extreme temperatures, plant responses to water stress, plant responses to toxic gasses, plant responses to nutrition and mineral stress, plant responses to anthropogenic stress, and interaction between organisms (competition, predation, allelopathy, and parasitism).
References	1. Lambers H, Chapin FS, and Pons TL. , PLant Physiological Ecology. , Springer. , 2008. 2. Nobel PS., Physicochemical and Environmental Plant Physiology. , Associate Press. , 2009. 3. Bechtold U., Plant Life in Extreme Environments: How Do You Improve Drought Tolerance? , Front. Plant Sci. , 9, 543, 2018, www.frontiersin.org. 4. Fernandez-Marin B, Gulias J, Figueroa CM, Iniguez C , Clemente-Moreno MJ , Nunes-Nesi A, Fernie AR , Cavieres LA , Bravo LA, Garcia-Plazaola JI and Gagoi J. , How do vascular plants perform photosynthesis in extreme environments? An integrative ecophysiological and biochemical story., The Plant Journal , 101, 101, 2020, Wiley-Blackwell.
Course Lecturer	Dr. Solichatun, S.Si. M.Si. Ari Pitoyo, M.Sc.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Cooperative learning/class discussion	8	Written test 1/ exam (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/class discussion	8	Written test 2/ exam (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Case study/group discussion	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Solichatun, S.Si. M.Si. Ari Pitoyo, M.Sc. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252050	Academic Session/Semester	6
Course name:	Animal Ecomorphology	Pre/co requisite Course name and code if applicable	Animal Structure and Development; Animal Structure and Development Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Animal Ecomorphology is an elective course that focuses on the suitability of vertebrate morphological structure to their environment. This course covers biological adaptations, the morphology of various animal feeding apparatuses, the morphology of fossorial, cursorial, saltatorial, scansorial, volant, and aquatic animals.
References	1. Milton Hildebrand, Analysis of Vertebrate Structure. , John Wiley & Sons, 1988.
Course Lecturer	Dr. Tetri Widiyani, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 1/ exam (30%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Cooperative learning/ class discussion	8	Written test 2/ exam (30%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Case study/ group discussion	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Tetri Widiyani, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252051	Academic Session/Semester	6
Course name:	Endocrinology	Pre/co requisite Course name and code if applicable	Animal Physiology, Animal Physiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Endocrinology course comprehensively studies the hormone system, i.e., hormone classification, cell and organ producing hormones, hormonal working mechanism on target cells, hormone secretion and synthesis control, and hormone-related research. After following this course, students exhibit a comprehensive understanding of the function and control mechanism of hormonal synthesis and secretion, hormonal pathophysiology and analyze and solve problems caused by hormonal factors.
References	1. Squieres, E.J., , Applied Animal Endocrinology, CABI Publishing, Cambridge. USA., 2013. 2. http://www.who.int/ipcs/publications/en/ch3.pdf , 2017.
Course Lecturer	Dr. Shanti Listyawati, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Case study/ collaborative learning	10.7	Exam (40%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C3-Synthesize	Case study/ collaborative learning	10.7	Paper and presentation (40%)
3	Demonstrate effective communication in either Indonesian or English language	PLO7	C2-Comprehend	Presentation/ collaborative learning	5.3	Presentation (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Shanti Listyawati, S.Si., M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252052	Academic Session/Semester	6
Course name:	Entomology	Pre/co requisite Course name and code if applicable	Biosystematics, Biosystematics Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Entomology is an optional course for students of the Bachelor Program in Biology, which covers a detailed study of insects, i.e., phylogeny and classification, anatomy and physiology, sensory system, behavior, reproduction, development, life cycle, biogeography, evolution, types of insects (soil insect, water insect, agricultural insect, and vector insect), collection and preservation methods, as well as curation and identification
References	1. Borror, D.J., C. A. Triplehorn and N. F. Johnson. 1992. Pengenalan Serangga, ed. 6. Terjemahan drh. Soetiyono Partosoejono MSc. Gajah Mada Univ. Press. 2. Borror, D.J. and R. E. White. 1987. A. Field Guide to the Insects. National Audubon and National Wildlife Federation USA. 3. Kerkut GA, Gilbert LI. 1985. Comprehensive Insect Physiology Biochemistry and Farmacology. Oxford. Pergamon Press. 4. Gullan, P. J and P. S Cranston. 2010. The Insect. An Outline of Entomology. WileyBlackwell. A John Wiley & Sons, Ltd.
Course Lecturer	Dr. Agung Budiharjo, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concepts of biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	13.3	Exam (50%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C6-Arrange	Lecturing/ collaborative learning	13.3	Exam (50%)

Prepared by:	**Certified by head department:**
Name: Dr. Agung Budiharjo, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252053	Academic Session/Semester	6
Course name:	Post-Harvest Physiology and Technology	Pre/co requisite Course name and code if applicable	Plant Physiology, Plant Physiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Post-Harvest Physiology and Technology course studies the definition of post-harvest, pre-harvest factors affecting post-harvest quality and physiology, phytochemistry changes during the accumulator organ growth, control in ripening and maturation, signs of harvest, damage in harvest, causes of physiological damage, respiration, transpiration, role of the dynamics of ethylene and other hormones during maturation, morphological and chemical changes during maturation and aging, atmospheric-controlled and modified storage, application of post-harvest technology on various crops (cereals, tubers, beans, vegetables, fruits, decorative plants, and medicinal plants).
References	1. Anggrahini, S. dan Suwedo, Perubahan-perubahan Bahan Pangan selama Proses Pematangan Sesudah Panen, PAU Pangan dan Gizi Universitas Gajah Mada. Yogyakarta., 1988. 2. Apandi, M, Teknologi Buah dan Sayur, IPB Press. Bandung, 1984. 3. Brody, A.L. , Controlled/Modified Atmosphere/Vacuum Packaging of Foods, Food & Nutrition Press, Inc., Connecticut., 1989. 4. Chakraverty, A., and Sigh, R.P. , Postharvest Technology: Cereal, Pulses, Fruits and Vegetables., Science Publishers. Inc. USA., 2001. 5. Gardjito, M., and Swasti, Y. R., Fisiologi Pascapanen Buah dan Sayur., UGM Press, 2018. 6. Giovannoni, J.J. , Molecular Biology of Fruit Maturation and Ripening, Plant Molecular Biology., 52:725–749., -, 2001, Plant Molecular Biology. 7. Kader, A.A., Kasmire, R.F., Mitchell, F.G., Reid, M.S., Sommer, N.F., and Thomson, J.F. , Postharvest Technology of Horticultural Crops, University of California, 1985. 8. Kays, S. , Postharvest Physiology of Perishable Plant Product, AVI Book. New York., 1997. 9. Lieberman, M. , Post-Harvest Physiology and Crop Preservation, Plenum Press. New York., 1983. 10. Ostergaard, L. , Fruit Development and Seed Dispersal., Annual Plant Reviews, 38, -, 2010, Blackwell Publishing Ltd. United Kingdom. 11. Pantastico, ER. B. , Fisiologi Pascapanen, Penanganan dan Pemanfaatan Buah-buahan dan Sayur-sayuran Tropika dan Subtropika, Gajah Mada University Press. Yogyakarta, 1986. 12. Santoso, B.B., dan B.S. Purwoko. , Fisiologi dan Teknologi Pasca Panen Tanaman Hortikultura, Indonesia Australia Eastern Universities Project Report. Jakarta., 1995. 13. Winarno, F.G., Kimia Pangan dan Gizi., PT.Gramedia, 2004.
Course Lecturer	Dr. Widya Mudyantini, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	10.7	Exam (40%)

2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	10.7	Exam (40%)

3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C3-Apply	Lecturing/ collaborative learning	5.3	Paper, presentation (20%)

Prepared by:	**Certified by head department:**
Name: Dr. Widya Mudyantini, S.Si., M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252054	Academic Session/Semester	6
Course name:	Physiology of Plant Development	Pre/co requisite Course name and code if applicable	Structure of plant development, Plant physiology
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Physiology of Plant Development course studies the physiological aspects of plant organ formation resulting from endogenous and environmental factors. The physiological aspect of the study is related to the organ structure and function during the development in various conditions, from the molecular level, cell, into plant individual.
References	1. Beckman, T. , Root Development: Annual Plant Development Volume 37. , Wiley Blackwell. UK. , 2010. 2. Inze,D., Cell Cycle Control and Plant Development :Annual Plant Reviews. , Blackwell Publishing Ltd. UK. , 2007. 3. Siqueira JA, Otoni WC and Araujo WL, The hidden half comes into the spotlight: Peeking inside the black box of root developmental phases., Plant Communications, 3, 100246, 2021, Cell Press, Elsevier Inc. 4. Begcy K and Dresselhaus T, Epigenetic responses to abiotic stresses during reproductive development in cereals, Plant Reproduction , 31, 31, 2018, Springer.
Course Lecturer	Dr. Solichatun, S.Si., M.Si Ari Pitoyo, S.Si., M.Sc

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test/ exam 1 (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test/ exam 2 (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C5-Synthesize	Case study/ group discussion	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Solichatun, S.Si., M.Si Ari Pitoyo, S.Si., M.Sc May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252055	Academic Session/Semester	6
Course name:	Molecular Genetics	Pre/co requisite Course name and code if applicable	Genetics, Genetics Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	The Molecular Genetics course studies gene structure and function at the molecular level and how gene expression is controlled and passed from generation to generation. Selected subjects cover DNA structure, DNA chemistry, transcription, translation, DNA recombinant technology, control in gene expression in prokaryotes and eukaryotes, DNA mutations, repair mechanisms, extrachromosomal inheritance, marker-assisted selection (MAS) and its application inbreeding technology.
References	1. Michael S.D. Kormann (editors), Modern Tools for Genetics Engineering, ExLi4EvA, 2016, https://en.id1lib.org/book/3048145/2240e3?dsource=recommend. 2. Klug, W.S., Cummings, M.R., Spencer, C.A. and Palladino, M.A, Essentials of Genetics, Pearson Boston, 2013. 3. Larry Snyder, Joseph E. Peters, Tina M. Henkin, Wendy Champness, Molecular Genetics of Bacteria, ASM Press, 2013, https://en.id1lib.org/book/2653916/c91857. 4. Terry Brown , Introduction to Genetics. A Molecular Approach, GS New York, 2012, https://en.id1lib.org/book/3270366/7673c0.
Course Lecturer	Prof. Drs. Sutarno, M.Sc.Ph.D Dr. Nita Etikawati, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Collaborative learning	13.3	Exam (50%)
2	Produce scientific article or innovative products based research	PLO3	C5-Synthesize	Case-based methods	6.7	Paper (25%)
3	Demonstrate professional attitude	PLO5	C1-Knowledge	Project-based methods	6.7	Presentation (25%)

Prepared by:	**Certified by head department:**
Name: Prof. Drs. Sutarno, M.Sc.Ph.D Dr. Nita Etikawati, S.Si., M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252056	Academic Session/Semester	6
Course name:	Ichthyology	Pre/co requisite Course name and code if applicable	Biosystematics, Biosystematics Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course covers principles of ichthyology study, fish characteristics, diversity, body structure, ecology, fish distribution, common behavior and feeding behavior, communication, reproduction concept, basic techniques on fish cultivation, and conservation.
References	1. Allen, G. 2000. Marine Fishes of South East Asia. Periplus Edition (HK) Ltd. Singapore. 2. Biswas, S.P. 2000. Manual of Methods in Fish Biology. South Asian Publishers Pvt Ltd. New Delhi. 3. Effendie, M.I. 1997. Biologi Perikanan. Yayasan Pustaka Nusantara. Yogyakarta 4. Evans, D.H. 1998. The Physiology of Fishes. CRC Press. New York. 5. Hildebrand, M. 2000. Analysis of Vertebrae Structure. John Wiley and Sons Inc. New York. 6. Kottelat, M., Whitten, A.J., Kartikasari, S.D., and Wirjoatmodjo, S. 1993. Freshwater Fishes of Western Indonesia and Sulawesi. Periplus Edition (HK) Ltd. In collaborated wirh EMDI Project. 7. Moyle, P.B. and Cech, J.J. 1992. Fishes: An Introduction to Ichthyology. Prentice Hall. Newe Jersey. 8. Nelson, J.S. 1996. Fishes of the World. John Wiley and Sons. New York. 9. Shreck, C.B. and Moyle, P.B. 2002. Methods for Fish Biology. American Fisheries Society. Maryland. 10. Wooton, R.J. 1992. Fish Ecology. Blackie. Chapman and Hall. New York
Course Lecturer	Dr. Agung, Budiharjo, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecturing/ collaborative learning	6.7	Written test (25%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C3-Apply	Lecturing/ collaborative learning	13.3	Presentation (50%)
3	Demonstrate fluency of information technology	PLO9	C1-Knowledge	Lecturing/ collaborative learning	6.7	Exam (25%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Agung, Budiharjo, S.Si., M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252057	Academic Session/Semester	6
Course name:	Nutrition science	Pre/co requisite Course name and code if applicable	Plant Physiology; Plant Physiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Nutrition Science is a course on the study of soil type and structure, soil as nutrient and mineral sources, ion absorbance mechanism in plant roots, mineral absorbance through leaf and other organs, soil and rhizosphere, source and sink relationship, essentiality criteria, macronutrients, micronutrients, nitrogen fixation and metabolism, phosphate metabolism, sulfate metabolism, micronutrient metabolism, nutrient-stress condition. After following this course, students master basic biochemical and cell physiological concepts, are also able to explain plant growth and development aspects and solve related problems. Students also write a paper and present it in the classroom.
References	1. Barker, A.V. and D.J. Pilbeam. 2007. Handbook of Plant Nutrition. CRC Press. USA. 2. Deskmukh, A.M., R.M.Khobragade and P.P.Dixit. 2007. Handbook of Biofertilizers and Biopesticides. Oxford Book Company. India. 3. Marschner, H. 1986. Mineral Nutrition of Higher Plants. Academic Press. London. 4. Berbagai jurnal.
Course Lecturer	Dr. Solichatun, S.Si. M.Si. Dr. Widya Mudyantini, S.Si.M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test exam 1 (30%)
2	Mastering knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test exam 2 (30%)
3	Develop problem solving logically and systematically	PLO6	C5-Synthesize	Case study/ group discussion	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Solichatun, S.Si. M.Si. Dr. Widya Mudyantini, S.Si.M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252058	Academic Session/Semester	6
Course name:	Diversity of Endemic Plants	Pre/co requisite Course name and code if applicable	Biosystematics, Practical Biosystematics, Ecology, Ecology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Diversity of Endemic Plants course discusses endemic plant diversity and its economic importance for human life. Selected subjects cover definition and scope of endemic plant, endemic plant characteristics, the benefit of learning endemic plant, internal factors affecting endemicity in plants, external factors affecting endemicity in plants, plant endemicity pattern in Indonesia, endemic plant diversity in Indonesia, conservation strategy of endemic plants, cultivation techniques of endemic plants, transplantation techniques of endemic plants.
References	1. Polunin, N. 1990. Pengantar Geografi Tumbuhan dan Beberapa Ilmu Serumpun. Diterjemahkan oleh Gembong Tjitrosoepomo. Yogyakarta: Gadjah Mada University Press. 2. Ewusie, J.Y. 1990. Pengantar Ekologi Tropika. Bandung: Penerbit ITB. 3. Odum, E. 1993. Dasar-Dasar Ekologi. Diterjemahkan oleh Tjahjono Samingan. Yogyakarta: Gadjah Mada University Press. 4. Pijil, L.V.D. 1990. Asas-Asas Pemencaran pada Tumbuhan Tinggi. Diterjemahkan oleh Gembong Tjitrosoepomo. Yogyakarta: Gadjah Mada University Press.
Course Lecturer	Suratman, S.Si., M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO 1	C2-Comprehend	Lecture/Cooperative learning	8	Exam; Quiz (30%)
2	Produce scientific article or innovatibe products based on research	PLO 3	C5-Synthesize	Project-based learning	5.3	Project based assignment (20%)
3	Analyzing the potential for further utilization of biological resources	PLO 4	C4-Analysize	Project-based learning	8	Project based assignment (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO 7	C2-Comprehend	Listening to lectures, discussing, and compiling papers	5.3	Assignment (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Suratman, S.Si., M.Si May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252059	Academic Session/Semester	6
Course name:	Limnology	Pre/co requisite Course name and code if applicable	Ecology; Ecology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Limnology course covers characteristics of limnology as a knowledge, i.e., the basic concept of the aquatic ecosystem, the potential of water bodies (freshwater lake, artificial lake, pond, and river), structural and functional aspects of limnology (morpho-habitat concepts, community and organism characteristics), lotic and lentic ecosystems (lake and river), physical and chemical factors affecting the freshwater ecosystem, key organism affecting the freshwater productivity, primary productivity, eutrophication, biodiversity, chemical and physical factors in lake and river, adaptation and stability controller of lake and river, competition, predator and prey, freshwater community dynamics
References	1. Odum, E.P. 1971. Fundamental of Ecology, 3rd, cd.W.B. Saunders Co. Philadelphia London 2. Begon, M., J.L. Harper, and C.R. Townsend, 1990. Ecology; Individuals, Populations and Communities. Blackwell Scientific Publications, London Brower, J.E., and J.H. Zar, 1977. Field and Laboratory methods for General Ecology.WM.C. Brown Company Publishers, Iowa. 3. Wetzel, R.G dan G.E Linkens. 1977. Limnologycal Analysis. W.B. Saunders Co.Philadelphia London. 4. Wetzel, R.G. 1983. Limnology. Saunders College publishing Philadelphia London.
Course Lecturer	Dr. Edwi Mahajoeno, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Field practicum /Cooperative learning	13.3	Exam (50%)
2	Produce scientific article or innovatibe products based on research	PLO3	C5-Synthesize	Cooperative learning/ Team based project	5.3	Project based learning (20%)
3	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analysize	Lecture and discussion	2.7	Discussion (10%)
4	Utilizing information technology to keep abreast of the latest development in science and technology	PLO9	C5-Synthesize	Lecture and Discussion	5.3	Quiz (10%) and Individual Assignment (10%)

Prepared by:	Certified by head department:
Name: Dr. Edwi Mahajoeno, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252060	Academic Session/Semester	6
Course name:	Food microbiology	Pre/co requisite Course name and code if applicable	Microbiology; Microbiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course focuses on food as a substrate, types of microorganisms in food, food contamination by microorganisms, microbial growth and metabolism in food, food damage, microbial control in food, food-transmitted diseases, food quality standard, microbiological test on food, basic of food fermentation, types of fermented food.
References	1. Bintsis, T., Foodborne pathogens, AIMS Microbiology, 3, 3, 2017, AIMS. 2. Hungaro, H, Silva, N., Pena WEL, Alvarenga VO, Food Microbiology, Encyclopedia of Agriculture and FoodSystems, 3, -, 2014, Elsevier. 3. Lorenzo, JM., Munekata, PE., Dominguez, R., Pateiro, M., Saraiva, JA., Franco, D., Main Groups of Microorganisms of Relevance for Food Safety and Stability: General Aspects and Overall Description, Elsevier, 2018.
Course Lecturer	Dr. Ari Susilowati, S.Si., M.Si. Dr. Ratna Setyaningsih, M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of microbiology and their applications in food industry	PLO 1	C2-Comprehend	Case study/Collaborative learning	8	Exam; Quiz (30%)
2	Produce scientific article or innovative products based on research	PLO 3	C5-Synthesize	Case study/Collaborative learning	8	Exam; Quiz (30%)
3	Demonstrate effective communication in either Indonesian or English language	PLO 7	A2-Respond	Case study/Collaborative learning	10.7	Making papers; Presentations (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Ari Susilowati, S.Si., M.Si. Dr. Ratna Setyaningsih, M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252061	Academic Session/Semester	6
Course name:	Food Microbiology Practicum	Pre/co requisite Course name and code if applicable	Microbiology; Microbiology Practicum
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face
P	1	40 h
Total	1	40h (1.33 ECTS)

Course Synopsis	This practicum is complementary to the Food Microbiology course. In this course, students practice aseptic working skills, preparation of tools and materials, sterilization principles, bacterial count in milk using a standard plate count method, effect of pasteurization on the bacterial count in milk, determination of microbiological spoilage of food and expired food, Salmonella detection in food using plating method and PCR, detection of Escherichia coli and E. coli 0157: H7 in food using plating technique, and fermented food (yogurt and kimchi) production.
References	1. Neelima Garg, K. L. Garg, K. G. Mukerji 2010 Laboratory Manual of Food Microbiology I. K. International Pvt Ltd. 2. Kevine Otieno 2016. Microbiological Testing Procedures In Dairy Quality Assurance. http://dairytechnologist.com/microbiological-testing-procedures-in-dairy-quality-assurance 3. Abigail B. Snyder, Randy W. Worobo, and Alicia Orta-Ramirez Undergraduate Laboratory Exercises SpecifictoFood Spoilage Microbiology. Journal of Food Science Education. 4. Napa cabbage kimchi Tongbaechu-kimchi ????? https://www.maangchi.com/recipe/tongbaechu-kimchi. 5. Robert D, Greenwood M. 2003. Practical of Food Microbiology. Malden: Blackwell.
Course Lecturer	Dr. Ari Susilowati, S.Si., M.Si. Dr. Ratna Setyaningsih, M.Si.
Topics	1. Principles of food preservation and the practice of making fermented foods 2. Food biological spoilage, food borne diseases

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO 1	C2-Explain	Collaborative learning	12	Written examination (30%)
2	Mastering the basic principles and analytical skills for instruments in the field of biology	PLO 2	P3-Practice	Project-based learning	20	Product (30%) performance (20%)
3	Utilizing information technology to keep abreast of the latest development in science and technology	PLO 9	C3-Use	Collaborative learning	8	Report (20%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Ari Susilowati, S.Si., M.Si. Dr. Ratna Setyaningsih, M.Si. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252062	Academic Session/Semester	6
Course name:	Nanobiotechnology	Pre/co requisite Course name and code if applicable	Biochemistry; Biochemistry Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course covers the development and use of nanobiotechnology in relevant fields, e.g., medical and industry. Nanoparticles can be used as probes, sensors, or molecule carriers in the cellular system and this principle can be applied in medicine, agriculture, environment, and bioindustry.
References	1. Basma A. Omran, Nanotechnology in the Life Sciences, Springer Nature Switzerland AG., 2020, https://doi.org/10.1007/978-3-030-46071-6. 2. Rajesh Singh Tomar, PhD, Anurag Jyoti, PhD, Shuchi Kaushik, PhD (ed), Nanobiotechnology: concepts and applications in health, agriculture, and environment, Apple Academic Press, Inc., 2020.
Course Lecturer	Dr. Artini Pangastuti, S.Si., M.Si,

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C3-Apply	Lecturing/ case-base	13.3	Written test (50%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Project-based method	13.3	Paper and presentation (50%)

Prepared by:	**Certified by head department:**
Name: Dr. Artini Pangastuti, S.Si., M.Si, May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252063	Academic Session/Semester	6
Course name:	Neuroscience	Pre/co requisite Course name and code if applicable	Animal Physiology; Animal Physiology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Neuroscience course studies the structure and function of the neuron system and the brain, including neuron structure and supporting cells, basic working principles of neuron, neuron function in the internal communication, organization and function of the sensory system, disturbance/diseases caused by neuron damage and signal delivery damage, neuron function in learning and memory, also methods in neuroscience research.
References	1. Bear, MF, BW Connors, MA Paradosa, Neuroscience: Exploring The Brain, John Willey, 2015. 2. Robin A. Murphy and Robert C. Honey, The Wiley Handbook on the Cognitive Neuroscience of Learning, – Wiley Blackwell, 2016.
Course Lecturer	Dr. Shanti Listyawati, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Lecturing/ cooperative learning	5.3	Test; Quiz (20%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Lecturing/ cooperative learning	5.3	Test; Quiz (20%)
3	Demonstrate effective communication in either Indonesian or English language	PLO7	A2-Respond	Lecturing/ cooperative learning	8	Papers; Presentations (30%)
4	Demosntrate teamwok skills	PLO8	A5-Characterize	Lecturing/ cooperative learning	8	Papers; Presentations (30%)

Prepared by:	**Certified by head department:**
Name: Dr. Shanti Listyawati, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252064	Academic Session/Semester	6
Course name:	Orchidology	Pre/co requisite Course name and code if applicable	Plant Structure and Development; Plant Structure and Development Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Orchidology is an elective course that focuses on the whole aspects of the plant family Orchidaceae, also known as orchids. The scope of discussed subjects covers structure and development, physiology, genetics, systematics crossover and evolution, reproductive biology, ecology, and application aspects such as biotechnology and orchid breeding. As a non-model plant, this plant group with many members will give a new point of view on plant biology that other model plants are underrepresenting. Students can apply basic knowledge on orchids given in this course as a tool to identify chances in the development of floriculture or other related fields.
References	1. Hew, C.S. and J.W.H. Yong. , The Physiology of Tropical Orchids in Relation to the Industry. , World Scientific Publishing Co. Pte. Ltd. , 2004. 2. Johnson, L. , Orchids. , DK Publishing New York, 2010. 3. Jenna Wraith, Catherine Pickering, Quantifying anthropogenic threats to orchids using the IUCN Red List, Ambio , 47, 47, 2018, Springer. 4. Jenna Wraith , Patrick Norman, Catherine Pickering, Orchid conservation and research: An analysis of gaps and priorities for globally Red Listed species, Ambio, 49, 49, 2020, Springe.
Course Lecturer	Ari Pitoyo, S.Si., M.Sc. Dr. Solichatun, S.Si., M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 1 (30%)
2	Mastering the knowledge and technology related to biology	PLO1	C2-Comprehend	Cooperative learning/ class discussion	8	Written test 2 (30%)
3	Analyzing the potential for further utilization of biological resources	PLO4	C2-Comprehend	Case study/ group discussion	10.7	Paper and presentation (40%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
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MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252065	Academic Session/Semester	6
Course name:	Environmental Pollution	Pre/co requisite Course name and code if applicable	General Biology; General Biology Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	The Environmental Pollution course covers the causes and sources of pollution in the land, water, and air and the impact of environmental pollution on water sources and ocean, land, and air caused by biotic or abiotic factors. This course discusses examples of pollution effects on the biotic and abiotic environment and their countermeasures. Several selected subjects cover concepts of environmental pollution as a scientific field of study, industrial pollution effect on the environment, mining pollution, agriculture and forestry, cities, coast area, water, land, and air pollution.
References	1. Ernest W Steel, Michael, & Duncan Okunt,1960. 2. Water Supplay & seweeap and Severages, 1960 Kogakusa Internasioal Studen indiek. 3. Begon, M., J.L. Harper, and C.R. Townsend, 1990. Conceps Ecology. Prentice Hall Of India Private Limited, London 4. Chapman, J.L, M.J., Reis, 1975, Natural Ecosystems. The Mac MillanCompany NyewYork Macmillan Limited London. 5. Chapman, J.L, M.J., Reis, 1973, Pollution. Cambridge: Cambridge University Press. 6. Slamet Ryadi., 1984. Pencemaran Lingkungan. Penerbit Karya Anda Surabaya Jawa Timur. Indonesia.
Course Lecturer	Dr. Edwi Mahajoeno, M.Si

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Field practicum/ cooperative learning	16	Exam (60%)
2	Demonstrate a logical and systematic problem-solving ability	PLO6	C4-Analyze	Lecture and discussion	10.7	Discussion (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Edwi Mahajoeno, M.Si May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252066	Academic Session/Semester	6
Course name:	Nutrient and Functional Food	Pre/co requisite Course name and code if applicable	Animal Physiology; Animal Physiology Practicum; Biochemistry; Biochemistry Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Functional Nutrients and Food course studies the nutrient, a bioactive compound in food, antioxidant, functional carbohydrates and lipids, bioactive protein and peptide, digestion, absorption, metabolism and abnormal metabolism, nutrigenomics, application on several diseases (anticancer, anti inflammation, antiaging, antiosteoporotic, anticholesteremic, etc), as well as functional product development and regulation at the national scale.
References	1. David A. Bender. , Introduction to nutrition and metabolism 5th ed., CRC Press, 2014. 2. Chad Cox (editor)., Nutritional Biochemistry. , Apple Academic Press., 2015. 3. Gibson GR and CM William. , Functional Food. , Woodhead Pub. Limited., 2000. 4. Raffaele De Caterina, J. Alfredo Martinez, Martin Kohlmeier, Principles of Nutrigenetics and Nutrigenomics: Fundamentals of Individualized Nutrition, Academic Press, 2019.
Course Lecturer	Dr. Artini Pangastuti, S.Si. Dr. Shanti Listyawati, S.Si., M.Si. Dr. Nita Etikawati, S.Si., M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO1	C2-Comprehend	Case-based method	13.3	Written test (50%)
2	Analyzing the potential for further utilization of biological resources	PLO4	C4-Analyze	Project-based method	6.7	Paper (25%)
3	Demosntrate teamwok skills	PLO8	A4-Organize	Project-based method	6.7	Presentation (25%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Artini Pangastuti, S.Si. Dr. Shanti Listyawati, S.Si., M.Si. Dr. Nita Etikawati, S.Si., M.Si. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252067	Academic Session/Semester	6
Course name:	Systematics of Cryptogamae	Pre/co requisite Course name and code if applicable	Biosystematics; Biosystematics Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Systematics of Cryptogamae is a course that studies Cryptogamae plants. Selected subjects cover characterization, taxonomy and nomenclature, diversity, systematics, basic classification, linkage to other taxonomic groups and evolution, characteristics, and classification of selected members (algae, lichens, fungi, Bryophyta and Pteridophyta), and economic values and benefit of Cryptogamae.
References	1. Damayanti, L. 2006. Koleksi Bryophyta Taman Lumut Raya. Cibodas: UPT Balai Konservasi Kebun Raya Cibodas. 2. Eddy, A. 1989. A Handbook of Malesian Mosses. London: HMSO. 3. Hasan, M. dan N.S.Ariyanti. 2004. Mengenal Lumut (Bryophyta) di Taman Nasional Gunung Gede Pangrango. Cibodas: Taman Nasional Gunung Gede Pangrango. 4. Holttum, R.E.1966. A Revides Flora of Malaya. Singapore: Government Printing Office. 5. Lee, R.E. 1989. Phycology. Cambridge University Press. Cambridge. 6. She, P. 1993. A Biology of the Algae. Second Edition. C.Brown. Melbourne. 7. Smith, G.M. 1979. Cryptogamic Botany. Vol. II. New York: McGraw Hill Book Co 8. So, M.L. 1995. Mosses and Liverworts of Hong Kong. Hong Kong: Heavenly People Depot. 9. Winter, W.P. De and V.B.Amoroso (Ed). 2003. Plant Resources of South-East Asia. No 15(2): Cryptogams (Fern and Fern Allies). Bogor: PROSEA Foundation Bhattacharyya, B and B.M.Johri. 1998. Flowering Plants: Taxonomy and Phylogeny. New Delhi: Narosa Publishing House.
Course Lecturer	Suratman, S.Si., M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Understand the concept of biology	PLO1	C2-Comprehend	Lecture/ cooperative learning	8	Exam; quiz (30%)
2	Produce scientific article or innovative products based on research	PLO3	C5-Synthesize	Project-based learning	5.3	Project-based assignment (20%)
3	Analyzing the potential for further utilization of biological resoures	PLO4	C6-Evaluate	Project-based learning	8	Project-based assignment (30%)

4	Demonstrate effective communication in either Indonesian or English language	PLO7	C4-Analyze	Listening to lectures, discussing, and compiling papers	5.3	Assignment (20%)

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MODULE HANDBOOK

Department:	Biology	Page	1 of 2
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252068	Academic Session/Semester	6
Course name:	Systematics of Cryptogamae Practicum	Pre/co requisite Course name and code if applicable	Biosystematics; Biosystematics Practicum
Credit/ECTS:	1/1.33		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	This course is complementary to the main theoretical course of Systematics of Cryptogamae. Students are equipped with skills in Cryptogamae identification, characteristics, taxonomy, diversity, and economic value of Cryptogamae. Students can apply these skills in their biological research or final project. This course covers practical activities with different sessions, i.e., a short lecture on basic theory, practical exercises, report making, and evaluation.
References	1. Damayanti, L. 2006. Koleksi Bryophyta Taman Lumut Raya. Cibodas: UPT Balai Konservasi Kebun Raya Cibodas. 2. Eddy, A. 1989. A Handbook of Malesian Mosses. London: HMSO. 3. Hasan, M. dan N.S.Ariyanti. 2004. Mengenal Lumut (Bryophyta) di Taman Nasional Gunung Gede Pangrango. Cibodas: Taman Nasional Gunung Gede Pangrango. 4. Holttum, R.E.1966. A Revides Flora of Malaya. Singapore: Government Printing Office. 5. Lee, R.E. 1989. Phycology. Cambridge University Press. Cambridge. 6. She, P. 1993. A Biology of the Algae. Second Edition. C.Brown. Melbourne. 7. Smith, G.M. 1979. Cryptogamic Botany. Vol. II. New York: McGraw Hill Book Co 8. So, M.L. 1995. Mosses and Liverworts of Hong Kong. Hong Kong: Heavenly People Depot. 9. Winter, W.P. De and V.B.Amoroso (Ed). 2003. Plant Resources of South-East Asia. No 15(2): Cryptogams (Fern and Fern Allies). Bogor: PROSEA Foundation Bhattacharyya, B and B.M.Johri. 1998. Flowering Plants: Taxonomy and Phylogeny. New Delhi: Narosa Publishing House. 10. Suratman. 2021. Petunjuk Praktikum Sistematika Cryptogamae. Surakarta: Program Studi Biologi FMIPA UNS.
Course Lecturer	Suratman, S.Si., M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the basic principles and analysis of instrument results in the field of biology	PLO 2	C2-Comprehend	Lecture/Discussion	12	Exam: Quiz (30%)
2	Mastering the application of instruments in the field of biology	PLO 2	C2-Comprehend	Lecture/Discussion	8	Exam: Quiz (20%)

3	Demonstrate teamwork skills	PLO 8	C2-Comprehend	Project-based learning	12	Project-based assignment (30%)

4	Demonstrate fluency of information technology	PLO 9	C2-Comprehend	Project-based learning	8	Project-based assignment (20%)

Prepared by:	**Certified by head department:**
Name: Suratman, S.Si., M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252069	Academic Session/Semester	6
Course name:	Cytogenetics	Pre/co requisite Course name and code if applicable	Genetics; Genetics Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload	Type	CSU	Face to Face	Structured Activities	Self-study
	T	2	26.6h	26.6h	26.6h
	Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Cytogenetics course covers chromosome structure, number, type, and diversity, in relation to its function and environmental interaction. This course also covers technique related to cytogenetic analysis.
References	1. Czepulkowski, B.,, Analyzing Chromosomes, BIOS Scientific Publisher Limited, 2001. 2. Tariq Ahmad Bhat • Aijaz Ahmad Wani, Chromosome Structure and Aberration, Springer, 2017. 3. Nicolini C., Genome, structure and function, Kluwer Academic Publisher, 1997.
Course Lecturer	Dr. Nita Etikawati, S.Si., M.Si. Ari Pitoyo, S.Si., M.Sc.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology and its applications according to the context	PLO1	C2-Comprehend	Collaborative learning	8	Written test (30%)
2	Produce scientific article or innovative products based on research	PLO 3	C6-Evaluate	Case-based methods	8	Presentation (30%)
3	Demonstrate a logical and systematic problem-solving ability	PLO 5	A4-Organize	Case-based methods	2.7	Presentation (10%)
4	Utilizing information technology to keep abreast of the latest development in science and technology	PLO 9	C3-Apply	Project-based methods	8	Paper (30%)

Prepared by:	**Certified by head department:**

MODULE HANDBOOK

Name:	**Name:**
Dr. Nita Etikawati, S.Si., M.Si. Ari Pitoyo, S.Si., M.Sc. May 20, 2022	Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252070	Academic Session/Semester	6
Course name:	Taxonomy of Invertebrate	Pre/co requisite Course name and code if applicable	Biosystematics; Biosystematics Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Invertebrate Taxonomy explains the use of invertebrates, the base of classification, the evolution of invertebrates, and in-depth explanations of invertebrate phylum members, i.e., protozoaPorifera, Coelenterata, Platyhelminthes, Nemathelminthes, Mollusca, Annelida, Arthropoda, and Echinodermata
References	1. Barnes, R.D. 1980. Invertebrate Zoology. Holt Saunders International Edition. Padova. 2. Ferguson, A. 1980. Biochemical Systematic and Evolution. Blackie and Sons Limited. Bishopbrigges. Glasgow. 3. Harvey, P.H. and Pagel, M.D. 1993. The Comparative Methods in Evolutionary Biology. Oxford University Press Inc. Newe York. 4. Hook, P. 2003. The Worlds of Sheashells. Periplus edition (HK). Select edition. China. 5. Mayr, E. and Ashlock, P.D. 1991. Principles of Systematic Zoology. Second Edition. Tata McGrwa Hill Publishing Company. New York. 6. Meglitsch, P.A. 1980. Invertebrate Zoology. Oxford University Press. London
Course Lecturer	Dr. Agung, Budiharjo, S.Si., M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO 1	C2-Comprehend	Lecturing/ Collaborative learning	16	Test; Quiz (60%)
2	Demonstrate a logical and systematic problem-solving ability	PLO 6	C3-Apply	Lecturing/ Collaborative learning	10.7	Paper (40%)

Prepared by:	**Certified by head department:**
Name: Dr. Agung, Budiharjo, S.Si., M.Si. May 20, 2022	**Name:** Dr. Ratna Setyaningsih, M.Si.

MODULE HANDBOOK

Department:	Biology	Page	1 of 1
Faculty:	Faculty of Mathematics and Natural Sciences Universitas Sebelas Maret		
Course code:	09043252071	Academic Session/Semester	6
Course name:	Taxonomy of Cultivated Plants	Pre/co requisite Course name and code if applicable	Biosystematics; Biosystematics Practicum
Credit/ECTS:	2/2.67		
Language	Indonesia	Relation to Curriculum	Elective

Workload

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.6h	26.6h	26.6h
Total	2	79.8h (2.67 ECTS)		

Course Synopsis	Taxonomy of Cultivated Plants course studies the cultivated plant taxonomy and its economic importance to human life. This course also covers selected subjects, i.e., definition and scope of cultivated plants, history and use of cultivated plants, characteristics of cultivated plants, benefits of learning cultivated plants taxonomy, basic of cultivated plants nomenclature, principles of taxonomy (characterization, classification, nomenclature).
References	1. Andrew, S., Leslic A.Alexander C. (Eds). 1999. Taxonomy of Cultivated Plants. Lndon: Royal Botanic Gardens Kew. ISBN 978-1-900347-89-1. 2. Rifai, M.A. 2005. Sendi-Sendi Biosistematik. Bogor: PUSLIT BIOLOGI LIPI
Course Lecturer	Suratman, S.Si., M.Si.

Mapping the Course Learning Outcome (CLO) to the Program Learning Outcome (PLO), Teaching & Learning (T&L) Methods and Assessment Methods:

No.	CLO / CPMK	PLO /CPL (Code)	Bloom's Taxonomy	T&L Method	Work Loads (Hours)	Assessment Methods
1	Mastering the concept of biology	PLO 1	C2-Comprehension	Lecture/Cooperative learning	8	Exam; Quiz (30%)
2	Produce scientific article or innovative products based on research	PLO 3	C5-Synthesize	Project based learning	5.3	Project-based assignment (20%)
3	Analyzing the potential for further utilization of biological resources	PLO 4	C6-Evaluate	Project based learning	8	Project-based assignment (30%)
4	Demonstrate effective communication in either Indonesian or English language	PLO 7	C4-Analyze	Listening to lectures, discussing and compiling papers	5.3	Assignment (20%)

Prepared by:	**Certified by head department:**
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