UNIVERSITAS DIPONEGORO
The Excellent Research University

FACULTY OF ANIMAL AND AGRICULTURE SCIENCES

MODULE HANDBOOK

BACHELOR OF AGROECOTECHNOLOGY STUDY PROGRAM

FACULTY OF ANIMAL AND AGRICULTURAL SCIENCES
UNIVERSITAS DIPONEGORO

2025

1st SEMESTER

UNW21301 Religion

Module designation	*UNW21301*
Module title	*Religion*
Semester(s) in which the module is taught	*First*
Person responsible for the module	
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are able to carry out, implement, and practice Islamic teachings in their daily lives. Furthermore, students are expected to apply Islamic principles correctly and appropriately, enabling them to live in peace, tranquility, prosperity, and happiness both in this world and the hereafter. Ultimately, the course aims to guide students to become individuals who contribute positively to their nation and society.*
Content	*The importance of understanding the existence of Islam significantly influences one's mindset, attitude, and behavior in life. By gaining accurate knowledge and experience in practicing Islamic teachings, individuals can lead peaceful, calm, prosperous, and joyful lives both in this world and the hereafter. Moreover, such understanding fosters contributions that are beneficial to the nation and society.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Anshori, Abdul Ghofur. (2005). Hukum dan Praktik Perwakafan di Indonesia. Yogyakarta: Pilar Media.* 2. *Azizy, A. Qodri. (2004). Membangun Fondasi Ekonomi Umat: Meneropong Prospek Berkembangnya Ekonomi Islam. Yogyakarta: Pustaka Pelajar.* 3. *Azra, Azyumardi, et al. (2003). Berderma Untuk Semua. Jakarta: Teraju.* 4. *Azra, Azyumardi, dkk. (2003). Buku Tulis Pendidikan Agama Islam. Jakarta: Departemen Agama RI.* 5. *Bahreisjy, Husein. Hadist Shahih Al-Jami'ush Shahih Bukhari Muslim. Surabaya: CV Karya Utama, t.t.* 6. *Daud Ali, Muhammad. (1998). Pendidikan Agama Islam. Jakarta: Rajawali Press.* 7. *Departemen Agama RI. (1976). Al-Quran dan Terjemahan. Semarang: PT Toha Putra.*

UNW21303 Civic Education and Pancasila

Module designation	*UNW21303*
Module title	*Civic Education and Pancasila*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Prof. Dr. Lita Tyesta Addy Listya Wardhani S.H., M.Hum. and Marzellina Hardiyanti S.H., M.H.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*3/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are able to explain and internalize the values of Pancasila, understand the concept of citizenship and national identity, and apply civic knowledge and responsibilities to daily life and national development with integrity and democratic spirit.*
Content	*This course discusses the historical, philosophical, and juridical aspects of Pancasila as the state ideology, the 1945 Constitution, human rights, democracy, rule of law, national diversity and unity, civic responsibilities, and the roles of citizens in the life of the nation and state. The course combines theoretical understanding with contextual civic applications to encourage responsible citizenship and national awareness.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Kaelan. (2013). Pendidikan Pancasila. Yogyakarta: Paradigma.* 2. *Yudi Latif. (2011). Negara Paripurna: Historisitas, Rasionalitas dan Aktualitas Pancasila. Jakarta: Gramedia.* 3. *Miriam Budiardjo. (2008). Dasar-dasar Ilmu Politik. Jakarta: Gramedia.* 4. *Tim Dosen Pendidikan Kewarganegaraan. (2020). Pendidikan Kewarganegaraan. Jakarta: Kencana.* 5. *Undang-Undang Dasar Negara Republik Indonesia Tahun 1945 (Naskah Amandemen).* 6. *Other relevant academic books and peer-reviewed journals.*

UNW21304 Bahasa Indonesia

Module designation	*UNW21304*
Module title	*Bahasa Indonesia*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Marta Widyawati S.Hum., M.Hum.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are able to understand and apply the principles of academic writing and effective communication in Indonesian. They can express ideas logically, critically, and ethically in written and oral forms appropriate to academic and professional contexts.*
Content	*This course covers the foundations of Bahasa Indonesia as a scientific and formal communication tool. Topics include spelling and grammar rules, paragraph and essay structure, academic writing techniques, citation and references, as well as oral presentation skills. The course emphasizes clarity, logic, coherence, and proper language use in academic settings.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Atmazaki. (2011). Ilmu Menulis: Teori dan Praktik. Padang: UNP Press.* 2. *Keraf, Gorys. (2004). Komposisi. Jakarta: Gramedia.* 3. *Dalman, D. (2015). Keterampilan Menulis. Jakarta: Rajagrafindo Persada.* 4. *Moeliono, Anton M. (2017). Tata Bahasa Baku Bahasa Indonesia. Jakarta: Balai Pustaka.* 5. *Pusat Bahasa. (2008). Pedoman Umum Ejaan Bahasa Indonesia. Jakarta: Departemen Pendidikan Nasional.* 6. *Other relevant academic references and scientific writing guides.*

PAT21301 Introduction to Agricultural Science

Module designation	*PAT21301*
Module title	*Introduction to Agricultural Science*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar and Dr. Ir. Susilo Budiyanto, M.S.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*After completing this course, students will be able to explain the role of agriculture; including its key resources such as land, environment, commodities, plant protection, agroecotechnological diversity, human involvement, agribusiness and agroindustry systems, and supporting sectors; in human life. Students will also be able to develop sustainable agricultural approaches to meet the evolving needs of society while maintaining ecological balance and long-term natural productivity.*
Content	*Introduction to Agricultural Science is a basic course that introduces students to agriculture as an applied science. The course explains how agriculture combines biological, environmental, socio-cultural, and economic aspects to improve human welfare. Students will learn about key agricultural resources, agroecosystems, agribusiness, and sustainable farming practices. The course emphasizes the role of agriculture in ensuring food security, protecting the environment, and supporting rural development.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Soemarno. (2010). Introduction to Agricultural Science. Malang: Universitas Brawijaya Press.* 2. *Sukartawi et al. (2003). Farm Management Science. Jakarta: RajaGrafindo Persada.* 3. *Gliessman, S. R. (2015). Agroecology: The Ecology of Sustainable Food Systems (3rd ed.). CRC Press.* 4. *Conway, G. R., & Barbier, E. B. (1990). After the Green Revolution: Sustainable Agriculture for Development. Earthscan.* 5. *Additional academic references, scientific journals, and relevant publications.*

PAT21304 Microbiology

Module designation	*PAT21304*
Module title	*Microbiology*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Dr. Ir. Eny Fuskhah, M.Si, Dr. Dian Safitri, M.Si and Muhammad Iqbal Fauzan, S.P., M.Si.*
Language	*Bahasa/ English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, Lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students will understand the role of microorganisms in agroecosystems, including their function in soil fertility, plant interactions, and sustainability. They will gain fundamental knowledge and skills in microbiological techniques applicable to biofertilizers, biocontrol, and organic matter management in agriculture.*
Content	*This course introduces fundamental concepts of microbiology with emphasis on its applications in agriculture. Topics include microbial structure, metabolism, and genetics; soil and environmental microbiology; plant-microbe interactions; and the use of beneficial microbes in biofertilizers, biopesticides, and composting. Students will also learn basic laboratory techniques to isolate, culture, and identify microorganisms relevant to agroecosystem sustainability.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Madigan, M.T. et al. (2021). Brock Biology of Microorganisms (16th ed.). Pearson.* 2. *Pelczar, M.J. et al. (2001). Microbiology: Concepts and Applications. McGraw-Hill.* 3. *Subba Rao, N.S. (2004). Soil Microbiology (4th ed.). Science Publishers.* 4. *Sylvia, D.M. et al. (2005). Principles and Applications of Soil Microbiology (2nd ed.). Pearson.* 5. *Additional academic references, scientific journals, and relevant publications.*

PAT21305 Climatology

Module designation	*PAT21305*
Module title	*Climatology*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Dr. Ir. Sutarno, M.S.., Dr. Ir. Eny Fuskhah, M.Si and Septrial Arafat, S.P., M.P.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, Lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students will be able to explain key climatic elements and processes, interpret climate data, and assess the influence of climate on crop growth and productivity. They will develop analytical and practical skills in agroclimatic data interpretation to support decision-making for sustainable agricultural and environmental management.*
Content	*The course covers atmospheric components and energy balance; temperature, humidity, rainfall, wind, and radiation; global and regional climate patterns; microclimates; agroclimatic zoning; climate change and variability; and their impacts on crops and land use. The practicum includes observation techniques, use of meteorological instruments, and climate data analysis for agricultural planning.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Ahrens, C.D. (2013). Meteorology Today: An Introduction to Weather, Climate, and the Environment (10th ed.). Cengage Learning.* 2. *Lutgens, F.K. & Tarbuck, E.J. (2010). The Atmosphere: An Introduction to Meteorology (11th ed.). Pearson.* 3. *Critchfield, H.J. (1993). General Climatology (4th ed.). Prentice Hall.* 4. *Additional academic references, scientific journals, and relevant publications.*

PAB21301 Introduction to Economics

Module designation	*PAB21301*
Module title	*Introduction to Economics*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Prof. Dr. Ir. Titik Ekowati, M.Sc and Suryani Nurfadillah, S.E., M.Si*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, Lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students will be able to explain key economic concepts such as scarcity, opportunity cost, supply and demand, market equilibrium, production and cost theory, and macroeconomic indicators. They will be able to analyze simple economic problems, interpret policy impacts, and apply economic logic in agricultural and resource-based contexts.*
Content	*Topics include fundamental concepts of micro- and macroeconomics, supply and demand analysis, elasticity, market structures, national income, inflation, unemployment, monetary and fiscal policy, and the role of government in the economy. The course integrates examples from the agricultural and rural sectors to enhance contextual understanding.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Case, K.E., Fair, R.C., & Oster, S.M. (2022). Principles of Economics (13th ed.). Pearson.* 2. *Todaro, M.P. & Smith, S.C. (2020). Economic Development (13th ed.). Pearson.* 3. *Samuelson, P.A. & Nordhaus, W.D. (2019). Economics (20th ed.). McGraw-Hill.*

UNW21308 Statistics

Module designation	*UNW21308*
Module title	*Statistics*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.S. and Ir. Karno, M.Appl.Sc., Ph.D*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, Lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students will be able to apply statistical principles to summarize and interpret agricultural data, perform hypothesis testing, correlation, and regression analysis, and use statistical software to support research in agroecotechnology. They will develop skills in data-driven reasoning and scientific communication of quantitative results.*
Content	*Topics include types of data and variables; data presentation; measures of central tendency and dispersion; probability distributions; sampling techniques; hypothesis testing (t-test, chi-square, ANOVA); correlation and regression analysis; and introduction to statistical software (e.g., SPSS, R, Excel). The course emphasizes application in agricultural research, field trials, and environmental monitoring.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Gomez, K.A. & Gomez, A.A. (1984). Statistical Procedures for Agricultural Research (2nd ed.). Wiley-Interscience.* 2. *Steel, R.G.D. & Torrie, J.H. (2013). Principles and Procedures of Statistics: A Biometrical Approach (3rd ed.). McGraw-Hill.* 3. *Triola, M.F. (2022). Elementary Statistics (14th ed.). Pearson.* 4. *Montgomery, D.C. & Runger, G.C. (2020). Applied Statistics and Probability for Engineers (7th ed.). Wiley.*

PAB21303 Fundamentals of Management

Module designation	*PAB21303*
Module title	*Fundamentals of Management*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Prof. Dr. Ir. Titik Ekowati, M.Sc and Suryani Nurfadillah, S.E., M.Si*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students will be able to describe core management functions and processes, analyze simple organizational cases, and apply management concepts to agricultural and environmental sectors. They will also develop communication and teamwork skills through discussions and group-based problem solving.*
Content	*Topics include definitions and roles of management; evolution of management theories; planning and decision-making; organizational structure and design; leadership and motivation; communication and coordination; and performance control. Case examples focus on agribusiness, farmer organizations, and agricultural institutions.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*

Reading list	1. *Griffin, R.W. (2021). Fundamentals of Management (10th ed.). Cengage Learning.* 2. *Certo, S.C. & Certo, T.S. (2020). Modern Management (14th ed.). Pearson.* 3. *Daft, R.L. (2018). Management (13th ed.). Cengage Learning.* 4. *Gitosudarmo, I. & Mulyono, S. (2014). Prinsip Dasar Manajemen. Yogyakarta: BPFE (translated/local context).*

2nd SEMESTER

UNW21308 Sports

Module designation	*UNW21308*
Module title	*Sports*
Semester(s) in which the module is taught	*Second semester*
Person responsible for the module	
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 45.33 hours* *1. Contact hours = 26.67 hours* *a. Laboratory sessions (1 credit):1 x 50 minutes/week x 16 weeks = 26.67 hours* *2. Private study = 18.67 hours* *a. Reviewing lecture = 16 hours* *b. Examination preparation (mid and final) = 2.67 hours*
Credit points	*1/ ± ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to understand the fundamental concepts of sports and physical fitness, and demonstrate the ability to perform various forms of physical exercises and basic sports techniques. The course develops both cognitive and psychomotor domains through practical activities such as fitness testing, aerobic and rhythmic gymnastics, basic athletic movements, swimming techniques, team sports (soccer, volleyball, basketball, futsal), martial arts, and outbound games. Emphasis is also placed on promoting coordination, endurance, flexibility, and overall physical well-being through structured and progressive training sessions.*
Content	*This course provides information on fundamental principles of sports training, physical fitness, basic physical conditioning, and outbound activities. It focuses on applying these principles to promote a healthy lifestyle through various physical activities aimed at maintaining and improving students' physical fitness.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Adi, T. (2010). Senam Aerobik. Semarang: Aneka Ilmu.* 2. *Anandita, F. P. (2010). Mengenal Renang. Jakarta: Penerbit Quadra.* 3. *Biddle, J. H., Fox, K. R., & Boucher, S. H. (2000). Physical Activity and Psychological Well-Being. London & New York: Routledge.* 4. *Bompa, T. (2009). Periodization: Theory and Methodology of Training. USA: Human Kinetics.* 5. *Mielke, D. (2003). Soccer Fundamentals. USA: Human Kinetics.* 6. *Batty, E. C. (2008). Latihan Metode Baru Sepak Bola Serangan. Bandung: Penerbit CV Pionir Jaya.* 7. *Fédération Internationale de Gymnastique (FIG). (2005). Aerobic Gymnastics Code of Points 2005–2008. France.* 8. *Giriwiyono, H. Y. S. S., & Zafar, S. D. (2012). Ilmu Kesehatan Olahraga. Bandung: PT Remaja Rosdakarya.* 9. *Oliver, J. (2004). Basketball Fundamentals. USA: Human Kinetics.* 10. *Luxbacher, J. A. (1996). Soccer: Steps to Success. USA: Human Kinetics.*

UNW21306 English

Module designation	*UNW21306*
Module title	*English*
Semester(s) in which the module is taught	*First*
Person responsible for the module	*Albertus Fajar Irawan, S.P., M.Si., Ph.D., Bagus Herwibawa, S.P., M.P., Anasrullah, S.P., M.S.*
Language	*English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to demonstrate an understanding of English grammar with a particular focus on active and passive tenses, classification structures, and foundational writing skills. Through continuous exposure and guided learning, students will develop their cognitive ability to comprehend and apply basic grammatical concepts in both oral and written contexts. The course also aims to improve students' academic writing proficiency, enabling them to construct grammatically correct and well-organized sentences and paragraphs in English.*
Content	*In this course, students will learn about active and passive tenses, classification, and writing skills.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Jordan, R. R. (1988). Academic Writing Course. London: Scotprint Ltd.*

UNW21310 Internet of Things

Module designation	*UNW21310*
Module title	*Internet of Things*
Semester(s) in which the module is taught	*Second semester*
Person responsible for the module	*Ir. Karno, M.Appl.Sc., Ph.D. (Coordinator), Muhammad Iqbal Fauzan, S.P., M.Si., Anasrullah, S.P., M.Sc.*
Language	*English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to understand the fundamental concepts of the Internet of Things (IoT), including its components, supporting technologies, communication protocols, and network systems. They will gain theoretical knowledge and critical perspectives on IoT interoperability, platforms, cloud fundamentals, sensor clouds, and Industrial IoT. Furthermore, students will be able to analyze case studies, formulate ideas, and present innovative solutions based on real-world IoT implementations. Emphasis is placed on developing critical thinking, conceptual understanding, and analytical skills across various domains of IoT technology and application.*
Content	*This course equips students with both theoretical and practical understanding of artificial neural networks.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Greengard, Samuel the Internet of Things*

PAT21306 Botany

Module designation	*PAT21306*
Module title	*Botany*
Semester(s) in which the module is taught	*Second*
Person responsible for the module	*Ir. Karno, M.Appl.Sc., Ph.D., Rosyida, S.P., M.Sc., and Fajrin Pramana Putra, S.P., M.Sc*
Language	*Bahasa/ English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Lab works, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Upon completing this course, students are able to explain the role of plants in life and agricultural production systems (C2); describe and analyze plant morphology and anatomy, including roots, stems, leaves, flowers, fruits, and seeds (C2 – C4); and evaluate processes of pollination, fertilization, growth, and development in relation to crop productivity (C4). Students are also expected to demonstrate scientific curiosity, responsibility, and the ability to work collaboratively during class discussions and practical sessions (A2 - A3). In addition, they are able to observe, identify, and document plant structures accurately, conduct simple analyses of plant growth and development, and compose a Written Idea (WI) that integrates botanical principles into agricultural contexts as a form of scientific communication (P2 - P3). Achievement of these outcomes is evaluated through quizzes, practical assignments, laboratory reports, and the final WI project.*
Content	*This course introduces the scope of botany and its relevance to agricultural sciences. Topics include the role of plants in life, plant evolution and classification, basic taxonomy, plant organ structures (roots, stems, leaves, flowers, and fruits), pollination and fertilization in fruit and seed formation, plant dispersal mechanisms, growth and development, and economic botany. Students will engage in practical observations of plant structures and literature-based studies. At the end of the course, students are required to develop a* ***Written Idea (WI)*** *that integrates botanical concepts with their applications in agriculture.*

Examination forms	7. *Active Participation: 30%* 8. *Project Output: 20%* 9. *Assignments: 10%* 10. *Quizzes: 10%* 11. *Midterm Examination: 15%* 12. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Mauseth, J. D. (2017). Botany: An introduction to plant biology (6th ed.). Jones & Bartlett Learning.* 2. *Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2018). Plant physiology and development (7th ed.). Sinauer Associates.* 3. *Recent relevant scientific articles related to plant morphology, anatomy, growth, development, pollination, and economic botany (to be provided by the lecturer according to lecture topics).*

PAB21304 Rural Sociology

Module designation	*PAB21304*
Module title	*Rural Sociology*
Semester(s) in which the module is taught	*Second semester*
Person responsible for the module	*Siwi Gayatri, Ph.D.,*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to understand and explain key sociological concepts, including classical and contemporary theories, rural sociology branches, and the distinct characteristics of rural and urban communities. They will be able to analyze cultural dynamics, gender roles, social stratification, poverty, leadership, and land-related conflicts in rural areas. The course also enhances students' comprehension of social processes such as urbanization, industrialization, and technological change, and how these influence rural development, institutions, and patterns of social change. Through critical reflection, students will be equipped to assess social structures and transformations affecting rural communities in Indonesia and beyond.*
Content	*Rural Sociology is a branch of sociology that specifically studies rural communities. From a static perspective, it examines structural aspects such as social groups, social institutions, stratification, and forms of authority in rural areas. From a dynamic perspective, it explores social processes, particularly how the components of society interact with one another, whether in associative or dissociative forms.*
Examination forms	*1. Active Participation: 30%* *2. Project Output: 20%* *3. Assignments: 10%* *4. Quizzes: 10%* *5. Midterm Examination: 15%* *6. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Alfian, M. G. T., & Sumardjan, S. (1980). Kemiskinan Struktural, Suatu Bunga Rampai. Yayasan Ilmu-Ilmu Sosial.* 2. *Berutu, H. K. (1999). Otonomi Pemerintahan Desa: Berdasarkan Undang-Undang No. 22 Tahun 1999. Yayasan Bina Budaya Bangsa.* 3. *Geertz, C. (1983). Involusi Pertanian, Proses Perubahan Ekologi di Indonesia. Bhara Karya Aksara, Jakarta.* 4. *Geertz, C. (1992). Abangan, Santri, Priyayi dalam Masyarakat Jawa. Pustaka Jaya, Jakarta.* 5. *Goode, W. J. (1976). The Family. Prentice Hall, New Jersey.* 6. *Goode, W. J. (1983). Sosiologi Keluarga. PT Bina Aksara, Jakarta.* 7. *Champion, T., & Hugo, G. (2005). New Form of Urbanization: Beyond a Rural-Urban Dichotomy.*

PAT21307 Fundamentals of Technology of Crop Production

Module designation	*PAT21307*
Module title	*Fundamentals of Technology of Crop Production*
Semester(s) in which the module is taught	*Second semester*
Person responsible for the module	*Prof. Ir. Didik Wisnu Widjajanto, M.Sc., Ph.D. (Coordinator),* *Albertus Fajar Irawan, S.P., M.Agr., Ph.D., A'isyah Surya Bintang, S.P., M.Sc.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, field and laboratory practices, project-based learning*
Workload (incl. contact hours, self-study hours)	*Total workload : 136 hours* *1. Contact hours = 40 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26.67 hours* *b. Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 26.67 hours* *2. Private study = 82.67 hours* *a. Reviewing lecture = 32 hours* *b. Preparing assignments = 42.67 hours* *c. Examination preparation (mid and final) = 8 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are able to understand the principles of crop cultivation, the growth requirements of plants, and the treatments involved, ranging from soil preparation to post-harvest handling.*
Content	*This course explores the meaning of crop cultivation and its economic benefits to humans, focusing on how cultivation contributes to yield and post-harvest processing that can provide profits for farmers. It also explains the principles of cultivation, emphasizing the relationship between natural resources and how the environment can be controlled and modified. This is addressed through examining land potential, land-use classification, and land suitability assessment. To help students become proficient cultivators.* *The course also discusses growth requirements, including plant germination, growth-influencing factors, and conditions necessary for optimal plant development. Training includes soil management, seedling production, and planting techniques to ensure students understand and can explain processes from land preparation to plant transplanting. Knowledge of irrigation, fertilization, pest and disease control, and weed management is vital for achieving high-quality harvests.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Asparno Mardjuki (1990). Agriculture and Its Problems. Andi Offset, Yogyakarta.* 2. *Chandrasekaran (2009). Textbook of Agronomy. New Age International Pvt Ltd Publishers, 856 pp. ISBN-10: 812242743X; ISBN-13: 978-8122427431.* 3. *Craig C. Sheaffer & Kristine M. Moncada (2011). Introduction to Agronomy: Food, Crops and Environment (2nd ed.). Cengage Learning, 720 pp. ISBN-13: 978-1111312336; ISBN-10: 1111312338.* 4. *Hasan Basri Jumin (1991). Fundamentals of Agronomy. CV Rajawali, Jakarta.* 5. *Other relevant textbooks and peer-reviewed journals.*

PAT21308 Plant Biochemistry

Module designation	*PAT21308*
Module title	*Plant Biochemistry*
Semester(s) in which the module is taught	*Second*
Person responsible for the module	*Ir. Karno, M.Appl.Sc., Ph.D., Rosyida, S.P., M.Sc., and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa/ English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Lab works, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Upon completing this course, students are able to explain the structure and function of plant biomolecules and the role of enzymes in plant metabolism (C2); analyze primary and secondary metabolic processes such as photosynthesis, respiration, and secondary metabolite formation in relation to crop productivity (C4); and evaluate biochemical mechanisms underlying plant responses to biotic and abiotic stresses (C4). Students are also expected to demonstrate scientific curiosity, responsibility, and the ability to collaborate effectively during discussions and laboratory sessions (A2 – A3). Students will perform basic plant biochemistry laboratory activities, including extraction, identification, and analysis of plant biomolecules, and document results accurately in lab reports (P2). The attainment of these outcomes is assessed through quizzes, laboratory reports, practical assignments, midterm and final exam, and a final integrative project linking plant biochemistry to agricultural applications.*
Content	*This course introduces the biochemical principles underlying plant life processes and their relevance to agricultural productivity. Topics include the structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids), enzymes and plant metabolism, photosynthesis, respiration, secondary metabolite biosynthesis, and the biochemical basis of plant stress responses. Students will analyze how biochemical pathways regulate plant growth, development, and adaptation to environmental conditions.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2017). Lehninger principles of biochemistry (7th ed.). W. H. Freeman and Company.* 2. *Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2018). Plant physiology and development (7th ed.). Sinauer Associates.* 3. *Selected recent scientific articles on plant biochemistry and metabolism, including topics such as photosynthesis, respiration, secondary metabolites, and biochemical stress responses (to be provided by the lecturer according to lecture topics).*

PAT21309 Soil Science

Module designation	*PAT21309*
Module title	*Soil Science*
Semester(s) in which the module is taught	*Second*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si.; Septrial Arafat, S.P.,M.P. ; Muhammad Iqbal Fauzan, S.P., M.Si.; Nani Kitti Sihaloho, M.P.; Anasrullah, S.P., M.S.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*This module provides students with explain the fundamental concepts of soil science and distinguish between pedological and edaphological approaches; Classify soil parent materials and describe the processes of soil formation (genesis); Analyze and interpret key physical properties of soils including texture, structure, density, porosity, and temperature, and their implications for plant growth and soil behavior; Describe the chemical characteristics of soils, including colloid types, mineral structures, soil pH, cation exchange capacity (CEC), and nutrient availability; Evaluate soil reactions and understand the use of lime and other amendments in managing soil acidity, alkalinity, and fertility; Discuss the biological components of soils, particularly the role and dynamics of organic matter and nitrogen in organic and peat soils; Identify and classify organic soils and Histosols based on their genesis, physical, and chemical properties; Apply knowledge of soil science to assess soil health and recommend appropriate management strategies for different soil types and conditions.*

Content	*This course introduces students to the fundamental aspects of soil science, including soil concepts, two main approaches (pedology and edaphology), classification of parent materials, soil genesis, and physical properties (texture, structure, particle density, bulk density, soil porosity, soil aggregates, consistency, and the characteristics and behavior of water, air, and soil temperature, as well as soil classification). The course also covers soil chemical properties (soil colloids, types of colloids, silicate layer structures, mineralogical organization of soil, soil acidity, cation exchange, cation exchange capacity (CEC), soil reactions, acidity and alkalinity, lime reactions in soil, and soil nutrients), lime and fertility management, soil alkalinity, and soil biology. In the biological aspect, the course includes organic matter and organic soils (sources of organic matter, composition, decomposition, energy of organic matter, carbon cycle, simple decomposition products, humus, C/N ratio, factors affecting organic matter and nitrogen), organic soil genesis, classification of organic soils, physical properties of peat soils, chemical characteristics of Histosols, and Histosol soil management.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*

Reading list	1. *Brady, N. C., & Weil, R. R. (2016). The Nature and Properties of Soils (15th ed.). Pearson Education.* 2. *Weil, R. R., & Brady, N. C. (2017). Soil and the Environment (2nd ed.). Pearson.* 3. *Tan, K. H. (2016). Soil Sampling, Preparation, and Analysis (3rd ed.). CRC Press.* 4. *Brevik, E. C., & Hartemink, A. E. (2018). Soils and Human Health. CRC Press.* 5. *Lal, R., & Stewart, B. A. (Eds.). (2015). Soil-Specific Farming: Precision Agriculture. CRC Press.* 6. *Sparks, D. L. (Ed.). (2020). Environmental Soil Chemistry: Applications of Chemical Equilibrium and Kinetics to Soil Systems. Academic Press.* 7. *Lehmann, J., & Kleber, M. (2015). The contentious nature of soil organic matter. Nature, 528(7580), 60–68. https://doi.org/10.1038/nature16069* 8. *Soil Science Society of America. (2018). Glossary of Soil Science Terms. SSSA.* 9. *Ahmed, O. H., Husni, M. H. A., & Anuar, A. R. (2016). Organic Soils and Peat Materials for Sustainable Agriculture. CRC Press.* 10. *Baveye, P. C., Baveye, J., & Gowdy, J. (2016). Soil "ecosystem" services and natural capital: Critical appraisal of research on uncertain ground. Frontiers in Environmental Science, 4, 41.*

PAT21310 Plant Genetics

Module designation	*PAT21310*
Module title	*Plant Genetics*
Semester(s) in which the module is taught	*Second*
Person responsible for the module	*Prof. Dr. Ir. Florentina Kusmiyati, M.Sc. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, problem based-learning, project-based learning, seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to demonstrate a fundamental understanding of genetic principles and their relevance to plant systems. They will be able to explain patterns of inheritance, gene expression, and genetic variation among plant species, as well as interpret how these concepts contribute to plant breeding and crop improvement. Although this course does not include laboratory sessions, students will develop theoretical knowledge of standard genetic techniques such as DNA extraction, Mendelian analysis, and molecular marker applications, equipping them with a conceptual foundation for future laboratory or field-based learning.*
Content	*Plant genetics introduces the fundamental principles of heredity and genetic variation in plants. Topics covered include the history and development of genetics, Mendelian and non-Mendelian inheritance, chromosome structure and behavior, molecular genetics, population genetics, and the role of genetic markers. The course emphasizes the theoretical understanding of classical and modern approaches in plant genetics, including DNA isolation, polymerase chain reaction (PCR), and marker-assisted selection, through case studies and literature-based discussions. Designed as a lecture-based course, it focuses entirely on conceptual and analytical aspects of plant genetics without practical laboratory sessions. Students will engage with current applications of genetic principles in agroecological research and crop improvement programs, preparing them for further studies or research in the field.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%*

	3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of scheduled lectures* 2. *Actively participate in all course activities* 3. *Complete all assignments and assessments* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final examinations*
Reading list	1. *Grotewold, E., Chappell, J., & Kellogg, E. A. (2015). Plant genes, genomes and genetics. Hoboken, NJ: Wiley.* 2. *Chitikineni, A., Pandey, M. K., & Varshney, R. K. (Eds.). (2018). Plant genetics and molecular biology. Cham, Switzerland: Springer International Publishing.* 3. *Acquaah, G. (2020). Principles of plant genetics and breeding (3rd ed.). Hoboken, NJ: Wiley.* 4. *Other relevant textbooks and peer-reviewed journals.*

3rd SEMESTER

PAT21311 Seed Technology

Module designation	*PAT21311*
Module title	*Seed Technology*
Semester(s) in which the module is taught	*Third*
Person responsible for the module	*Dr. Ir. F. Kusmiyati, MSc; Prof. Dr. Ir. Syaiful Anwar, MSi; Bagus Herwibawa, SP, MP*
Language	*Bahasa/ English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Lab works, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*This course completing students are expected to understand and explain the concept and role of seeds in crop cultivation, plant reproduction, seed quality, and techniques of seed production—both through generative (non-hybrid and hybrid) and vegetative (conventional and tissue culture) propagation. Furthermore, students will be able to describe seed harvesting and processing, seed testing, germination, seed vigor, seed deterioration, seed storage and packaging, seed certification and marketing, as well as seed legislation in Indonesia.*
Content	*This course provides learning experiences that enable students to produce and manage high-quality seeds for crop production purposes. The course covers the concepts and roles of seeds, seed quality, seed production techniques—both through generative (non-hybrid and hybrid) and vegetative (conventional and tissue culture) propagation—seed harvesting and processing, seed testing, germination, seed vigor, seed deterioration, seed storage and packaging, seed certification and marketing, as well as seed legislation in Indonesia.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Copeland, L. O. 1976. Principle of Seed Science and Technology. Burgess Publishing Company. Minneapolis, Minnesota* 2. *Kamil, J. 1982. Teknologi Benih. Angkasa Bandung.* 3. *Kartasapoetra, A. G. 1986. Teknologi Benih, Pengolahan Benih dan Tuntunan Praktikum. Bina Aksara, Jakarta.* 4. *Sutopo, L. 1980. Teknologi Benih. Rajawali Press. Jakarta* 5. *Darjanto dan Siti Satifah. 1984. Biologi Bunga. PT. Gramedia, Jakarta.* 6. *Hartman, N.H. and D.E. Kester. 1975. Plant Propagation Principles and Practices. Prentice Hall Inc., New Jersey.*

PAT 21312 Plant Protection

Module designation	*PAT 21312*
Module title	*Plant Physiology*
Semester(s) in which the module is taught	*Third*
Person responsible for the module	*Dr. Ir. F. Kusmiyati, MSc; Dr. Dian Safitri, M.Si.*
Language	*Bahasa/ English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Lab works, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*This completing this course, students are expected to understand and explain the significance of plant diseases, the processes of their occurrence and development, major pathogens and their physiological aspects, epidemiology, and various methods of plant disease control. The section on pests covers the definition of plant pests, their biomorphology and classification, factors influencing pest populations, principles of pest management, and integrated pest management (IPM). The topic on weeds discusses their taxonomy, characteristics, and control methods.*
Content	*This course examines the methods of managing and protecting cultivated plants from disturbances, attacks, and damages caused by Plant Pests and Diseases (Organisme Pengganggu Tanaman, OPT), which include pathogens, insects, and weeds. The topics covered include the importance of plant diseases, the processes of their occurrence and development, major pathogens and their physiological characteristics, epidemiology, and methods of plant disease control. The section on pests discusses the definition of plant pests, their biomorphology and classification, factors influencing pest populations, principles of pest management, and integrated pest management (IPM). The section on weeds addresses their taxonomy, characteristics, and control strategies.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Agrios, G.N. 2005. Plant Pathology. Academic Press* 2. *Semangun, H. 2001. Pengantar Ilmu Penyakit Tumbuhan. Gadjah Mada Univ. Press* 3. *Untung, K. 2001. Pengantar Hama Terpadu. Gadjah Mada Univ. Press* 4. *Triharso. 1996. Dasar-dasar Perlindungan Tanaman. Gadjah Mada Univ. Press* 5. *Anonim. 1991. Kunci Determinasi Serangga. Penerbit Kanisius, Yogyakarta..*

PAT21313 Plant Physiology

Module designation	*PAT21313*
Module title	*Plant Physiology*
Semester(s) in which the module is taught	*Third*
Person responsible for the module	*Ir. Karno, M.Appl.Sc., Ph.D., Rosyida, S.P., M.Sc., and Fajrin Pramana Putra, S.P., M.Sc*
Language	*Bahasa/ English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Lab works, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*This course is designed to develop students' understanding and application of plant physiological concepts in agroecosystems. Upon completing the course, students are able to explain fundamental physiological processes including water absorption and transport, photosynthesis, respiration, translocation, and hormonal regulation (C2); analyze the relationships between these processes and crop growth and productivity (C4); and evaluate plant responses to environmental and abiotic stresses in the context of agricultural production (C4). Students are also expected to demonstrate scientific curiosity, responsibility, and collaborative skills in laboratory and field activities (A2 - A3). Students will perform basic physiological measurements, such as leaf water status, photosynthetic rate observations, and growth response analysis, as well as document results accurately in scientific reports (P2 - P3). Achievement of these outcomes is assessed through quizzes, laboratory reports, practical assignments, mid and final exam, and a final project that integrates plant physiology with agricultural applications.*
Content	*This course explores the physiological processes that regulate plant growth, development, and adaptation in relation to agricultural production systems. The topics include water relations and plant–water balance, mineral nutrition, photosynthesis, respiration, translocation of assimilates, plant growth regulators, and responses to environmental stresses. Students will gain experience in observing and analyzing physiological processes through laboratory experiments and field-based activities, and will relate plant physiological mechanisms to crop management and productivity in agroecosystems.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2018). Plant physiology and development (7th ed.). Sinauer Associates.* 2. *Hopkins, W. G., & Hüner, N. P. A. (2023). Introduction to plant physiology (6th ed.). Wiley.* 3. *Selected recent scientific articles on photosynthesis, respiration, water relations, plant growth regulators, and physiological responses to abiotic stress, provided according to lecture topics.*

PAT21314 Soil Fertility and Fertilization Science

Module designation	*PAT21314*
Module title	*Soil Fertility and Fertilization Science*
Semester(s) in which the module is taught	*Third*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si.; Muhammad Iqbal Fauzan, S.P., M.Si.; Nanni Kitti Sihaloho, M.P.; Anasrullah, S.P., M.S.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*This module provides students with a comprehensive understanding of soil fertility in the context of sustainable agricultural production. It covers the historical development and conceptual foundations of soil fertility, plant growth dynamics, and the interaction between soil and plant systems. Students will explore nutrient uptake, fertilizer types, application methods, and the efficiency of fertilization practices, as well as soil quality and health indicators. Special attention is given to managing soil fertility in problematic soils and evaluating the roles of macro- and micronutrients, water availability, and biological activity in supporting plant productivity. Through a combination of lectures, structured learning, and independent study, students will develop the ability to critically assess soil fertility status, interpret growth curves and plant development factors, and apply appropriate fertilization strategies to enhance agricultural output in a responsible and evidence-based manner.*

Content	*This course introduces students to the fundamental and applied aspects of soil fertility in agricultural systems. It covers the historical development of soil fertility concepts, plant growth dynamics, and the interaction between soil properties and plant productivity. Students will study nutrient uptake mechanisms, types and functions of fertilizers, fertilization efficiency, and soil health indicators. The course also addresses the management of soil fertility in problematic soils, including the role of macro- and micronutrients, water availability, and soil biological activity. Delivered through a combination of lectures, structured learning, and independent study, the course equips students with the analytical skills and practical knowledge needed to assess soil fertility status and apply appropriate fertilization strategies to support sustainable agricultural production.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Datta, A., Meena, R. S., & Pathan, S. I. (Eds.). (2020). Soil fertility management for sustainable development. Springer.* 2. *Ellis, B., & Foth, H. D. (2018, re-released in updated digital format post-2020). Soil fertility (2nd ed.). CRC Press.* 3. *Jones, J. R. (2012). Plant nutrition and soil fertility manual. CRC press.* 4. *Stockdale, E. A., Goulding, K. W., George, T. S., & Murphy, D. V. (2013). Soil fertility. Soil conditions and plant growth, 49-85.* 5. *Marschner, H. (2012). Marschner's mineral nutrition of higher plants. Academic press.* 6. *Ndegwa, J. K., Gichimu, B. M., Mugwe, J. N., Mucheru-Muna, M., & Njiru, D. M. (2023). Integrated soil fertility and water management practices for enhanced agricultural productivity. International Journal of Agronomy, 2023(1), 8890794.* 7. *Troeh, F. R., & Thompson, L. M. (2005). Soils and soil fertility (Vol. 489). Iowa: Blackwell.* 8. *Havlin, J.L., Beaton, J.D., Tisdale, S.L. and Nelson, W.L. (2017) Soil Fertility and Fertilizers: An Introduction to Nutrient Management. 8th Edition, Pearson Educational, Inc., Upper Saddle River, New Jersey.* 9. *Other relevant textbooks and peer-reviewed journals.*

PAT 21315 Plant Ecology

Module designation	*PAT 21315*
Module title	*Soil Fertility and Fertilization Science*
Semester(s) in which the module is taught	*Third*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si.; Muhammad Iqbal Fauzan, S.P., M.Si.; Nanni Kitti Sihaloho, M.P.; Anasrullah, S.P., M.S.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Able to apply (C3) plant ecology in crop cultivation, develop (P4), and integrate (A4) ecological principles into sustainable and continuous agricultural practices.*
Content	*This course discusses the concept and importance of organic agriculture, the integration of various components within organic farming systems, the fundamentals of soil nutrition supporting organic cultivation, the composting process of organic materials, and the quality and properties of organic matter. It also covers the role and application of organic pesticides, the fundamentals of research and development in organic agriculture, organic food and horticultural crops, as well as organic certification.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Cox, G. W. And M. D. Atkin. 1979. Agricultural Ecology. W.H. Freeman and Company, San Francisco.* 2. *Odum, E. P. 1983. Dasar-dasar Ekologi. Gadjah Mada Ubiversity Press, Yogyakarta. (Diterjemahkan T. Samingan dan B. Srigandono)* 3. *Heddy, S. 2010. Agroekosistem, Permasalahan Lingkungan Pertanian. PT. RajaGrafindo Persada, Jakpeer-reviewed journals.* 4. *Heddy, S. 2012. Metode Analisis Vegetasi dan Komunitas. PT. RajaGrafindo Persada, Jakarta.*

PAT21405 Fundamentals of Plant Breeding

Module designation	*PAT21405*
Module title	*Fundamentals of Plant Breeding*
Semester(s) in which the module is taught	*Third*
Person responsible for the module	*Prof. Dr. Ir. Florentina Kusmiyati, M.Sc. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, problem-based learning, project-based learning, seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to demonstrate a solid understanding of the fundamental principles and methods used in plant breeding. They will be able to explain the roles of genetic variation and inheritance in achieving breeding objectives, describe different modes of reproduction in plants, and distinguish between classical and modern breeding approaches. The course emphasizes theoretical knowledge, equipping students with a conceptual foundation that supports further application in crop improvement and agroecological research contexts.*
Content	*This course introduces the basic concepts, goals, and strategies of plant breeding. Core topics include genetic variability, modes of reproduction, principles of selection, hybridization techniques, inbreeding and heterosis, and the evaluation of breeding populations. Students will learn to compare classical and molecular plant breeding methods through literature analysis and case studies. Although the course does not include laboratory sessions, students will gain a strong theoretical understanding of practical breeding activities such as controlled pollination, selection schemes, and trait evaluation in plant improvement programs. The course consists entirely of theoretical instruction delivered through lectures, discussions, and independent study.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of scheduled lectures* 2. *Actively participate in all course activities* 3. *Complete all assignments and assessments* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final examinations*
Reading list	1. *Brown, J., & Caligari, P. (2011). An introduction to plant breeding (2nd ed.). Chichester, UK: Wiley.* 2. *Kuckuck, H., Kobabe, G., Böringer, D., Wenzel, G., Hondelmann, W., Stoy, V., & Tatlioglu, T. (2020). Fundamentals of plant breeding. Berlin, Germany: De Gruyter.* 3. *Yadava, D. K., Mishra, G. P., Dikshit, H. K., & Tripathi, S. (Eds.). (2022). Fundamentals of field crop breeding. Singapore: Springer Nature Singapore.* 4. *Other relevant textbooks and peer-reviewed journals.*

PAT21408 Soil Survey and Land Evaluation

Module designation	PAT21408
Module title	*Soil Survey and Land Evaluation*
Semester(s) in which the module is taught	*Seventh*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si. (Coordinator), Septrial Arafat, S.P., M.P., Nani Kitti Sihaloho, M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*soil sciences*
Module objectives/intended learning outcomes/CPMK	*students will be able to explain the purpose, principles, and stages of soil survey and land evaluation in agricultural and environmental planning. They will demonstrate an understanding of soil profile characteristics and classification according to national and international standards. Students will be able to interpret topographic and thematic maps, identify landforms and soil distribution patterns, and assess the physical and chemical properties of soil relevant to land use potential. They will analyze land characteristics and climate data for evaluating land suitability for various agricultural commodities using established frameworks. Furthermore, students will be capable of formulating land suitability classes and compiling technical reports in accordance with land use planning procedures. The course strengthens students' ability to integrate geospatial data (e.g., slope, drainage, and erosion risk), evaluate limiting factors, and recommend appropriate land management strategies. Through this course, students also develop competencies in critical thinking, written communication, and decision-making related to sustainable land resource management.*

Content/deskripsi	*This course introduces fundamental concepts of soil survey and mapping in relation to land use planning. It consists of 100% theoretical content covering topics such as the roles and types of soil surveys, soil survey methods, implementation techniques for soil mapping, and interpretation of soil survey data. Students will explore land capability classification, land suitability evaluation for both agricultural and non-agricultural purposes, soil fertility assessment, and the use of computer-based models for land evaluation. Delivered through lectures and guided discussions at an intermediate level, the course aims to develop students' ability to analyze land characteristics and apply soil survey data in sustainable land resource planning and management.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Allison. R.J. 2002. Applied Geomorphology: Teory and Practices. John Wile & Sons. New York.* 2. ***Bockheim, J. G., & Gennadiyev, A. N. (2010).** Soil Geography and Geomorphology. Oxford University Press.* 3. ***Brady, N. C., & Weil, R. R. (2016).** The Nature and Properties of Soils (15th ed.). Pearson Education.* 4. ***FAO. (2007).** Land Evaluation: Towards a Revised Framework. FAO Land and Water Discussion Paper 6, Rome.* 5. *Hardjowigeno, S dan Widiatmaka. 2015. Evaluasi Kesesuaian Lahan dan Prencanaan Tata Guna Tanah. Gadjah Mada University Press. Yogyakarta..* 6. ***Lagacherie, P., McBratney, A. B., & Voltz, M. (Eds.). (2007).** Digital Soil Mapping: An Introductory Perspective. Elsevier.* 7. *Rayes, M.L. 2007. Metode Inventarisasi Sumberdaya Lahan. Penerbit Andi. Yogyakarta. 298 p* 8. ***Rossiter, D. G. (2016).** A Framework for Land Evaluation. Cornell University.*

4th SEMESTER

PAT 21316 Plant Taxonomy

Module designation	*PAT 21316*
Module title	*Plant Taxonomy*
Semester(s) in which the module is taught	*Fourth*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, MSi; Bagus Herwibawa, SP, MP*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, problem-based learning, project-based learning, seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*2/ ± 3 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Completing this course, students are expected to understand and explain the importance of plant diversity as the basis of taxonomy, including classification, identification/determination, and plant nomenclature.*
Content	*This course provides students with the knowledge and understanding of various aspects of plant diversity, including a general study of plant variation, the characteristics and traits used for synthesis and diagnostic analysis of plants in accordance with their phylogenetic development. Through this understanding, plants can be classified into bryophytes, pteridophytes, and spermatophytes, as well as analyzed for their diversity data. The identified characteristics and traits of plants can be utilized to predict their potential uses and inform conservation strategies. Additionally, at the end of the course, students are required to write a written essay (GT) related to aspects of plant taxonomy.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 5. *Attend at least 85% of scheduled lectures* 6. *Actively participate in all course activities* 7. *Complete all assignments and assessments* 8. *Achieve a minimum final score of 60/100, including passing the midterm and final examinations*
Reading list	1. *Judd WS et al. 2002. Plant Systematics: A Phylogeny Approach. Second edition, Sinauer Associates, Inc. Massachusetts.* 2. *Radford AE. 1986. Fundamentals of Plant Systematics. Harper & Row publisher. New York* 3. *Rifai MA. 1976. Sendi sendi Botani Sistematika. Herbarium Bogoriense. LIPI. Bogor* 4. *Rugayah et al. 2004. Pedoman Pengumpulan Data Keanekaragaman Flora. Puslit Biologi. LIPI* 5. *Singh G. 2010. Plant Systematics An integrated Approach. Science Publicers. Delhi India* 6. *Tjitrosoepomo G. 2003. Taksonomi Umum (Dasar-dasar Taksonomi Tumbuhan). Gadjah Mada University Press.Yogyakarta* 7. *Jurnal-jurnal taksonomi tumbuhan (Taxon; Biodiversitas dll) dan hortikultura*

PAT21318 Plant Propagation

Module designation	*PAT21318*
Module title	*Plant Propagation*
Semester(s) in which the module is taught	*Fourth semester*
Person responsible for the module	*Ir. Karno, M.Appl.Sc., P.hD. (Coordinator) and Fajrin Pramana Putra, S.P., M.Sc.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students can describe (C5) the basic concepts of plant propagation and plant propagation techniques both generatively and vegetatively.*
Content	*This course studies the basic concepts of plant propagation systems which include: environment, facilities and media for plant propagation; principles and techniques of generative plant propagation using seeds; principles and techniques of vegetative (asexual) plant propagation using cuttings, grafting, budding, layering and plant propagation using special plant organs such as tubers and rhizomes, as well as the latest principles and techniques of plant propagation using tissue culture.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Hartmann, H.T. and D.E. Kester. 1975. Plant Propagation: Principles and Practices (3th ed.), Prentice Hall, 662pp.* 2. *Hartmann, H.T., D.E. Kester, F.T. Davies, Jr. and R.L. Geneve. 2011. Plant Propagation: Principles and Practices (8th ed.), Prentice Hall. 869pp.* 3. *Gunawan, E. 2014. Plant Propagation: Practical and Popular Methods. Agromedia Pustaka, Jakarta. 104 pages.* 4. *Wijaya and Budiana. 2014. Making Cuttings, Graftings, Connecting, and Inoculation. Penebar Swadaya. Jakarta. 156 pages.* 5. *Textbooks and other related journals.*

PAT21319 Experimental Design

Module designation	*PAT21319*
Module title	*Experimental Design*
Semester(s) in which the module is taught	*Fourth*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.S., and Ir. Karno, M.Appl.Sc., Ph.D.*
Language	*Bahasa/*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*After completing this course, students will be able to describe the fundamental concepts of experimental design and its application in agricultural research (C2), evaluate various experimental designs and select the most suitable approach for solving agroecotechnology research problems (C4), and develop experimental plans that apply correct principles of randomization, replication, and local control (P2). They are also expected to show precision, responsibility, and ethical conduct when constructing and analyzing agricultural experiments (A3). By the end of the course, students will compose and present a written proposal for an experimental design applicable to crop or field research within agroecosystems (C5, P3).*
Content	*This course provides students with theoretical and practical knowledge of experimental design in agricultural research. Topics cover the principles of experimental design, hypothesis formulation, selection of experimental units, randomization, replication, local control, types of experimental designs (CRD, RBD, LSD, split-plot, factorial designs), error analysis, and data interpretation. Students will learn how to plan, implement, and evaluate agricultural experiments to produce reliable and scientifically valid results. Practical sessions focus on designing experiments, analyzing data using statistical tools, and interpreting results to support decision-making in crop and agroecosystem studies.*
Examination forms	13. *Active Participation: 30%* 14. *Project Output: 20%* 15. *Assignments: 10%* 16. *Quizzes: 10%* 17. *Midterm Examination: 15%* 18. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 5. *Attend at least 85% of classes* 6. *Actively participate in all learning activities and lab works* 7. *Complete all assignments and lab reports* 8. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Gomez, K. A., & Gomez, A. A. (1984). Statistical Procedures for Agricultural Research (2nd ed.). Wiley-Interscience.* 2. *Montgomery, D. C. (2017). Design and Analysis of Experiments (9th ed.). Wiley.* 3. *Recent articles on crop experiment methodology and field trial analysis will be provided to complement the textbook learning*

PAT21402 Plant Growth and Development

Module designation	*PAT21402*
Module title	*Plant Growth and Development*
Semester(s) in which the module is taught	*Fourth Semester*
Person responsible for the module	*Rosyida, S.P., M.Sc. (Coordinator) and Fajrin Pramana Putra, S.P., M.Sc.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*After attending this course, students can compare (C5) growth movements, primary - secondary growth, vegetative growth (germination, juvenile and adult vegetative), generative growth (flowering, fruit and seed formation), aging/senescence, plant growth analysis, growth hormones, plant defense systems - signal transduction, plant defense systems - oxidative damage, growth environmental factors - growth optimization, growth environmental factors - environmental stress.*
Content	*This course studies aspects of growth and development in plants to achieve optimal results and plant growth responses exposed to environmental and biotic stress conditions. The study materials covered in this course are: growth movement, primary - secondary growth, vegetative growth (germination, juvenile and adult vegetative), generative growth (flowering, fruit and seed formation), aging/senescence, plant growth analysis, growth hormones, plant defense systems - signal transduction, plant defense systems - oxidative damage, environmental factors of growth - growth optimization, environmental factors of growth - environmental stress. It consists of 60% theoretical content (plant growth and development) and 40% practical activities (laboratory work and plant growth). The course is delivered at an introductory to intermediate level, combining lectures and hands-on sessions to develop foundational plant growth and development knowledge and skills.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Taiz and Zeiger. Plant Physiology. 6th Edition* 2. *S.M. Sitompul dan Bambang Guritno. Analisa Pertumbuhan Tanaman. Gajah Mada University Press* 3. *Journals related to plant growth and development* 4. *Journals related to plant growth responses towards environmental factors* 5. *Other relevant textbooks and peer-reviewed journals.*

PAT21406 Organic Agriculture

Module designation	*PAT21406*
Module title	*Organic Agriculture*
Semester(s) in which the module is taught	*Fourth*
Person responsible for the module	*Prof. Ir. Didik Wisnu Widjajanto, M.ScRes., Ph.D., A'isyah Surya Bintang, S.P., M.Sc.; Albertus Fajar I, S.P.,M.Agr., Ph.D.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students will be able to demonstrate a foundational understanding of the principles, practices, and ecological significance of organic agriculture; analyze and evaluate soil fertility, composting processes, and organic pest management strategies; and apply integrated organic farming knowledge responsibly and collaboratively in both field and research contexts, including certification and marketing of organic products at national and international levels.*
Content	*This course introduces the fundamental principles and practices of organic agriculture, with a focus on ecological sustainability, soil health, and integrated farming systems. The course content is structured to include approximately 60% theoretical instruction—covering soil fertility, composting processes, organic pest and disease management, biomass utilization, and certification standards—and 40% practical activities, such as fieldwork, compost preparation, pest control demonstrations, and organic crop cultivation. Through a combination of lectures, case studies, and hands-on sessions, students will develop the ability to design, evaluate, and implement organic farming systems that are environmentally responsible and economically viable. The course also emphasizes collaborative learning and ethical application of organic agricultural practices in both local and international contexts.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Nandwani, D. (Ed.). (2016). Organic farming for sustainable agriculture (Vol. 9). New York, NY.: Springer.* 2. *Das, S. K. (Ed.). (2020). Organic agriculture. BoD–Books on Demand.* 3. *Widjajanto, D. W. dan Sumarsono. (2005). Pertanian Organik. Badan Penerbit Universitas Diponegoro, Semarang.* 4. *Montgomery, D. R. (2017). Growing a revolution: Bringing our soil back to life. W. W. Norton & Company.* 5. *Lorenz, K., & Lal, R. (2022). Introduction to organic agriculture. In Organic agriculture and climate change (pp. 1-38). Cham: Springer International Publishing.* 6. *Other relevant textbooks and peer-reviewed journals.*

PPAT6406 Agricultural Microbiology

Module designation	PPAT6406
Module title	*Agricultural Microbiology*
Semester(s) in which the module is taught	*Fourth*
Person responsible for the module	*Dr. Ir. Eny Fuskhah, M.Si, Dr. Dian Safitri, M.Si and Muhammad Iqbal Fauzan, S.P., M.Si.*
Language	~~*Bahasa/*~~ *English*
Relation to curriculum	*Compulsory /* ~~*elective / specialisation*~~
Teaching methods	*lecture, Lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Upon completing this course, students are expected to develop a comprehensive understanding of agricultural microbiology. They will be able to explain the fundamental concepts, including the classification, characteristics, and ecological roles of microorganisms such as bacteria, fungi, protozoa, algae, and viruses in agricultural systems. Students will gain knowledge of microbial diversity in soil, water, and air, as well as the physiology and ecological interactions of these organisms with plants, whether beneficial or harmful. Furthermore, they will acquire practical skills in microbial cultivation techniques, understand strategies for controlling both pathogenic and beneficial microbes, and explore the production and application of microbial products, including biofertilizers, biopesticides, and fermentation-based products. In addition, students will learn the basic principles of microbial genetic engineering and assess its applications in agricultural biotechnology. Finally, they will be able to demonstrate the integration of microorganisms into sustainable agricultural practices to enhance productivity and maintain environmental quality.*

Content	*This course provides comprehensive knowledge and practical skills in agricultural microbiology, focusing on the diversity, physiology, and application of microorganisms in sustainable agriculture. The topics include microbial interactions in agricultural ecosystems; techniques for isolation, growth, and mass propagation of microorganisms; and an in-depth study of major microbial groups such as viruses, bacteria, protozoa, algae, fungi, and plant growth-promoting rhizobacteria (PGPR). Students will explore various types of microbe–plant interactions and strategies for controlling harmful microorganisms. The course also emphasizes the concepts, production processes, and applications of microbial products, including biofertilizers, biopesticides, biofood, and bioremediation agents. Furthermore, the course introduces genetic engineering of microorganisms and its application in agriculture, along with research methodologies involving agricultural microbes. Through lectures, laboratory experiments, and project-based learning, students will develop cognitive, psychomotor, and affective competencies aligned with Outcome-Based Education (OBE) principles.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*

Reading list	a. *Provorov, N. A. (2022). Agricultural microbiology and symbiogenetics: Synthesis of classical ideas and construction of highly productive agrocenoses (review). Sel'skokhozyaistvennaya Biologiya, 57(5), 821–833. https://doi.org/10.15389/agrobiology.2022.5.821.* b. *Goss, M. J., Carvalho, M., & Brito, I. (2017). Functional diversity of mycorrhiza and sustainable agriculture: Management to overcome biotic and abiotic stresses. Frontiers in Environmental Science, 5, 39. https://doi.org/10.3389/fenvs.2017.00039* c. ***Suganya, T., Renuga Devi, N., Vignesh, S., & Nguyen, T. A. (2022). Microbiology in agriculture: An introduction. In Nanosensors for Smart Agriculture (pp. 100–115). Elsevier.*** d. ***Meena, V. S. (2018). Role of rhizospheric microbes in soil: Stress management and agricultural sustainability. Springer. https://doi.org/10.1007/978-981-10-8402-7*** e. *Gouda, S., Kerry, R. G., Das, G., Paramithiotis, S., Shin, H.-S., & Patra, J. K. (2018). Revitalization of plant growth promoting rhizobacteria for sustainable development in agriculture. Microbiological Research, 206, 131–140. https://doi.org/10.1016/j.micres.2017.08.016* f. *Tyagi, S., Kumar, R., Saharan, B. S., & Nadda, A. K. (2021). Plant-microbial interactions and smart agricultural biotechnology. CRC Press. https://doi.org/10.1201/9781003213864* g. *Kumawat, K. C., Razdan, N., & Saharan, K. (2022). Role of plant growth-promoting rhizobacteria in sustainable agriculture. Microbiological Research, 254, 126901. https://doi.org/10.1016/j.micres.2021.126901* h. *Suganya, T., Renuga Devi, N., Vignesh, S., Rajendran, S., Dorothy, R., & Nguyen, T. A. (2021). Microbiology in agriculture: An introduction. In S. Rajendran, T. A. Nguyen, & R. Dorothy (Eds.), Nanosensors for smart agriculture (pp. 41–51). Elsevier. https://doi.org/10.1016/B978-0-12-824554-5.00023-9* i. *Tikhonovich, I. A., & Provorov, N. A. (2011). Symbiotic plant–microbe interactions: The key to sustainable and efficient agriculture. Annals of Applied Biology, 159(2), 155–168. https://doi.org/10.1111/j.1744-7348.2011.00489.5*

PAT21430 Agricultural Mechanization

Module designation	*PAT21430*
Module title	*Agricultural Mechanization*
Semester(s) in which the module is taught	*Fourth*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si. (Coordinator), Muhammad Iqbal Fauzan, S.P., M.Si.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, private study)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to be able to explain the fundamental concepts and history of agricultural mechanization, and analyze various methods, equipment, and machine performance in soil tillage, planting, fertilization, weed control, irrigation, hydroponics, post-harvest handling, preservation, and agricultural building systems. Students will also be able to describe the mechanical principles underlying each of these agricultural operations. The course enhances students' analytical skills in evaluating the effectiveness and suitability of farm machinery and infrastructure, providing them with a comprehensive understanding of how mechanization supports efficient, sustainable agricultural production.*
Content	*This course introduces the fundamental principles of agricultural mechanization and the use of mechanical tools in farming operations. It consists of 60% theoretical content (pre-harvest equipment such as plowing, harrowing, planting, fertilizing, pest and disease control, harvesting; post-harvest activities including threshing, drying, and milling; as well as crop processing techniques like drying, cooling, frying, and preserving) and 40% practical activities (demonstrations and simulations of farm machinery operations, tractor use, and calculation of equipment operating costs). The course is delivered at an intermediate level, combining lectures, field practice, and applied analysis to develop students' competence in selecting and operating appropriate farm machinery.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Srivastava, A., Goering, C., Rohrbach, R., & Buckmaster, D. (2006). Engineering Principles of Agricultural Machines.* 2. *Food and Agriculture Organization (FAO). (2018). Sustainable Agricultural Mechanization: A Framework for Africa. FAO.* 3. *Gebbers, R., & Adamchuk, V. I. (2016). Precision Agriculture and the Future of Farming in Europe. European Parliament.* 4. *Hadiutomo, K. (2012). Mekanisasi Pertanian. IPB Press.* 5. *Handjosoediro, S. (1983). Mekanisasi Pertanian. Kerjasama BPLPP-JICA, Jakarta.* 6. *Hunt, D. (1972). Farm Power and Machinery Management. McGraw-Hill, Inc., New York.* 7. *Mulyoto, et al. (2002). Mesin-Mesin Pertanian. PT Graha Persada, Jakarta.* 8. *Robbins, S. R. (2005). CRC Handbook of Engineering in Agriculture. CRC Press, Boca Raton, FL.* 9. *Yasumastha, K. (1988). Farm Machinery Vol. II. Tsukuba International Agricultural Training Course, JICA, Japan.*

PTP21 Fundamentals of Agricultural Product Technology

Module designation	*PTP21*
Module title	*Fundamentals of Agricultural Product Technology*
Semester(s) in which the module is taught	*Fourth*
Person responsible for the module	*Anang M Legowo, Prof., Dr., Ir., M.Sc., Yoyok Budi Pramono, S.Pt., M.P., Ahmad Ni'matullah Al-Baarri, SPT., MP., PhD..*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, private study)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*completing this course, students are expected to be able to explain (C2) the meaning, scope, and fundamental concepts of agricultural product technology, particularly the introduction to handling various agricultural commodities and food processing, as well as their interrelation with broader scientific disciplines and professional fields. The course also covers the basic principles of various methods of preservation and processing of agricultural products, and examines the contribution of agricultural product technology to food production, food security, international trade of agricultural commodities, and the utilization of local (tropical indigenous) resources.*
Content	*This This course discusses the general characteristics of agricultural products, the fundamental processes of agricultural product processing, and the postharvest physiology of various agricultural commodities, including fruits, vegetables, tubers, grains, animal products, and aquatic products. It also covers the basic principles of postharvest technology, beginning with harvesting methods, postharvest handling principles, and postharvest distribution systems.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* 7. *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Mangunwidjaja, D. dan I. Sailah. 2005. Pengantar Teknologi Pertanian. Penebar Swadaya, Jakarta.* 2. *Winarno, F. G. 1980. Pengantar Teknologi Pangan. PT Gramedia, Jakarta.* 3. *Winarno, F. G. dan B. S. L. Jenie. 1985. Kerusakan Bahan Pangan dan Pencegahannya. PT Gramedia, Jakarta.* 4. *Rahman, M.S. 2007. Handbook of Food Preservation. Second Edition. CRC Press, London – New York.* 5. *Pustaka lain terkait komoditas pertanian, penanganan, pengawetan, dan pengolahanCourse, JICA, Japan.*

5th SEMESTER

PAB21307 Entrepreneurship

Module designation	*PAB21307*
Module title	*Entrepreneurship*
Semester(s) in which the module is taught	*Fifth semester*
Person responsible for the module	*Siwi Gayatri, S.Pt., MSc., Ph.D., Ir. Kustopo Budiraharjo, M.P., Dr. Migie Handayani, S.Pt., M.Si., Hery Setiawan, S.Pt., M.Sc.*
Language	*Bahasa, english*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, private study)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hour*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are expected to understand and apply the principles of entrepreneurship, as well as to enhance their attitudes and motivation to pursue independent entrepreneurial ventures.*
Content	*Entrepreneurship Course explores the role and objectives of entrepreneurship, entrepreneurial personality, motivation, innovation, and business opportunities. It also covers identifying opportunities and challenges in entrepreneurship, starting and developing a business, and building customer loyalty*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*

Reading list	1. *Birah Paul, Brian Clegg. (1996). Business Creativity. PT Gramedia Pustaka Utama, Jakarta.* 2. *Djatmiko, D. Entrepreneurship and Development. CV Alfabeta, Bandung.* 3. *Drucker, P.F. (1996). Innovation and Entrepreneurship. Erlangga, Jakarta.* 4. *Geoffrey G.M., et al. (1992). Entrepreneurship: Theory and Practice of Management Art No. 97. PT Pustaka Binaman Pressindo.* 5. *Histick, R.D., Peters, M.P. (1995). Entrepreneurship. Irwin, Chicago.* 6. *Alma, B. (2000). Entrepreneurship. Alfabeta Publisher, Bandung.* 7. *Wiratmo, M. (1996). Introduction to Entrepreneurship: The Basic Framework of Entering the Business World. BPFE, Yogyakarta.* 8. *Virgilio, V. Vitung, et al. (1988) (Editor). Agribusiness Opportunities: A Practical How-to Book on Livelihood and Agricultural Business Ventures. Agriscoope, Quezon City.* 9. *Longenecker, J.R., C.W. Moore, and J.W. Petty. Entrepreneurship, Small Business Management (translation). Volume 1 and 2. Salemba Empat, Jakarta.*

PAT21317 Agricultural Hidrology

Module designation	*PAT1624607*
Module title	*Agricultural Hidrology*
Semester(s) in which the module is taught	*Sixth semester*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si. (Coordinator), Septrial Arafat, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*soil sciences*
Module objectives/intended learning outcomes/CPMK	*students will be able to explain the principles and components of the hydrological cycle in agricultural landscapes, including rainfall, infiltration, evapotranspiration, and surface runoff. They will demonstrate understanding of climatic and agroclimatic factors influencing crop water needs, as well as the concepts of soil-water-plant relationships. Students will be able to analyze rainfall data, calculate water balance, and evaluate irrigation water requirements for various cropping patterns. Furthermore, students will be capable of assessing watershed characteristics and interpreting hydrological parameters relevant to land use and agricultural planning. They will acquire skills to critically analyze hydrological data, apply theoretical concepts in water resource assessment, and communicate findings in written and oral formats. The course also develops students' capacity for teamwork, independent thinking, and responsible decision-making in water and land resource management.*
Content/deskripsi	*This course introduces fundamental concepts in agricultural hydrology, focusing on the role and movement of water within agricultural systems. It consists of 100% theoretical content covering topics such as the hydrological cycle, rainfall characteristics, evapotranspiration, infiltration, runoff processes, water balance analysis, irrigation planning, and watershed hydrology. The course is delivered through lectures and interactive discussions at an intermediate level, aiming to build students' understanding of water management in agricultural landscapes and its importance in optimizing crop productivity and sustainability.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Bardan, M. 2014. Irigasi. Graha Ilmu, Yogyakarta.* 2. *Dingman, S. L. (2015). Physical Hydrology (3rd ed.). Waveland Press.* 3. *Glavan, M. (Ed.). (2018). Environmental Impact of Agricultural Management Practices. InTechOpen.* 4. *Goyal, M. R., & Ojha, C. S. P. (2018). Management of Irrigation and Drainage Systems. Apple Academic Press.* 5. *Hillel, D. (2008). Soil Water and Climate. Academic Press.* 6. *Laode Sabaruddin. 2012. Agroklimatologi, Aspek-aspek Klimatik untuk Sistem Budidaya Tanaman. Penerbit Alfabeta, Bandung.* 7. *Mawardi, M. 2012. Rekayasa Konservasi Tanah dan Air. Bursa Ilmu, Yogyakarta.* 8. *Sharma, P. K., & Singh, A. K. (2021). Agricultural Drainage Engineering. Springer.* 9. *Ward, R. C., & Robinson, M. (2020). Principles of Hydrology (5th ed.). McGraw-Hill Education.*

PAT21403 Food Crop Production Technology

Module designation	*PAT21403*
Module title	*Food Crop Production Technology*
Semester(s) in which the module is taught	*Fifth*
Person responsible for the module	*Prof. Ir. Didik Wisnu Widjajanto, M.Appl.Sc., Ph. D., Rosyida, S.P., M.Sc., Fajrin Pramana Putra, S.P., M.Sc., and Dr. Dian Safitri, S.P., M.Si*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of the course, students will be able to describe the characteristics and economic importance of major food crops, including cereals, legumes, and tubers (C2), analyze the ecological and agronomic factors that influence their growth and yield (C4), and design appropriate production strategies and technologies for selected crops (C4, P2). Students are also expected to demonstrate responsibility, precision, and environmental awareness in assessing and proposing food crop production systems (A3). As the final task, students will develop a simple plan for integrated and sustainable production of a selected food crop (C5, P3).*

Content	*This course provides students with a comprehensive understanding of the principles and technologies for the production of staple food crops, integrating botanical, agronomic, and economic aspects. The materials cover characteristics of major food crops, their ecological and physiological requirements, and their role in food security and the economy. The course includes detailed studies of cereal crops (rice, maize, wheat, sorghum, barley, and millet), legume crops (soybean, mungbean, groundnut, cowpea, and pigeon pea), and an introduction to root and tuber crops. Topics also address land preparation, variety selection, crop establishment, nutrient and water management, integrated pest and disease management, harvesting, and postharvest handling. Special attention is given to yield improvement and sustainable production practices, incorporating modern cultivation technology and Good Agricultural Practices (GAP). Through lectures, discussions, and case studies, students are prepared to evaluate and plan efficient and sustainable food crop production systems relevant to agroecosystems.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Acquaah, G. (2012). Principles of crop production: Theory, techniques, and technology (2nd ed.). Pearson.* 2. *Relevant journals in the field of food crop production cover fundamental theories, cultivation practices, and production technologies for cereals and legumes.*

PAT21407 Agricultural Research Methodology

Module designation	*PAT21407*
Module title	*Agricultural Research Methodology*
Semester(s) in which the module is taught	*Fifth semester*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.S., and Ir. Karno, M.Appl.Sc., Ph.D.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hour*
Credit points	*2/ ± 3,21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are able to explain the basic steps of agricultural research and their purpose (C2), identify research problems and translate them into objectives and hypotheses (C3), and draft a short research proposal with clear methods and structure (C4, P2). Students are expected to show responsibility, honesty, and willingness to collaborate in preparing research proposals (A3). At the end of the course, students will submit and present a concise thesis proposal draft relevant to agroecotechnology research (C5, P3).*
Content	*This course introduces students to basic agricultural research methods as preparation for undergraduate thesis writing. Topics include formulating research problems, conducting simple literature reviews, defining objectives and hypotheses, identifying variables, choosing basic research designs, and determining data collection methods. The course also guides students in writing a simple and systematic research proposal, covering title, background, objectives, literature review, methodology, and references. Practical activities include drafting and presenting a short proposal relevant to agroecosystem research.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities and lab works* 3. *Complete all assignments and lab reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	3. *Sugiyono. (2017). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Alfabeta.* 4. *Syamsuddin, M., & Damayanti, A. (2011). Metodologi Penelitian Bidang Pertanian. Gadjah Mada University Press.* 5. *Kothari, C. R. (2004). Research methodology: Methods and techniques (2nd ed.). New Age International.* 6. *Supporting References from Relevant Scientific Journals*

PAT21409 Technology of Production of Estate crops

Module designation	PAT21409
Module title	*Technology of Production of Estate crops*
Semester(s) in which the module is taught	*Fifth semester*
Person responsible for the module	*Prof. Dr. Ir. Endang Dwi Purbajanti, MS. (Coordinator),* *Albertus Fajar Irawan, S.P., M.Agr., Ph.D., A'isyah Surya Bintang, S.P., M.Sc.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, field practices, project-based learning*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are able to understand growth requirements and land suitability, soil fertility and land conservation. They study seeds and seedling practices, planting of shade trees and ground cover, land preparation and planting techniques, plant maintenance including irrigation, fertilization, and pruning, as well as pest, disease, and weed control. Additionally, they grasp socio-economic aspects, entrepreneurship and partnerships, plantation development, and cultivation of plantation crops such as sugarcane, rubber, coffee, tea, cocoa, oil palm, and sago palm.*
Content	*This course introduces basic concepts of estate crop management including growth requirements and land suitability, soil fertility and land conservation. Students learn about seeds and seedling production, planting of shade trees and ground cover, land preparation and crop establishment. Plant maintenance includes irrigation, fertilization, and pruning, along with pest, disease, and weed control as well as socio-economic aspects, entrepreneurship and partnerships, and plantation development. It consists of 60% theoretical content (plant morphology, anatomy, and taxonomy) and 40% practical activities (field practices by team, discussion, and reports).*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Technical Guide for Sugarcane Cultivation – Ministry of Agriculture* 2. *Practical Guide to Rubber Cultivation (2013) – Agfor Sulawesi* 3. *Technical Manual for Rubber (2010) – Directorate General of Plantations, Ministry of the Republic of Indonesia* 4. *Cultivation and Maintenance of Coffee Plants in Mixed Gardens (2013) – Indonesian Coffee and Cocoa Research Center* 5. *Tea Cultivation and Post-Harvest Practices (2010) – Plantation Research and Development Center* 6. *Development of Cocoa Cultivation and Processing – Ministry of Agriculture* 7. *Practical Guide to Cocoa Cultivation (2008) – Soil Research Institute, Agricultural Research and Development Agency, Bogor* 8. *Djoehana Detyamidjaja (2006) Series of cultivation: Oil palm cultivation technique, harvest, and postharvest. Instiper Yogyakarta, Kanisius.* 9. *Edi Wiraguna (2021) Cultivation and harvest criteria in sago palm. First Ed. Adab Press.* 10. *Other relevant textbooks and peer-reviewed journals.*

PAT21410 Plant Biotechnology

Module designation	*PAT21410*
Module title	*Plant Biotechnology*
Semester(s) in which the module is taught	*Fifth semester*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.Si. (Coordinator), Bagus Herwibawa, S.P., M.P., Aisyah Surya Bintang, S.P., M.Sc.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, problem based-learning, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*Basic Genetics, Fundamentals of Plant Breeding, Plant Breeding Technology*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to demonstrate a comprehensive understanding of plant biotechnology concepts and their application in agriculture. They will be able to explain the principles of genetic engineering, tissue culture, molecular markers, and omics-based tools, as well as evaluate their roles in crop improvement, stress tolerance, and sustainable production. Students will gain practical experience in plant tissue culture techniques and molecular analyses, preparing them for advanced applications in research and industry.*
Content	*This course covers the theoretical foundation and practical applications of biotechnology in plant science. Major topics include recombinant DNA technology, genetic transformation, plant tissue culture, transgenic crops, molecular diagnostics, bioinformatics, and applications of genomics and proteomics in plant improvement. Emphasis is placed on the integration of biotechnology tools in breeding programs and their socio-economic and ethical implications. Laboratory sessions introduce students to aseptic techniques, callus induction, micropropagation, DNA extraction, and PCR-based marker analysis. The course consists of approximately 60% theoretical instruction and 40% practical laboratory activities.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Chawla, H. S. (2011). Introduction to plant biotechnology (3rd ed.). Boca Raton, FL: CRC Press.* 2. *Stewart, C. N., Jr. (Ed.). (2012). Plant biotechnology and genetics: Principles, techniques, and applications. Hoboken, NJ: Wiley.* 3. *Rasmussen, S. K. (Ed.). (2020). Molecular genetics, genomics and biotechnology of crop plants breeding. Basel, Switzerland: MDPI.* 4. *Other relevant textbooks and peer-reviewed journals.*

PAB21313 Business Economics

Module designation	*PAB21313*
Module title	*Business Economics*
Semester(s) in which the module is taught	*Fifth semester*
Person responsible for the module	*Prof. Dr. Ir. Siswanto Imam Santoso M.P. (Coordinator), Prof. Dr. Ir. Titik Ekowati M.Sc.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to be able to describe the definition of business and enterprise, including the influencing environments, scope of agribusiness economics, principles of agricultural enterprise economics, types and locations of enterprises, and the managerial functions that must be executed within a company. Students will also be able to formulate enterprise financing (e.g., calculate cost-revenue comparisons, profitability, break-even point, and cost of goods sold, interpret company balance sheets through bookkeeping, and analyze company financial aspects such as liquidity and solvency, business risks, and enterprise development, particularly in relation to agricultural commodities.*
Content	*This course discusses the fundamentals of Agricultural Enterprise Economics, beginning with the definition and characteristics of agricultural enterprises in a broad context. It covers the features and functions of agricultural enterprises, types of agricultural business entities, corporate budgeting, marketing approaches through supply chains, and financial and funding analyses. Key topics include break-even point (BEP), business profitability, liquidity and solvency, business risks, and the preparation of company cash flow statements.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Riyanto, B. (1984). Dasar-Dasar Pembelanjaan Perusahaan. BPFE, Yogyakarta.* 2. *Madura, J. (2001). Introduction to Business (2nd ed., S. W. R. Salib, Trans.). Salemba Empat, Jakarta.* 3. *Fuad, M., Christin, H., Nurlela, Sugiarto, & Paulus, Y. E. F. (2000). Pengantar Bisnis. PT Gramedia Utama, Jakarta.* 4. *Nasution, M. (1996). Pengantar Bisnis: Rencana Pendirian Perusahaan. Penerbit Djambatan, Jakarta.* 5. *Sumarni, M., & Soeprihanto, J. (2000). Pengantar Bisnis (Dasar-Dasar Ekonomi Perusahaan) (5th ed.). Liberty, Yogyakarta.* 6. *Pandojo, H. R., Irawan, & Reksohadiprodjo, S. (1982). Pengantar Ekonomi Perusahaan. BPFE, Yogyakarta.* 7. *Soedarsono. (1994). Pengantar Ekonomi Perusahaan. PT Gramedia Pustaka Utama, Jakarta.*

PAT21441 Plant Breeding Technology

Module designation	*PAT21441*
Module title	*Plant Breeding Technology*
Semester(s) in which the module is taught	*Fourth semester*
Person responsible for the module	*Prof. Dr. Ir. Florentina Kusmiyati, M.Sc. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, problem based-learning, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*3/ ± 4.77 ECTS*
Required and recommended prerequisites for joining the module	*Fundamentals of Plant Breeding*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to demonstrate a thorough understanding of technological approaches in plant breeding and how they enhance genetic improvement. Students will be able to apply advanced breeding strategies, analyze breeding program components, and utilize tools such as hybridization, polyploidy, mutation breeding, and marker-assisted selection. They will gain practical skills in planning, conducting, and evaluating breeding experiments with an emphasis on integrating conventional and modern technologies in crop improvement..*
Content	*This course explores key technologies used in modern plant breeding to improve crop performance, quality, and resilience. Topics include controlled pollination and hybrid seed production, ploidy manipulation, induced mutation, molecular markers, marker-assisted selection, tissue culture, and genetic transformation. Students will analyze case studies of successful breeding programs and simulate decision-making in breeding strategies. Laboratory sessions offer hands-on experience in emasculation and pollination techniques, seed handling, mutation induction, early generation selection, and basic molecular diagnostics. The course consists of approximately 60% theoretical instruction and 40% practical activities, fostering both conceptual depth and applied competence.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Koh, H.-J., Thomson, M., & Kwon, S.-Y. (Eds.). (2015). Current technologies in plant molecular breeding: A guide book of plant molecular breeding for researchers. Dordrecht, Netherlands: Springer Netherlands.* 2. *Al-Khayri, J. M., Jain, S. M., & Johnson, D. V. (Eds.). (2016). Advances in plant breeding strategies: Breeding, biotechnology and molecular tools (Vol. 1). Cham, Switzerland: Springer International Publishing.* 3. *Khan, Z. (Ed.). (2024). Plant breeding technology: Future trends and challenges. Wallingford, UK: CAB International.* 4. *Other relevant textbooks and peer-reviewed journals.*

PAT 21312 Plant Protection Technology

Module designation	*PAT 21312*
Module title	*Plant Breeding Technology*
Semester(s) in which the module is taught	*Fourth*
Person responsible for the module	*Prof. Dr. Ir. Florentina Kusmiyati, M.Sc. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, problem based-learning, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*(Estimated) Total workload: 126 hours / semester* *a. Contact hours: 70 hours/ semester* *a. Lectures (2 SKS):* *2 × 50 minutes/week × 14 weeks = 28 hours* *b. Laboratory Sessions (1 SKS):* *1 × 100 minutes/week × 14 sessions = 42 hours* *b. Private study: 56 hours/ semester* *c. Reviewing lecture and lab materials: ~24 hours* *d. Preparing lab reports and assignments: ~20 hours* *e. Examination preparation (mid & final): ~12 hours*
Credit points	*3/ ± 4.77 ECTS*
Required and recommended prerequisites for joining the module	*Fundamentals of Plant Breeding*
Module objectives/intended learning outcomes	*The Plant Protection Technology course discusses the concepts, principles, and applications of technology in protecting crops from pests, diseases, and weeds. Upon completion, students are expected to understand and explain the significance of plant diseases, the processes and development of diseases, major pathogens and their physiology, epidemiology, and various methods of disease control. The pest section covers the definition of plant pests, their biomorphology and classification, factors influencing pest populations, as well as the principles and strategies of pest management, including Integrated Pest Management (IPM). The weed section focuses on taxonomy, biological characteristics, ecology, and various weed control methods—mechanical, chemical, biological, and integrated approaches. This course aims to equip students with both theoretical and practical understanding of crop protection and the ability to apply environmentally friendly, efficient, and sustainable plant protection technologies.*

Content	*Plant Protection Technology course explores various methods for managing and protecting cultivated plants from disturbances, attacks, and damage caused by Plant Pests and Diseases (Organisms Harmful to Plants), including pathogens, insect pests, and weeds. The course covers key aspects such as the importance of plant diseases, the processes of their occurrence and development, major pathogens and their physiological characteristics, epidemiology, and different methods of disease control. The section on pests discusses the definition of plant pests, their biomorphology and classification, the factors influencing pest populations, as well as the principles and strategies of pest management, including Integrated Pest Management (IPM). The weed section focuses on weed taxonomy, biological characteristics, and various weed control methods. Overall, this course provides students with comprehensive knowledge and practical understanding of how to effectively manage crop health through sustainable and environmentally friendly plant protection technologies.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* 7. *Total: 100%*
Study and examination requirements	*To pass the module, students must:* a. *Attend at least 85% of classes and labs* b. *Actively participate in all learning activities* c. *Complete all assignments and reports* d. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Agrios, G. N. (2005). Plant Pathology (5th ed.). Academic Press.* 2. *Semangun, H. (2001). Introduction to Plant Pathology. Gadjah Mada University Press.* 3. *Untung, K. (2001). Introduction to Integrated Pest Management. Gadjah Mada University Press.* 4. *Triharso. (1996). Fundamentals of Plant Protection. Gadjah Mada University Press.* 5. *Anonim. (1991). Insect Identification Key. Kanisius Publisher, Yogyakarta.*

6th SEMESTER

PAB21403 Agricultural Extension

Module designation	*PAB21403*
Module title	*Agricultural Extension*
Semester(s) in which the module is taught	*Sixth semester*
Person responsible for the module	*Dr. Ir Siwi Gayatri, M.Sc. (Coordinator), Tutik Dalmiyatun, S.Pt., M.Sc.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to be able to design an agricultural extension program and implement it, including the effective use of extension media.*
Content	*This course explores non-formal education for farming communities, focusing on teaching and learning processes, communication, innovation adoption and diffusion, extension methods, materials and media, as well as the planning, implementation, and evaluation of agricultural extension programs. It also covers government policies related to agricultural extension.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Bloom, B. S., Karthwohl, F. D. R., & Masia, B. B. (1965). Taxonomy of Educational Objectives. New York: David McKay Co., Inc.* 2. *Direktorat Jenderal Peternakan. (1992). Petunjuk Pelaksanaan Pembinaan Kelompok Tani Ternak. Dirjen Peternakan, Departemen Pertanian, Jakarta.* 3. *Goldberg, A. (1985). Komunikasi Kelompok, Proses Diskusi dan Penerapannya. Universitas Indonesia, Jakarta.* 4. *Havelock, R. G. (1969). Planning for Innovation: Dissemination and Utilization of Knowledge. Institute for Social Research, University of Michigan, Ann Arbor, Michigan.* 5. *Hawkins, H. S., Dunn, A. M., & Cary, J. W. (1982). Agricultural and Livestock Extension. Vol. 2: The Extension Process. Canberra: AUIDP.* 6. *Hawkins, H. S., & Van den Ban, A. W. (1990). Agricultural Extension. Co-published in the United States with John Wiley & Sons, Inc., New York.* 7. *Isbandi. (1991). Pendidikan dalam Penyuluhan. Fakultas Peternakan, Universitas Diponegoro, Semarang.* 8. *Isbandi. (1992). Proses Pendidikan Penyuluhan. Fakultas Peternakan, Universitas Diponegoro, Semarang.* 9. *Isbandi. (1992). Pendidikan, Komunikasi dan Perencanaan Program Penyuluhan Peternakan. Fakultas Peternakan, Universitas Diponegoro, Semarang.* 10. *Jalaluddin, R. (2001). Psikologi Komunikasi. Bandung: Penerbit PT Remaja Rosdakarya.*

PAT21404 Forage Crop Production Technology

Module designation	*PAT21404*
Module title	*Forage Crop Production Technology*
Semester(s) in which the module is taught	*Sixth semester*
Person responsible for the module	*Prof. Ir. Didik Wisnu Widjajanto, M.Sc., P.hD. (Coordinator), Dr. Ir. Eny Fuskhah, M.Si.*
Language	*Indonesian*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* *1. Contact hours = 53,33 hours* *a. Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* *b. Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* *2. Private study = 82,67 hours* *a. Reviewing lecture and lab materials = 32,00 hours* *b. Preparing lab reports and assignments = 42,67 hours* *c. Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are able to understand and comprehend the types of superior forage crops (including grasses and cereals), the principles of forage crop cultivation, and their utilization. They are also expected to understand the concept of rangelands, including their types, improvement methods, and the fundamental principles of rangeland management.*
Content	*This course discusses key terminology in forage crop science, the identification and adaptation of superior forage grasses and legumes, enabling students to recognize high-quality forage species—both leafy and non-leafy—in terms of productivity, quality, quantity, and palatability. The fundamentals of forage land establishment are also covered, including land preparation, planting materials, cultivation practices, and basal fertilization for both cut-and-carry and grazing systems. To ensure the production of high-quality forage, students will study forage utilization and maintenance, covering defoliation principles, utilization methods, and soil fertility management to sustain continuous forage supply. The course also introduces the concept of rangeland (pasture), its roles, types, and classification. In addition to forage land development, students will explore methods for improving natural rangelands—particularly relevant in Indonesia, where many existing rangelands produce low-quality forage. Proper rangeland management, including various grazing systems, is discussed to achieve efficient and sustainable pasture use.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Crowder, L. V., & Chheda, H. R. (1982). Tropical Grassland Husbandry. Longman Group Ltd., London.* 2. *Departemen Pertanian. (1983). Pedoman Bercocok Tanam Padi, Palawija, Sayur-sayuran. Jakarta.* 3. *Purbayanti, E. D. (2013). Rumput dan Legume sebagai Hijauan Makanan Ternak. Universitas Diponegoro Press.* 4. *Harland, J. R. (1956). Theory and Dynamics of Grassland Agriculture. D. Van Nostrand Co. Inc., Toronto.* 5. *Humphreys, L. R. (1980). A Guide to Better Pasture for the Tropics and Subtropics (4th ed.). Wright Stephenson and Co Pty. Ltd., Australia.* 6. *Koswara, J. (1982). Tanaman Setahun. IPB.* 7. *McIlroy, R. L. (1976). Pengantar Budidaya Padang Rumput Tropika. Pradnya Paramita, Jakarta.* 8. *Reksohadiprodjo, S. (1981). Produksi Tanaman Hijauan Makanan Ternak Tropik. Bagian Penerbitan Fakultas Ekonomi UGM, Yogyakarta.* 9. *Whiteman, P. C. (1980). Tropical Pasture Science. Oxford University Press, London.* 10. *Wilcox, J. R. (1987). Soybeans: Improvement, Production and Uses (2nd ed.). American Society of Agronomy, USA.*

PAT21412 Integrated Farming System

Module designation	*PAT21412*
Module title	*Integrated farming system*
Semester(s) in which the module is taught	*Fifth semester*
Person responsible for the module	*Prof. Ir. Didik Wisnu Widjajanto, M.Sc., P.hD., A'isyah Surya Bintang, S.P., M.Sc., Septrial Arafat, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to be able to explain the concept and learning organization of the integrated farming system, and apply various forms of integrated farming systems (IFS), including the LEISA approach and community-based IFS models. Students will develop competencies in managing the components of IFS such as crop and livestock integration, crop residue utilization, and the processing of agricultural products for feed, fertilizer, and energy purposes. The course also trains students to critically apply sustainable agricultural principles in real-world settings, equipping them to contribute to resource-efficient and community-empowering farming systems.*
Content	*This course explores the concept and significance of integrated farming systems (IFS) through an ecosystem-based approach. It consists of 60% theoretical content (definition and importance of IFS, system organization, forms of integration with livestock, LEISA approach, and community-based management) and 40% practical activities (analysis of IFS models, planning of integrated crop-livestock systems, and component management simulations). The course is delivered at an intermediate level, combining lectures, case studies, and applied fieldwork to equip students with practical knowledge and skills in designing and managing sustainable integrated farming systems.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Heddy, S. (2010). Agroekosistem, Permasalahan Lingkungan. Rajawali Press, Bandung.* 2. *Spedding, C. R. W. (1988). An Introduction to Agricultural Systems (2nd ed.). Elsevier Applied Science, London.* 3. *Guntoro, S. (2011). Pertanian Tekno-Ekologis. AgroMedia Pustaka, Jakarta.* 4. *Sutanto, R. (2002). Pertanian Organik, Menuju Pertanian Alternatif dan Berkelanjutan. Penerbit Kanisius, Yogyakarta.* 5. *Sutanto, R. (2002). Pertanian Organik, Pemasyrakatan dan Pengembangannya. Penerbit Kanisius, Yogyakarta.* 6. *Widjajanto, D. W., & Sumarsono. (2005). Pertanian Organik. Badan Penerbit Universitas Diponegoro, Semarang.* 7. *Lampkin, N. (1992). Organic Farming (2nd ed.). Farming Press Ltd., London.*

PAT 21413 Horticultural Crop Production Technology

Module designation	*PAT 21413*
Module title	*Integrated farming system*
Semester(s) in which the module is taught	*Fifth*
Person responsible for the module	*Prof. Ir. Didik Wisnu Widjajanto, M.Sc., P.hD., A'isyah Surya Bintang, S.P., M.Sc., Septrial Arafat, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*The Horticultural Crop Production Technology course enables students to understand and explain the definition and characteristics of horticultural crops, their prospects, and their economic and environmental importance. The course covers key topics including environmental factors affecting horticultural crop growth, and various horticultural production technologies such as greenhouse systems, media and pot management, hydroponics, and organic farming. Students will also learn about horticultural cultivation systems in Indonesia, focusing on the selection of high-quality seedlings, land preparation and planting, fertilization, pest and disease (Plant Pest Organisms/OPT) management, irrigation and fertigation, pruning, flowering regulation, and the management of flowers and fruits. Furthermore, the course discusses harvesting and post-harvest handling techniques to maintain product quality and extend shelf life. By the end of the course, students are expected to possess comprehensive knowledge and practical skills in managing horticultural production systems effectively and sustainably.*

Content	*The Horticultural Crop Production Technology course provides students with comprehensive learning to enable them to explain the definition and characteristics of horticultural crops, their prospects, and their significance in agricultural development. The course covers environmental factors affecting plant growth and various horticultural production technologies, including greenhouse management, media and pot systems, hydroponics, and organic farming. Students will gain understanding of horticultural cultivation systems in Indonesia, focusing on the selection of high-quality seeds, land preparation and planting, fertilization, management of plant pests and diseases (OPT), irrigation and fertigation, pruning, flowering regulation, and the management of flowers and fruits, as well as harvesting and post-harvest handling. Technical aspects of horticulture, particularly intensive cultivation practices, will be further explored and developed through practical sessions. This course aims to build students' competence in applying modern, efficient, and sustainable horticultural production technologies..*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Heddy, S. (2010). Agroekosistem, Permasalahan Lingkungan. Rajawali Press, Bandung.* 2. *Spedding, C. R. W. (1988). An Introduction to Agricultural Systems (2nd ed.). Elsevier Applied Science, London.* 3. *Guntoro, S. (2011). Pertanian Tekno-Ekologis. AgroMedia Pustaka, Jakarta.* 4. *Sutanto, R. (2002). Pertanian Organik, Menuju Pertanian Alternatif dan Berkelanjutan. Penerbit Kanisius, Yogyakarta.* 5. *Sutanto, R. (2002). Pertanian Organik, Pemasyrakatan dan Pengembangannya. Penerbit Kanisius, Yogyakarta.* 6. *Widjajanto, D. W., & Sumarsono. (2005). Pertanian Organik. Badan Penerbit Universitas Diponegoro, Semarang.* 7. *Lampkin, N. (1992). Organic Farming (2nd ed.). Farming Press Ltd., London.*

PAT21414 Field Work Course

Module designation	*PAT21414*
Module title	*Field Work Course*
Semester(s) in which the module is taught	*Sixth semester*
Person responsible for the module	*Prof. Dr. Ir. Florentina Kusmiyati, M.Sc. (Coordinator) and Prof. Dr. Ir. Syaiful Anwar, M.Si.*
Language	*Bahasa, english*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 45.33 hours* 1. *Contact hours = 26.67 hours* a. *Laboratory sessions (1 credit):1 x 50 minutes/week x 16 weeks = 26.67 hours* 2. *Private study = 18.67 hours* a. *Reviewing lecture = 16 hours* b. *Examination preparation (mid and final) = 2.67 hours*
Credit points	*1/ ± ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are expected to understand the importance and objectives of Field Work, comprehend the technical aspects of Field Work report preparation, and gain a clear understanding of the work systems at the companies or institutions they visit. They will develop both soft skills and hard skills necessary for participating in Field Work activities, including attentive listening to company representatives, proper documentation of activities, and producing comprehensive written reports that reflect their field experiences accurately and analytically.*
Content	*This course provides students with field-based learning experiences by exposing them to practical knowledge and techniques applied in agricultural industries and institutions. Students are expected to observe, understand, and analyze real-world agricultural practices, and reflect on how these can be integrated with academic theories. The course bridges classroom learning with professional work environments, enhancing students' readiness to apply their skills in both academic settings and the agricultural job market.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	-

PAT21435 Seminar

Module designation	*PAT21435*
Module title	*Seminar*
Semester(s) in which the module is taught	*Sixth semester*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.Si. (Coordinator) and Prof. Ir. Karno, M.Appl.Sc., Ph.D.*
Language	*Bahasa, english*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 45.33 hours* 1. *Contact hours = 26.67 hours* a. *Laboratory sessions (1 credit):1 x 50 minutes/week x 16 weeks = 26.67 hours* 2. *Private study = 18.67 hours* a. *Reviewing lecture = 16 hours* b. *Examination preparation (mid and final) = 2.67 hours*
Credit points	*1/ ± ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Upon completing this course, students are expected to demonstrate discipline and responsibility in accomplishing academic tasks while respecting diverse perspectives. They should be able to design, present, and critically evaluate scientific proposals related to agricultural sciences, particularly in the fields of soil science, plant breeding, crop cultivation, and plant protection. Additionally, students are expected to apply relevant tools, methods, and technologies to analyze soil properties, develop improved crop varieties, manage cultivation systems, and diagnose as well as control plant pests and diseases. They must also be able to communicate agricultural findings effectively in various ecological and socio-regional contexts*
Content	*This course is designed to develop students' academic communication and scientific reasoning skills through the preparation, presentation, and discussion of seminar topics related to agroecotechnology. Students are guided to formulate problems, review relevant literature, and structure seminar papers in areas such as soil science, crop breeding, crop cultivation, and plant protection. Emphasis is placed on critical thinking, clarity of scientific argumentation, and the ability to defend ideas in academic forums. The course also prepares students to present research proposals or findings as a foundation for their undergraduate thesis.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	-

7th SEMESTER

PAT21436 Industrial Internship

Module designation	*PAT21436*
Module title	*Industrial Internship*
Semester(s) in which the module is taught	*Seventh semester*
Person responsible for the module	
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 45.33 hours* *1. Contact hours = 26.67 hours* *a. Laboratory sessions (1 credit):1 x 50 minutes/week x 16 weeks = 26.67 hours* *2. Private study = 18.67 hours* *a. Reviewing lecture = 16 hours* *b. Examination preparation (mid and final) = 2.67 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are expected to carry out professional and responsible work in the field of agroecotechnology by constructing appropriate methods and utilizing tools or techniques in crop cultivation, soil management, plant breeding, and pest and disease control. Students are also able to manage themselves individually and work collaboratively in teams to accomplish tasks effectively.*
Content	*This Industrial Internship course is not a classroom-based course, but rather a field study conducted at institutions or companies selected by the students. It is designed to enable students to implement the theoretical knowledge and practical skills they have acquired by engaging directly in real-world professional work environments.*
Examination forms	*a. Active Participation: 30%* *b. Project Output: 20%* *c. Assignments: 10%* *d. Quizzes: 10%* *e. Midterm Examination: 15%* *f. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* *a. Attend at least 85% of classes* *b. Actively participate in all learning activities* *c. Complete all assignments and reports* *d. Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	-

UNW21408 Student Community Service

Module designation	*UNW21408*
Module title	*Student Community Service*
Semester(s) in which the module is taught	*Seventh semester*
Person responsible for the module	*Community Service Field Supervisor*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecture, project-based learning*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* *1. Contact hours = 26,67 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* *2. Private study = 64,00 hours* *a. Reviewing lecture = 32,00 hours* *b. Preparing assignments = 26,67 hours* *c. Examination preparation (mid and final) = 5,33 hours*
Credit points	*3/ ± 4.82 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Students are expected to be able to carry out community service activities facilitated through the Community Service Program course by applying the theories and knowledge acquired during their academic studies on campus to real-world societal contexts. They should be capable of adapting their academic knowledge to help address problems in the community and create innovative solutions for local issues by responding to the community's challenges. Students will collaborate with fellow students from various faculties at Universitas Diponegoro at the Community Service Program location. In partnership with the local community, they will actively engage in implementing programs that have been planned based on the actual needs and problems identified within the community.*
Content	*This course provides an overview of the essential topics that students must understand before participating in community service activities at the Community Service Program location. The materials delivered are aligned with the students' academic disciplines and are given during preparatory training at the faculty level, covering each study program's field of expertise in addressing various community issues at the designated Community Service Program site. These issues are translated into academic programs. Students are also expected to collaborate with peers from other departments to develop multidisciplinary programs aimed at solving real-world problems within the community.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Community Service Program Handbook*

PAT21599 Bachelor Thesis

Module designation	*PAT21599*
Module title	*Bachelor Thesis*
Semester(s) in which the module is taught	*Seventh semester*
Person responsible for the module	*Thesis Supervisor*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Project-based learning, Problem-Based Learning and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136 hours* *1. Contact hours = 40 hours* *a. Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26.67 hours* *b. Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 26.67 hours* *2. Private study = 82.67 hours* *a. Reviewing lecture = 32 hours* *b. Preparing assignments = 42.67 hours* *c. Examination preparation (mid and final) = 8 hours*
Credit points	*6/ ± 9.642 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*This module is designed to develop students' ability to independently conduct scientific research in the field of agroecotechnology by integrating knowledge, skills, and methodologies acquired throughout the undergraduate program. Upon completion, students are expected to identify relevant research problems, conduct a literature review, design appropriate research methodologies, collect and analyze data, and present their findings in a scientifically structured thesis. The course also fosters critical thinking, academic integrity, and ethical research behavior, while enhancing students' ability to communicate their research outcomes effectively in both written and oral formats.*
Content	*This course is a specialized final-year module designed to guide students in independently preparing a scientific thesis as a graduation requirement for a bachelor's degree. The thesis integrates various competencies and knowledge acquired from previous courses in the curriculum. Assessment requires that all other coursework has been successfully completed. The learning process commonly involves Problem-Based Learning, Discovery Learning, Self-Directed Learning, and Simulation. The standard structure of the thesis includes: Introduction, Literature Review, Research Methodology, Results and Discussion, Conclusion, References, and Appendices. This structure aims to provide clarity and consistency in thesis preparation among students.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	-

PAT21415 Seed Production and Storage

Module designation	*PAT 21415*
Module title	*Seed Production and Storage*
Semester(s) in which the module is taught	*Odd semester elective courses*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.Si. (Coordinator) and Prof. Ir. Karno, M.Appl.Sc., Ph.D.*
Language	*Bahasa, english*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*Lecture, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Upon completing this course, students are expected to understand and explain the role of **seed production and storage** in the field of agriculture, as well as the fundamental technological principles applied in these processes. Students will develop a comprehensive understanding of the entire system of seed production and storage, encompassing the stages from seed development, processing, and quality assurance to preservation and distribution. This holistic comprehension will enable students to critically evaluate potential opportunities and risks associated with the practical application of seed technology, ensuring effective, sustainable, and high-quality seed management in agricultural production systems.*
Content	*This Seed Production and Storage course provides students with the knowledge and skills necessary to produce and store seeds while maintaining their quality and viability. The course covers the fundamental principles of seed production, seed harvesting and processing, seed dormancy, and seed treatments. Students will also study the basic concepts of seed storage, seed certification, packaging and labeling, seed coating, as well as seed transportation and handling. In addition, the course introduces research methods related to seed production and storage to enhance students' analytical and problem-solving abilities. Through both theoretical and practical learning, students are expected to develop the competence to manage seed quality effectively, applying scientific and technological approaches to ensure sustainability and reliability in seed systems.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Justice, O. L., & Bass, L. N. (1978). Principles and Practices of Seed Storage. U.S. Government Printing Office, Washington, D.C.* 2. *Kuswanto, H. (1997). Seed Analysis. Andi Publisher, Yogyakarta.* 3. *Kuswanto, H. (1996). Fundamentals of Seed Technology, Production, and Certification. Andi Publisher, Yogyakarta.* 4. *Kuswanto, H. (2003). Seed Processing, Packaging, and Storage Technology. Kanisius Publisher, Yogyakarta.* 5. *McCormack, J. H. (2004). Seed Processing and Storage: Principles and Practices of Seed Harvesting, Processing, and Storage – An Organic Seed Production Manual for Seed Growers in the Mid-Atlantic and Southern U.S.*

Teknologi Produksi Tanaman Hias

Teknologi Produksi Hidroponik

Teknologi Produksi Tanaman Sayuran

PAT21425 Genetic Engineering

Module designation	*PAT1624713 / PAT1624714*
Module title	*Genetic Engineering*
Semester(s) in which the module is taught	*Odd semester elective courses*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.Si. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	~~*Compulsory*~~ */ elective /* ~~*specialisation*~~
Teaching methods	*lecture, lab works, problem based-learning, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*Plant Genetics, Fundamentals of Plant Breeding, Plant Breeding Technology and Plant Biotechnology*
Module objectives/intended learning outcomes	*By the end of this course, students are expected to understand the key concepts, tools, and techniques used in genetic engineering and their applications in plants. Students will be able to explain the mechanisms of gene cloning, vector design, transformation methods, and transgene expression. In addition to mastering core theoretical concepts, students will acquire hands-on experience with basic genetic engineering techniques such as DNA extraction, restriction enzyme digestion, electrophoresis, and gene transfer protocols, fostering skills needed for further research or biotechnology-based careers.*
Content	*This course introduces students to the fundamental principles and techniques of genetic engineering in plant systems. Topics include gene structure and function, restriction enzymes, cloning vectors, gene cloning strategies, plant transformation methods (Agrobacterium-mediated and biolistics), selectable markers, reporter genes, and biosafety considerations. Laboratory sessions provide practical training in molecular techniques including plasmid isolation, restriction digestion, gel electrophoresis, PCR, and gene expression analysis. Emphasis is placed on applying these tools in crop improvement, functional genomics, and synthetic biology. The course includes approximately 50% theoretical instruction and 50% practical laboratory activities.*

Examination forms	*a. Active Participation: 30%* *b. Project Output: 20%* *c. Assignments: 10%* *d. Quizzes: 10%* *e. Midterm Examination: 15%* *f. Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* *a. Attend at least 85% of classes and labs* *b. Actively participate in all learning activities* *c. Complete all assignments and reports* *d. Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	*1. Koul, B., & Tiwari, S. (Eds.). (2024). Genetic engineering of crop plants for food and health security (Vol. 2). Singapore: Springer Nature Singapore.* *2. Rao, V. S. (2014). Transgenic herbicide resistance in plants. Boca Raton, FL: CRC Press.* *3. Legault, J., & Pahara, J. (2021). Zero to genetic engineering hero: The beginner's guide to programming bacteria at home, school & in the makerspace. Sebastopol, CA: Make Community, LLC.* *4. Other relevant textbooks and peer-reviewed journals.*

PAT21426 Landscape Architecture

Module designation	*PAT21426*
Module title	*Landscape Architecture*
Semester(s) in which the module is taught	*Odd semester elective courses*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.Si. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	~~*Compulsory*~~ */ elective /* ~~*specialisation*~~
Teaching methods	*lecture, lab works, problem based-learning, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*Introduction to Architecture, Environmental Science, Basic Design Principles, and Ecology.*
Module objectives/intended learning outcomes	*This course introduces students to the fundamental principles, theories, and techniques of landscape architecture. It explores the integration of ecological, aesthetic, and cultural dimensions in the planning and design of outdoor environments. Topics include the history and philosophy of landscape architecture, principles of landscape design, site planning and analysis, planting design, and the application of sustainable design approaches. Students will examine the relationships between landform, vegetation, water, built structures, and human activity to create functional and meaningful spaces.*
Content	*The course emphasizes ecological sensitivity, spatial analysis, and creativity in design, preparing students to address contemporary challenges such as urbanization, climate change, and environmental degradation. Practical sessions provide hands-on experience in site analysis, design drawing, model making, and the use of digital tools such as CAD, GIS, and 3D visualization software. Fieldwork and case studies support the understanding of real-world landscape systems and professional practice.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* 7. *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Booth, N. K., & Hiss, J. E. (2012). Residential Landscape Architecture: Design Process for the Private Residence (6th ed.). Pearson Education..* 2. *Simonds, J. O., & Starke, B. W. (2013). Landscape Architecture: A Manual of Environmental Planning and Design (5th ed.). McGraw-Hill Education.* 3. *Motloch, J. L. (2000). Introduction to Landscape Design (2nd ed.). Wiley.* 4. *Thompson, I. H., & Sorvig, K. (2018). Sustainable Landscape Construction: A Guide to Green Building Outdoors (3rd ed.). Island Press.*

PAT21427 Advanced Organic Agriculture

Module designation	*PAT21427*
Module title	*Advanced Organic Agriculture*
Semester(s) in which the module is taught	*Odd semester elective courses*
Person responsible for the module	*Prof. Dr. Ir. Syaiful Anwar, M.Si. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	~~*Compulsory*~~ */ elective /* ~~*specialisation*~~
Teaching methods	*lecture, lab works, problem based-learning, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*(Estimated) Total workload: 84 hours / semester* *a. Contact hours: 42 hours/ semester* *a. Lectures (1 SKS):* *1 × 50 minutes/week × 14 weeks = 14 hours* *b. Laboratory Sessions (1 SKS):* *1 × 100 minutes/week × 14 sessions = 28 hours* *b. Private study: 56 hours/ semester* *c. Reviewing lecture and lab materials: ~16 hours* *d. Preparing lab reports and assignments: ~16 hours* *e. Examination preparation (mid & final): ~10 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*Introduction to Soil Science, Plant Physiology, Agricultural Ecology, and Environmental Science.*
Module objectives/intended learning outcomes	*This course introduces students to the fundamental principles and practices of organic agriculture, emphasizing its ecological, integrative, and sustainable approaches. It explores the concept and importance of organic farming systems, the interrelationships among soil, plants, and microorganisms, and the scientific basis of soil nutrition in supporting organic production. Topics include composting processes, the quality and properties of organic materials, and the role and application of organic pesticides. The course also addresses research and development principles in organic agriculture, as well as the cultivation of organic food and horticultural crops. In addition, students will learn about organic certification standards, procedures, and their implications for sustainable agricultural systems.*
Content	*This course discusses the concept and significance of organic agriculture, emphasizing its integrative and holistic nature. Topics include the fundamental principles of soil nutrition supporting organic farming, the process of organic matter composting, and the quality and properties of organic materials. The course also explores the role and application of organic pesticides, as well as the basic approaches to research and development in organic agriculture. In addition, it covers the production of organic food and horticultural crops, and the standards and procedures for organic certification.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* 7. *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Sutanto, R. (2002). Organic Agriculture: Towards Alternative and Sustainable Farming. Kanisius, Yogyakarta.* 2. *Sutanto, R. (2002). Organic Agriculture: Dissemination and Development. Kanisius, Yogyakarta.* 3. *Widjajanto, D. W., & Sumarsono. (2005). Organic Agriculture. Diponegoro University Press, Semarang.* 4. *Lampkin, N. (1992). Organic Farming (2nd ed.). Farming Press Ltd., London.* 5. *Kardiman, A. (2016). Organic Farming System: Philosophy, Principles, and Inspection. Intimedia, Malang.* 6. *Dermiyati. (2016). Sustainable Organic Farming System. Plantaxia, Yogyakarta.*

PAT 21418 Tuber Crop Production Technology

Module designation	*PAT21418*
Module title	*Tuber Crop Production Technology*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Albertus Fajar Irawan, S.P., M.Si., Ph.D.*
Language	*Bahasa*
Relation to curriculum	~~*Compulsory*~~ */ elective /* ~~*specialisation*~~
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*Introduction to Agronomy, Plant Physiology, Soil Science, and Crop Production Technology.*
Module objectives/intended learning outcomes/CPMK	*After completing the lectures and practical sessions of the* ***Tuber Crop Cultivation*** *course, students will be able to describe the characteristics of various types of tuber crops, explain the fundamental principles of tuber crop cultivation, and identify as well as utilize several potential tuber species as alternative food sources to rice and wheat. In addition, students will gain knowledge of the medicinal and traditional herbal uses of selected tuber crops.*
Content/deskripsi	*This course examines the contribution of various tuber crops to food security, emphasizing their role as major sources of carbohydrates and their nutritional value. It explores the potential of tuber crops as alternative staples to rice and wheat, discusses key aspects of their cultivation and post-harvest processing, and highlights their diverse uses beyond carbohydrate sources, including applications in food innovation, industry, and health.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* *a. Attend at least 85% of classes and labs* *b. Actively participate in all learning activities* *c. Complete all assignments and reports* *d. Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Ray, R. C., & Tomlins, K. I. (Eds.). (2010). Sweet potato: Post harvest aspects in food, feed and industry. Nova Science Publishers.* 2. *Onwueme, I. C., & Sinha, T. D. (1991). Field crop production in tropical Africa: Principles and practice. Technical Centre for Agricultural and Rural Cooperation (CTA).* 3. *Lebot, V. (2009). Tropical root and tuber crops: Cassava, sweet potato, yams and aroids. CABI Publishing.* 4. *Woolfe, J. A. (1992). Sweet potato: An untapped food resource. Cambridge University Press.*

Medicinal Plant Production Technology

Module designation	*PAT 21419*
Module title	*Land Resource Conservation Technology*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si. (Coordinator), Septrial Arafat, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload: 136,00 hours* *1. Contact hours = 53,33 hours* *a. Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* *b. Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* *2. Private study= 82,67 hours* *a. Reviewing lecture and lab materials = 32,00 hours* *b. Preparing lab reports and assignments = 42,67 hours* *f. Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*Introduction to Agronomy, Plant Physiology, Soil Science, and Crop Production Technology.*
Module objectives/intended learning outcomes/CPMK	*Students will be able to analyze (C5) the characteristics of various medicinal plants and explain the general cultivation principles of medicinal plants, both in general and based on the harvested plant parts.*
Content/deskripsi	*The **Medicinal Plant Cultivation** course explores various types of medicinal plants, with emphasis on their botanical characteristics, uses, and cultivation techniques. It also covers the harvesting and post-harvest handling of medicinal plants based on the specific plant parts harvested, including leaves, roots, flowers, fruits, seeds, herbs, bark, and rhizomes.*
Examination forms	*a. Active Participation: 30%* *b. Project Output: 20%* *c. Assignments: 10%* *d. Quizzes: 10%* *e. Midterm Examination: 15%* *f. Final Examination: 15%* *Total: 100%*

Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Napitupulu, R., Wisaksono, L. S., Efrizal, Mooduto, L., Herawati, T., Novianti, A., Wahyu, S., & Tumino. (2008). Taxonomy of Medicinal Plant Collections in the Citeureup Medicinal Plant Garden. National Agency of Drug and Food Control of the Republic of Indonesia.* 2. *Ministry of Trade of the Republic of Indonesia. (2009). Indonesian Herbal: The Traditional Therapy. Trade Research and Development Agency, Ministry of Trade of the Republic of Indonesia.* 3. *Hariana, H. A. (2005). 812 Recipes for Treating 236 Diseases. Penebar Swadaya.* 4. *World Health Organization. (2007). WHO Monographs on Selected Medicinal Plants (Vols. 1–4). World Health Organization.* 5. *Winarto. (2007). Indonesian Medicinal Plants for Herbal Medicine. Karyasari Herba Media.*

PAT21420 Plant Tissue Culture Techniques

Module designation	*PAT21420*
Module title	*Plant Tissue Culture Techniques*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Prof. Dr. Ir. Florentina Kusmiyati, M.Sc. (Coordinator) and Bagus Herwibawa, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*None*
Module objectives/intended learning outcomes/CPMK	*After completing this course, students will be able to understand and explain the definition, basic concepts, and benefits of plant tissue culture; laboratory equipment and culture media; sterilization techniques; sources of explants; culture regeneration; in vitro culture for germplasm conservation; meristem culture and virus-free culture; somaclonal variation; in vitro culture for biotic and abiotic stress tolerance; in vitro culture for secondary metabolite production; and acclimatization.*
Content/deskripsi	*This course provides learning experiences that enable students to manage and develop skills in using laboratory equipment, preparing culture media, performing sterilization, selecting explant sources, conducting culture regeneration, applying in vitro culture for germplasm conservation, meristem and virus-free culture, somaclonal variation, in vitro culture for biotic and abiotic stress tolerance, in vitro culture for secondary metabolite production, and acclimatization.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* 7. *Total: 100%*

Study and examination requirements	*To pass the module, students must:* *a. Attend at least 85% of classes and labs* *b. Actively participate in all learning activities* *c. Complete all assignments and reports* *d. Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Doyle, A., & Bryan, J. (1988). Cell and Tissue Culture: Laboratory Procedures in Biotechnology. John Wiley & Sons, Toronto.* 2. *Jackson, J. F., & Linsliens, H. F. (2002). Testing for Genetic Manipulation in Plants. Springer, Heidelberg.* 3. *Hartmann, H. T., Kester, D. E., Davies, F. T. Jr., & Geneve, R. L. (2002). Plant Propagation: Principles and Practices (7th ed.). Pearson Education, Inc.* 4. *Smith, R. H. (2000). Plant Tissue Culture. Academic Press, San Diego, USA.*

PAT21421 Vertical Farming

Module designation	*PAT21421*
Module title	*Vertical Farming*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Rosyida, S.P., M.Sc. (Coordinator) and Fajrin Pramana Putra, S.P., M.Sc.*
Language	*Bahasa, English*
Relation to curriculum	~~*Compulsory*~~ */ elective /* ~~*specialisation*~~
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*After completing this course, students will be able to explain (C2) the concepts, principles, and systems of vertical farming (verticulture), identify (C2) the types and characteristics of plants suitable for vertical cultivation, apply (C3) appropriate technologies and cultivation techniques in vertical farming systems, and analyze (C4) the potential, advantages, and challenges of verticulture in supporting sustainable urban agriculture and efficient land use.*
Content	*This course provides an in-depth understanding of vertical farming (verticulture) as an innovative approach to sustainable agricultural production in limited spaces. Topics include the concept, design, and principles of vertical farming systems; selection of suitable crops and growing media; and management of environmental factors such as light, temperature, humidity, and nutrient supply. The course also covers irrigation and fertigation techniques, the use of automation and smart farming technologies, and pest and disease management in vertical systems. In addition, students will explore the economic, environmental, and social aspects of verticulture, including its role in urban food security and sustainable development. Practical sessions emphasize the design, construction, and evaluation of small-scale vertical farming systems.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Despommier, D. (2011). The vertical farm: Feeding the world in the 21st century. New York, NY: Picador.* 2. *Kozai, T., Niu, G., & Takagaki, M. (Eds.). (2016). Plant factory: An indoor vertical farming system for efficient quality food production. San Diego, CA: Academic Press.* 3. *Kalantari, F., Mohd Tahir, O., Lahijani, A. M., & Kalantari, S. (2017). A review of vertical farming technology: A guide for implementation of building integrated agriculture in cities. Advanced Engineering Forum, 24, 76–91. https://doi.org/10.4028/www.scientific.net/AEF.24.76* 4. *Al-Kodmany, K. (2018). The vertical farm: A review of developments and implications for the vertical city. Buildings, 8(2), 24. https://doi.org/10.3390/buildings8020024*

PAT21422 Phytohormone

Module designation	*PAT21422*
Module title	*Phytohormone*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Rosyida, S.P., M.Sc. (Coordinator) and Fajrin Pramana Putra, S.P., M.Sc.*
Language	*Bahasa, English*
Relation to curriculum	~~*Compulsory*~~ */ elective /* ~~*specialisation*~~
Teaching methods	*lecture, lab works, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*none*
Module objectives/intended learning outcomes	*Able to explain (C2) the types, structure and role of plant hormones, apply (C3) hormones in the fields of biology and agriculture, analyze (C4) the potential and possible risks in the application of phytohormones.*
Content	*Studying the types, characteristics, roles and metabolism of plant hormones, as well as their applications in biology and agriculture.*
Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*

Reading list	5. *Davies, P.J. (2004) The Plant Hormones: Their Nature, Occurence, and Function, in Plant Hormones: Biosynthesis, Signal Transduction, Action! (ed P.J. Davies), Kluwer Academic Publishers, Dorrecht, The Netherlands.* 6. *Srivastava, L.M. (2001) Plant Growth and Development: Hormones and Environment, Academic Press, New York, USA* 7. *Oracz, K., Karpiński, S. (2016) Phytohormones Signaling Pathways and ROS Involvement in Seed Germination. Front. Plant Sci. 7:864.* 8. *Croglio, M.P., Haake, J.M., Ryan, C.P., Wang, V.S., Lapier, J., Schlarbaum, J.P., Dayani, Y., Artuso, E., Prandi, C., Koltai, H., Agama, K., Pommier, Y., Chen, Y.,Tricoli, L., LaRocque J.R., Albanese, C., Yarden, R.I. (2016) Analogs of the novel phytohormone, strigolactone, trigger apoptosis and synergize with PARP inhibitors by inducing DNA damage and inhibiting DNA repair. Oncotarget. 7(12): 13984-4001.* 9. *Zein, A. (2016). Plant Growth Regulators (Phytohormones). Prenada Media Group. Jakarta*

PAT21424 Land Resource Conservation Technology

Module designation	*PAT21424*
Module title	*Land Resource Conservation Technology*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si. (Coordinator), Septrial Arafat, S.P., M.P.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*Soil sciences*
Module objectives/intended learning outcomes/CPMK	*Students will be able to explain the basic concepts, objectives, and principles of land and water conservation technology in relation to sustainable land management. They will demonstrate understanding of the structure and functions of watersheds, erosion processes, and degradation impacts on soil and water resources. Students will be able to classify erosion types, identify contributing factors, and evaluate conservation needs using appropriate technical approaches. They will also be able to describe and assess vegetative and mechanical conservation methods such as contour planting, terracing, and agroforestry systems. Furthermore, students will be capable of utilizing erosion prediction models (e.g., USLE, MUSLE) and applying GIS-based mapping to support conservation planning. The course equips students with critical thinking and analytical skills to formulate soil and water conservation strategies for different land uses, while also fostering awareness of environmental protection and land sustainability.*

Content/deskripsi	*This course introduces fundamental concepts in soil and water conservation, focusing on the causes and consequences of erosion and degradation in agricultural and natural landscapes. It consists of 100% theoretical content covering topics such as the definition and importance of soil and water conservation, types of erosion, erosion processes and impacts at both source and deposition areas, and the factors contributing to erosion. The course also explores technical, chemical, and biological methods for erosion control, including soil preservation technologies and predictive erosion models such as USLE. Delivered through lectures and interactive discussions at an intermediate level, the course aims to equip students with a comprehensive understanding of sustainable land management practices and the scientific principles behind erosion control and resource conservation.*
Examination forms	7. *Active Participation: 30%* 8. *Project Output: 20%* 9. *Assignments: 10%* 10. *Quizzes: 10%* 11. *Midterm Examination: 15%* 12. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Arsad, S. 2010. Konservasi Tanah dan Air. IPB Pres. Bogor.* 2. *Govers, G., Van Oost, K., & Poesen, J. (2017). Soil Erosion Processes and Their Measurement. In Soil and Water Conservation Advances in the United States (SSSA Book Series).* 3. *Hudson, N. (1995). Soil Conservation (3rd ed.). Iowa State University Press.* 4. *Kartasapoetra A.G. 2005. Teknologi Konservasi Tanah dan Air.Asdi Mahasatya. Jakarta.* 5. *Lal, Rattan. (2015). Soil Conservation and Ecosystem Services. Springer.* 6. *Liniger, H., & Critchley, W. (2007). Where the Land is Greener: Case Studies and Analysis of Soil and Water Conservation Initiatives Worldwide. WOCAT/CTA/FAO.* 7. *Pimentel, D. (Ed.). (2011). Soil Erosion: Conservation and Rehabilitation. CRC Press.* 8. *Schwilch, G., Liniger, H. P., & Hurni, H. (2014). Preventing Land Degradation: The Importance of Land Conservation Measures. Environmental Management, 54(5), 971–980.*

PAT21429 Bioremediation and Land Reclamation

Module designation	*PAT21429*
Module title	*Bioremediation and Land Reclamation*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si. (Coordinator), Septrial Arafat, S.P., M.P., Muhammad Iqbal Fauzan, S.P., M.Si.*
Language	*Bahasa, English*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 26,67 hours* a. *Lectures (2 credits):2 x 50 minutes/week x 16 weeks = 26,67 hours* 2. *Private study = 64,00 hours* a. *Reviewing lecture = 32,00 hours* b. *Preparing assignments = 26,67 hours* c. *Examination preparation (mid and final) = 5,33 hour*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*Microbiology, Soil Science, Environmental Science, and Waste Management.*
Module objectives/intended learning outcomes/CPMK	*After completing this course, students will be able to explain (C2) the principles, mechanisms, and types of bioremediation and land reclamation; identify (C2) environmental problems related to soil and water pollution; apply (C3) biological, chemical, and physical methods for the restoration of degraded lands; and analyze (C4) the effectiveness and sustainability of bioremediation and reclamation techniques. Students will also be able to evaluate (C5) the potential of microorganisms, plants, and organic materials in improving soil quality and restoring ecological balance.*
Content	*This course provides a comprehensive understanding of the principles and applications of bioremediation and land reclamation for restoring degraded and polluted environments. Topics include the sources and types of environmental contamination, the role of microorganisms and plants in pollutant degradation, and the mechanisms of microbial and phytoremediation. The course also covers the use of biochar, compost, and other organic amendments for soil quality improvement, as well as physical and chemical reclamation methods. Students will learn about the assessment of soil contamination levels, monitoring and evaluation of remediation success, and case studies of bioremediation and reclamation in agricultural, mining, and industrial areas. Emphasis is placed on sustainable management approaches that integrate ecological, environmental, and socio-economic aspects of land recovery. Practical sessions involve laboratory and field activities focused on microbial inoculation, soil amendment application, and evaluation of soil health indicators.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Cunningham, S. D., & Berti, W. R. (2000). Phytoremediation of contaminated soils and water. In J. L. Hatfield & B. A. Stewart (Eds.), Advances in agronomy (Vol. 69, pp. 1–86). San Diego, CA: Academic Press.* 2. *Vidali, M. (2001). Bioremediation: An overview. Pure and Applied Chemistry, 73(7), 1163–1172. https://doi.org/10.1351/pac200173071163* 3. *Maiti, S. K. (2013). Ecorestoration of the coalmine degraded lands. Berlin, Germany: Springer.* 4. *Glick, B. R. (2010). Using soil bacteria to facilitate phytoremediation. Biotechnology Advances, 28(3), 367–374. https://doi.org/10.1016/j.biotechadv.2010.02.001*

PAT21431 Integrated Pest Management

Module designation	*PAT21431*
Module title	*Integrated Pest Management*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Dr. Dian Safitri, S.P., M.Si., A'isyah Surya Bintang, S.P., M.Sc., Chaieydha Noer Afiefah, S.P., M.Sc.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 136,00 hours* 1. *Contact hours = 53,33 hours* a. *Lectures (2 credits): 2 x 50 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* b. *Laboratory sessions (1 credit): 1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 82,67 hours* a. *Reviewing lecture and lab materials = 32,00 hours* b. *Preparing lab reports and assignments = 42,67 hours* c. *Examination preparation (mid and final) = 8,00 hours*
Credit points	*3/ ± 4,82 ECTS*
Required and recommended prerequisites for joining the module	*Introduction to Agronomy, Plant Pathology, Entomology, and Weed Science.*
Module objectives/intended learning outcomes/CPMK	*After completing this course, students will be able to explain (C2) the principles, concepts, and importance of Integrated Pest Management (IPM) in crop production, including the management of pests, diseases, and weeds. Students will be able to identify (C2) common crop pests, pathogens, and weeds, and apply (C3) IPM strategies, including cultural, biological, mechanical, and chemical control methods in a sustainable and environmentally responsible manner. Additionally, students will analyze (C4) pest dynamics, evaluate (C5) the effectiveness of different IPM approaches, and design evidence-based management plans to minimize crop losses while maintaining ecological balance.*
Content	*This course provides an in-depth understanding of Integrated Pest Management (IPM) principles and practices for sustainable crop production. Topics include the identification and biology of major crop pests, diseases, and weeds, and the assessment of pest damage and population dynamics. The course covers preventive and control strategies, including cultural, mechanical, biological, and judicious chemical methods, as well as the integration of these approaches into a comprehensive IPM program. Students will also learn about pest monitoring, forecasting, and decision-making tools, as well as the environmental, economic, and social aspects of pest management. Practical sessions involve field surveys, pest identification, evaluation of pest control methods, and the development of IPM plans tailored to specific crops and agroecosystems..*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Kogan, M. (1998). Integrated pest management: Historical perspectives and contemporary developments. Annual Review of Entomology, 43, 243–270. https://doi.org/10.1146/annurev.ento.43.1.243* 2. *Pedigo, L. P., & Rice, M. E. (2015). Entomology and pest management (6th ed.). Pearson.* 3. *van Emden, H. F., & Service, M. W. (2004). Pest and vector management. Cambridge University Press.* 4. *Pimentel, D. (2009). Environmental and economic costs of the application of pesticides primarily in the United States. Springer.*

PAT21432 Agroforestry

Module designation	*PAT21432*
Module title	*Agroforestry*
Semester(s) in which the module is taught	*Even semester elective courses*
Person responsible for the module	*Dr. Ir. Susilo Budiyanto, M.Si. (Coordinator), Septrial Arafat, S.P., M.P., Muhammad Iqbal Fauzan, S.P., M.Si.*
Language	*Bahasa*
Relation to curriculum	*Compulsory / ~~elective / specialisation~~*
Teaching methods	*lecturer, project-based learning, and seminar*
Workload (incl. contact hours, self-study hours)	*Total workload : 90,67 hours* 1. *Contact hours = 40,00 hours* a. *Lectures (1 credit):1 x 50 minutes/week x 16 weeks = 1600 minutes = 13,33 hours* b. *Laboratory sessions (1 credit):1 x 100 minutes/week x 16 weeks = 1600 minutes = 26,67 hours* 2. *Private study = 50,67 hours* a. *Reviewing lecture and lab materials = 16,00 hours* b. *Preparing lab reports and assignments = 29,33 hours* c. *Examination preparation (mid and final) = 5,34 hours*
Credit points	*2/ ± 3.21 ECTS*
Required and recommended prerequisites for joining the module	*Introduction to Agronomy, Soil Science, Ecology, and Crop Production Technology..*
Module objectives/intended learning outcomes/CPMK	*After completing this course, students will be able to explain (C2) the concepts, principles, and benefits of agroforestry systems, including their ecological, economic, and social functions. Students will be able to identify (C2) various agroforestry models and components, apply (C3) appropriate design and management practices for integrating trees, crops, and livestock, and analyze (C4) the impact of agroforestry on soil fertility, biodiversity, and sustainable land use. Additionally, students will evaluate (C5) the potential of agroforestry systems for climate change mitigation, income diversification, and community development.*
Content	*This course provides a comprehensive study of agroforestry systems as a sustainable land-use practice that integrates trees, crops, and livestock. Topics include the concepts, principles, and ecological, economic, and social benefits of agroforestry. The course covers different agroforestry models, such as alley cropping, silvopasture, home gardens, and forest farming, as well as the selection of suitable tree and crop species. Students will learn about soil fertility management, nutrient cycling, water conservation, and biodiversity enhancement in agroforestry systems. The course also addresses socio-economic aspects, including income diversification, community development, and policy frameworks. Practical sessions emphasize the design, establishment, and management of agroforestry plots, monitoring of system performance, and evaluation of environmental and economic outcomes.*

Examination forms	1. *Active Participation: 30%* 2. *Project Output: 20%* 3. *Assignments: 10%* 4. *Quizzes: 10%* 5. *Midterm Examination: 15%* 6. *Final Examination: 15%* *Total: 100%*
Study and examination requirements	*To pass the module, students must:* 1. *Attend at least 85% of classes and labs* 2. *Actively participate in all learning activities* 3. *Complete all assignments and reports* 4. *Achieve a minimum final score of 60/100, including passing the midterm and final exams*
Reading list	1. *Nair, P. K. R. (2012). An introduction to agroforestry (2nd ed.). Dordrecht, The Netherlands: Springer.* 2. *Jose, S. (2009). Agroforestry for ecosystem services and environmental benefits: An overview. Agroforestry Systems, 76(1), 1–10. https://doi.org/10.1007/s10457-009-9229-7* 3. *Leakey, R. R. B. (2017). Agroforestry: A global perspective. London, UK: CABI.* 4. *Garrity, D. P. (2004). Agroforestry and the achievement of the Millennium Development Goals. Agroforestry Systems, 61(1), 5–17. https://doi.org/10.1023/B:AGFO.0000029008.85805.6a* 5. *Smith, J., & Perrot, T. (2018). Designing sustainable agroforestry systems for climate resilience. Renewable Agriculture and Food Systems, 33(3), 233–246. https://doi.org/10.1017/S1742170517000471*